Working Paper

Education as an Equalizing Force

How Have Declining Educational Inequality and Educational Expansion Contributed to More Social Fluidity in Germany?

Reinhard Pollak, Walter Müller

mannheimer zentrum für europäische sozialforschung

UNIVERSITÄT MANNHEIM

Reinhard Pollak
Walter Müller

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Editorial Note:

Reinhard Pollak is professor of sociology at the Freie Universität Berlin and leads the research group “National Educational Panel Study: Vocational Training and Lifelong Learning” at the WZB Berlin Social Science Center. His research focuses on social stratification in an internationally and historically comparative perspective, in particular social mobility and educational inequalities, adult education, and class-based gender inequalities.

Walter Müller is retired professor of research methods and applied sociology at the University of Mannheim and researcher at the Mannheimer Zentrum für Europäische Sozialforschung. His research focuses on social structural developments in modern societies, in particular education, labour markets, social inequality and social mobility.

Abstract

Education is often portrayed as the big sorting machine for life chances in modern societies. In this paper, we examine the role of education in social mobility among men and women in Germany during the 20th century. We analyse two pathways of how a person's social class origin affects her or his own class position in society: First, an education-mediated path, where a person's social origin influences her or his educational attainment, which in turn influences the social class position she or he attains in adult life. Second, a path that comprises all the mechanisms not related to formal education by which social origins influence an adult's social class position. Using data from various large-scale survey programmes (ALLBUS, SOEP, NEPS), we discuss and analyse how social mobility, educational inequality, returns to education and non-educational pathways develop over time. With log-linear modeling and decomposition methods, we find out that about two thirds of the total association between social origin and own social class position can be attributed to the education-mediated path. In a simulation study, we show that trends in social mobility are mainly associated with a decline in educational inequality and with an enormous educational expansion for men and women in the 20th century.

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Contents

1 Introduction

In this paper, we examine the role of education in social mobility among men and women in Germany during the 20th century. Since the early works of Carlsson (1958), and Blau and Duncan (1967), stability and mobility between the class positions of parents and their children have been considered to arise through two paths. In the first, the education-mediated path, a person's social origin, derived from their parents' class position, affects their educational attainment, which in turn influences the class destination they attain in adult life. Education can thus contribute to reproducing the advantages and disadvantages of class origin conditions in the next generation, but it can also be an important channel for social mobility. The second path comprises all those means by which class origins influence class destination through non-educational mechanisms: taken together this is often called the 'direct effect' of origin on destination. In contrast to education, these direct, non-educational paths tend to foster intergenerational immobility.

Education is especially important for social mobility in a country like Germany, with its stratified and standardized educational system (Müller and Shavit 1998, Allmendinger 1989), its pronounced educational inequalities (Breen et al. 2009, Jackson and Jonsson 2013), and its close links between education and the labor market (Gangl 2003). In an earlier study of Germany, Müller and Pollak (2004) observed an increase in social fluidity from earlier to more recent birth cohorts. They found that this was essentially due to a substantial decline of the so-called "hierarchy" effects in Erikson and Goldthorpe's (1992) core model of social fluidity, which, in turn, resulted from reduced inequality in educational attainment.

The present paper re-examines these processes and extends the focus. It analyses additional, more recent data and also includes women, which were neglected in the earlier analyses. This allows an encompassing account of similarities and differences between men and women in the patterns of social mobility and fluidity and provides evidence how these patterns might have changed in most recent years. We pursue also a more sophisticated study of the role of education in contributing both to intergenerational mobility and immobility, notably by studying different processes and mechanisms (educational expansion, educational equalization and changing returns to education) through which change of mobility over time may occur and in which men and women may differ. Compared to earlier work we use different methods that allow more in-depth study and we examine the robustness of conclusions in view of various problems connected with the age-period-cohort structure of the data.

We begin by discussing the theoretical and empirical bases of the paper, followed by a brief review of the specific institutional features of education in Germany and its relationship to the labour market. Then we describe the database and the design of the analyses. Next, we turn to our results in the form of a series of descriptive figures on absolute rates of mobility, followed by log-linear models of the origin-education-destination triangle and its change over successive birth cohorts. In the next step, we use simulation techniques to assess the relative contribution of different aspects of educational change to the long-term evolution of social fluidity. Finally, we describe the results of a number of sensitivity analyses and summarize our findings and conclusions.

2 Theoretical and empirical background

Modernization theory expected the stratification process to become increasingly achievement-based—generally equated with education-mediated—, while ascription-based, direct effects were expected to become smaller. As, for various reasons, inequality of educational attainment was assumed to decline, effects of origin mediated through education should decline as well. Thus, via both the direct and the indirect path, intergenerational mobility and social fluidity should increase (Parsons 1940, 1970, Blau and Duncan 1967, Treiman 1970, Treiman and Yip 1989). Yet, the two main comparative studies of the early 1990s came to refute these expectations. Shavit and Blossfeld (1993) found persistent educational inequality, and Erikson and Goldthorpe (1992) found largely constant social fluidity in most of the economically advanced societies they studied. However, more recent comparative research has questioned these findings. For educational inequality, Breen et al. (2009, 2010) observe a decline in most of the European countries they look at. Breen and Luijkx (2004, 2007) find slight increases over time in both absolute mobility and social fluidity in several countries.

In re-examining these issues for Germany, we analyze three pathways which describe the impact of social origin and education on class destinations of individuals: a) the association between social origin and education (class-based educational inequalities); b) the association between education and class destination (returns to education); and c) a non-education mediated, direct effects of social origin on class destination. In addition, we take into account how educational expansion influences the total association between social origin and class destination.

The degree to which the origin–destination association is mediated through education depends on the paths between origin and education, and education and destination. Several studies have shown that, although educational inequality is high in Germany, it has declined over time (Müller and Haun 1994, Jonsson et al. 1996, Pollak 2009, Klein et al. 2010, Breen et al. 2009, 2010, Schindler and Lörz 2011, Blossfeld et al. 2015). If all other conditions in the mobility triangle had remained the same, we would expect the diminishing impact of social origin on education to bring about an increase in social mobility.

However, given the equalization and the expansion of the educational system in the past decades (Ziefle 2017), the links between education and jobs may also have changed (Gangl 2003). Some specific links between particular qualifications and jobs may have weakened, others might have grown stronger. Both educational equalization and weakening associations between education and class destination would reduce the education-mediated contribution to the total association between origin and destination. Furthermore, when the education path becomes less efficient in securing advantageous class positions for upper class children, these families may invest more into efforts to obtain them via non-educational means, so strengthening the direct influence of origin on destination, unmediated by education. These interdependencies are hard to predict theoretically but we can discuss a set of factors that work towards an increase or decrease of direct, non-education mediated effects (Breen 2010, Bernardi and Ballarino 2016).

Direct effects are residual influences of origin on destination net of education, captured in differences in class destinations between individuals with the same education but different social origins. They can be the result of various mechanisms. Much research shows effects of (family-based) networks in recruitment processes (e.g., Granovetter 1973): children of families with better network resources are likely to have higher chances of entering more advantageous jobs. Children may develop preferences for occupations similar to those of their parents and this can foster persistence between the occupations of parents and children (Jonsson et al. 2009). Goldthorpe (2007) argues that there is an increase in the proportion of jobs requiring soft skills and, to the extent that these are learned in the family environment rather than in school, direct influences of social origin may strengthen accordingly. Similarly, non-cognitive abilities acquired in the family and fostering success in the occupational career may also strengthen intergenerational transmission of advantage and disadvantage over direct ways not mediated by education.[1]

1 Relating to intergenerational income correlations Mood et al. (2012) review the relevant literature concerning both cognitive and non-cognitive abilities and present detailed findings for men in Sweden. Both explain a substantial share of the intergenerational income correlation: Cognitive abilities account for some 20 percent, personality traits (mainly mediated by leadership capacity) for 13 percent and physical characteristics for 4 percent. All of these contribute independently to the income correlation, also after controlling for son's

The transmission of businesses from parents to children, especially among farmers and the self-employed, usually has little to do with education. Such direct intergenerational inheritance constitutes a strong element of intergenerational immobility (Treiman 1970, Ishida et al. 1995). However, with the long-term shrinkage of farming, this source of direct effects of origin on destination should decline.

Decline is also expected through educational expansion. If the origin–destination association is weaker among individuals with higher levels of education, educational expansion will reduce the overall association as the share of more highly educated persons increases (see Hout 1988, Breen and Jonsson 2007). In this *educational expansion hypothesis* the weak direct effects among people with higher-level qualification is sometimes explained by assuming that graduates are more likely to be found in more meritocratic job markets associated with the bureaucratic organizations in which large proportions of them are employed. Another explanation draws on the differential ability of parents to compensate for their children's educational failures. Upper class families can mobilize resources to help such children avoid downward mobility while lower class families cannot. It follows, therefore, that direct class origin effects will be more pronounced among children with low levels of education (Bernardi and Ballarino 2016).

Goldthorpe and Jackson (2008: 105) argue for another perspective: their interpretation of the OED interaction is that "the strength of the ED association varies with O" (as opposed to the OD association varying with E). The underlying logic of this *"differential educational impact hypothesis"* is that for children from less-advantaged backgrounds, education is crucial to their advancement into high class positions, implying a strong ED association, while this association is likely to be weaker for children from more advantaged backgrounds because "other resources may be available to help them maintain their parents' position even if their educational attainment is only modest". Goldthorpe and Jackson note that the two interpretations of the OED interaction are compatible. In our analyses, we will examine which interpretation finds more support in the data.

Concerning change over time in direct effects, theoretical expectations thus point in different directions: decline resulting from educational expansion and the shrinking of self-employment might be compensated by the increasing significance of soft skills in the growing service sector. As the focus of this chapter is the role of education for social mobility, in the next section we briefly describe core features of the institutional arrangements in Germany's provision of education and the reforms that may have affected its impact on the mobility process.

3 Education and labor markets in Germany

The most characteristic feature of education in Germany, which likely affects the various routes for social mobility, is the marked track differentiation and stratification of education. For the cohorts studied here, Germany (still) channeled its school population already at the lower secondary level and at a very early age (usually age 10) into (usually three) different tracks of general education with clearly varying curricula, learning opportunities, and requirements. While in recent years some of the *Länder* reduced the number of tracks, postponed tracking to some extent, or introduced comprehensive tracks, tracking already in lower secondary education continues to channel children early in all *Länder*.

education. But while about half of effects of cognitive abilities is mediated by education, the effects of personality and physical characteristics remain largely unchanged when education is controlled. In our terminology, they thus remain as direct effects. Even though these findings relate to father-son income correlations, it is not unrealistic to assume that parental class affects children's class destination in similar ways independent of education.

At the upper secondary level, track-differentiation is even more marked, especially due to the sharp division into general vs. vocational tracks. But also general education is track-divided. In all *Länder*, the traditional *Gymnasium* still provides the most direct path from lower to upper secondary education and up to the so-called *Abitur* exam which qualifies students for entering tertiary education. Yet, since the 1960s, several new paths of general education (varying across the *Länder*) have been introduced. They are intended to lead students from non-gymnasium lower secondary education to different kinds of *Abitur* qualifications, which, however, vary in the likelihood of their graduates to enter higher education. This has led to growing participation in upper secondary and tertiary education (Schindler 2014) Nevertheless, most students from non-gymnasium secondary tracks still enter vocational training more or less at the end of compulsory schooling. Especially for students from the lowest tracks, the chances of reaching a level of secondary education that qualifies them for tertiary studies are very limited. In consequence, and in contrast to many other countries, a clear majority of the members of all cohorts studied in this chapter have obtained a secondary-level vocational training as their highest qualification (either mainly school-based or much more frequently in the combined school–firm-based dual apprenticeship system).[2]

Much of the literature agrees that these distinctive institutional characteristics of the German educational system, maintained over many decades, are responsible for several particular features of the German variant of the social mobility triangle. First, children from different class origins are directed into the different segments of education at a very early age, with the children of working and other lower class origins following educational paths that lead to vocational training, while children of the service classes take paths that lead to tertiary education. This early selection of students into the different learning environments leads to high levels of inequality in both educational performance and attainment (Jonsson et al. 1996, Hanushek and Wößmann 2006, Pfeffer 2008, Arum et al. 2007, Jackson and Jonsson 2013). Second, both the high stratification and the vocational specificity of the system generate a particularly strong link between education and later occupational attainment. The different qualifications provided by the system prepare people for different jobs, and educational credentials provide strong signals for employers recruiting personnel for jobs with different requirements (Müller and Shavit 1998, Müller et al. 1998, Klein 2011).

In recent years most of the *Länder* have reduced the number of tracks, postponed tracking to some extent, or introduced comprehensive tracks. While the main features of the German system have been preserved, these reforms, together with educational expansion, have probably played a part in making the system slightly less rigid. In particular, participation in the least demanding educational track (*Hauptschule*) has declined dramatically, while participation in the intermediate track (*Realschule*) and the tracks leading to the *Abitur* have increased substantially.

As greater proportions of young people have reached the *Abitur*, so there have been substantial changes in what they do afterwards. Traditionally, a very large majority of *Abitur* graduates continued to tertiary education. Since the 1980s, however, an *Abitur* (or equivalent general qualification) has been increasingly required from school leavers who want to take up an apprenticeship in sectors such as public administration or finance. Furthermore, new types of apprenticeships were developed, often requiring *Abitur*-level qualifications. At that time, the number of school leavers searching for an apprenticeship or another vocational training place exceeded the number of vacancies, and employers accordingly raised their educational requirements. Under these conditions, especially in the working and intermediate classes to whom the vocational route is particularly attractive, increasing numbers of students obtained an *Abitur*-level general education with the aim of acquiring a promising apprenticeship place rather than entering tertiary studies. In consequence, educational inequality in attaining the *Abitur* declined because more working-class children

2 While general education is under the regulating competence of the Länder, vocational education is regulated under national law and is clearly more homogenously organized across the country than general education.

obtained it. But these equality gains were partly—yet not completely—lost in the transition to tertiary studies, which fewer working-class *Abitur* holders chose to pursue (Mayer et al. 2007, Schindler 2014).

We can summarize our expectations for the three paths of the OED triangle as follows. We expect the decline in educational inequalities (Klein et al. 2010, Breen et al. 2009, 2010, Blossfeld et al. 2015) to foster social mobility, all else equal. As for returns to education, the link between qualifications and class outcomes is well known to be strong in Germany, largely due to the occupational specificity of secondary education (Blossfeld and Mayer 1988, Müller and Shavit 1998, Müller et al. 1998). When the supply of qualifications expands more than the demand, this relationship may weaken. The slow growth of tertiary qualifications should have helped maintain demand for tertiary graduates. However, given the strong growth and the changing requirements for general education in the vocational training system, we can expect considerable change in class outcomes for secondary-level qualifications. Here, the linkage could have turned less strict and the association weaker.

As to the overall association between origin and destination, much of the impact of origin class on class in adulthood can be expected to be mediated via education, notably in older cohorts, because both the origin-education and the education-destination linkages were strong in Germany. The strong mediation of origin advantages by education probably also contributes to a strong total association between origin and destination class. As the OE association is expected to be smaller in more recent cohorts, this should lead to reduced education-mediated effects. In consequence, the total OD association should be smaller in more recent cohorts as well, unless the decline in education-inequalities is compensated by stronger direct OD inequalities. However, if direct OD influences are smaller for employees with high qualifications than for employees with lower qualifications, educational expansion should also contribute to the attenuation of the direct influence of origins on destinations.

4 Gender differences

To keep it short, we only discuss the most important elements of the mobility process in which men and women are likely to differ and to change differently over time. While—on average—men and women do not differ with regard to class origin, they do with regard to education and class destination. Educational attainment among women was substantially lower in older cohorts but became increasingly similar to that of men in more recent cohorts. From Breen et al. (2010) we know that class-based inequality in educational attainment (OE) has been rather similar among men and women in all cohorts and that—despite the general catching up of women—it declined similarly over time for both. Labor markets are gender-segregated with only limited rapprochement over time (Steinmetz 2012). Given this, and—especially in older cohorts—due to lower educational attainment, lower and less continuous labor market participation, sex-typed socialization and occupational aspiration (Polavieja and Platt 2014) as well as gender-based discrimination, women generally occupy different and more lower-level jobs than men. Therefore, mobility patterns in the earlier cohorts should be substantially less favorable for women than for men, but then improve with the women's catching up in education. Further differences are likely to result from the other factors just mentioned. Direct OD effects should be slightly smaller for women than for men because firms and farms are mostly inherited by sons rather than daughters. They may also be smaller because, in the gendered labor markets, the role of preferences in choosing a job in the father's occupational field will be smaller for daughters than for sons. As gender differences are mainly based in different distributions (education, labor market segmentation), differences in the mobility pattern are more likely in absolute rates than in relative rates, in which distributional differences are controlled.

5 Data and design of the analyses

The present analysis is based on 18,612 male and 10,160 female respondents of German nationality living in West-Germany.[3] Men are included when aged 35–64 at the time of the survey, women when aged 35–59 and participating in the labor force at the time of the survey.[4] The data come from various surveys collected at different points in time between 1976 and 2010 among random samples of the adult population. 67% of the male and 57% of the female respondents come from the series of the German General Social Survey (ALLBUS) and similar surveys, which were mostly carried out under the supervision of ZUMA/GESIS, Mannheim. 16% of the male and 21% of the female respondents are drawn from the samples of the German Socio-Economic Panel (GSOEP), and 17% of the male and 22% of the female respondents from the adult sample of the National Educational Panel Study (NEPS).[5] All surveys use similar standards of variable definitions but partly vary in survey procedures and covered contents.

Since we regard education as the main resource affecting class destination and since educational attainment substantially changes across cohorts, we analyze the pooled surveys across birth cohorts. Data collected by the different series of surveys scatter differently over cohorts (C) and survey periods (S) in which data have been collected (for details see appendix A). Moreover, as can be seen from table 1, the different cohorts differ with respect to the age at which cohort members have been surveyed. For instance: Among men, the mean age declines from 59 years in the oldest cohort to 40 years in the youngest cohort. Most members of the youngest cohorts thus are at a rather early stage of their working career. In the sensitivity tests in appendix B and C, we examine whether core results and conclusions could be biased by this age variation and by pooling the different surveys in a common database. We find no distortions that could be of concern.

Table 1: Cohort size, age range and mean age at which cohort members are surveyed

	Men				Women			
Cohort	**N**	**%**	**Age range**	**Mean age**	**N**	**%**	**Age range**	**Mean age**
1914–1924	1,366	7.3	52–64	59,5	319	3,1	52–59	56.4
1925–1934	2,827	15.2	42–64	53.9	984	9.7	42–59	51.5
1935–1944	4,508	24.2	35–64	48.1	2,110	20.8	35–59	45.3
1945–1954	4,396	23.6	35–64	48.8	2,436	24.0	35–59	46.6
1955–1964	3,791	20.4	35–55	44.7	2,957	29.1	35–55	44.7
1965–1974	1,724	9.3	35–45	39.6	1,354	13.3	35–45	39.3

It is well known that labor force participation of women has changed over cohorts and varies with education. Therefore, in order to adjust for the selectivity of women's labor force participation, data of women are weighted separately in each cohort by the inverse of the labor force participation rate predicted from a logistic regression model including father's class and women's education as predictors (with adjustments for keeping the cohort N unchanged).

3 Analyses are restricted to German citizens living in West-Germany because the earlier surveys only include data for citizens of the former Federal Republic of Germany before reunification.

4 The upper age limit for women is lower because only very few have worked at age 60 or older in the cohorts included.

5 The ALLBUS et al. series contributes relatively more respondents among older cohorts, in which labor force participation of women was lower.

6 Change over cohorts in variable distributions and absolute association patterns

The core interest is the relationship between origin class, education, and destination class of cohort members. As these relationships are affected by the distributions of the variables, figure 1 shows how the cohorts differ in these distributions. All variables are coded according to the Casmin schemas. In the graphs, we see the well-known transformations of the class and educational structures that occurred over time and the differences between men and women.

As to class origin, the proportions of self-employed—especially farmers—decline, while service-class backgrounds grow. For class destination, we see these same changes but also a decline of the unskilled working class in particular. Given the long time span of 60 years from the oldest to the youngest cohort, the changes are rather modest. Compositional change in the distribution of destination class is slightly stronger than in the distribution of origin class. With the exception of the first cohort (with a rather small sample of women), men and women have similar origins, as expected (data not shown). Given the gendered labor markets, however, men and women substantially differ in the destination classes they attain. Fewer women than men have service class destinations and women more often occupy lower rather than upper service class positions. Men more often have jobs in the skilled working class (V/VI), women more often routine non-manual jobs (IIIa). Especially in the first three cohorts, larger proportions of women than men occupy unskilled (service) jobs (class IIIb is aggregated with class VII).

In each cohort, sons—compared to their fathers—experience structural change towards more advantageous positions, notably with larger shares of service class destinations than origins. This opens structural opportunities for upward mobility. In contrast, daughters have less advantageous positions than their fathers, notably in the first three cohorts. From the 1945–54 cohort onwards, shares of service class destinations hardly increased any further for both, men and women, while shares of service class origins continued to rise. Hence, for the last two cohorts, the conditions for upward mobility resulting from structural dissimilarities in origin and destination shares become less favorable.

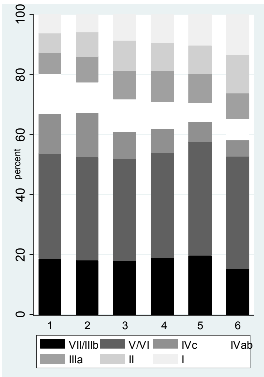
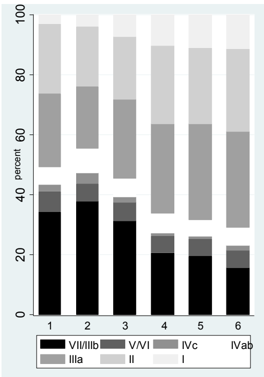
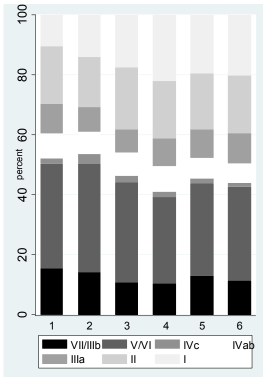
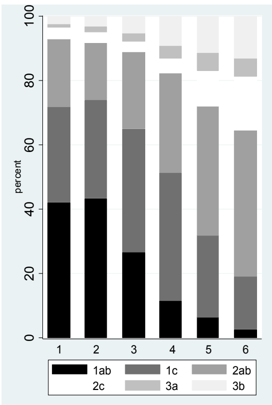
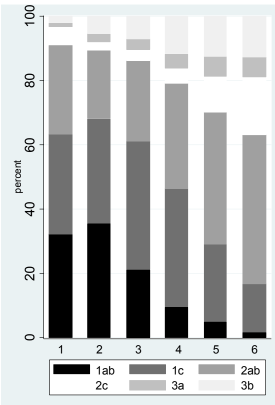
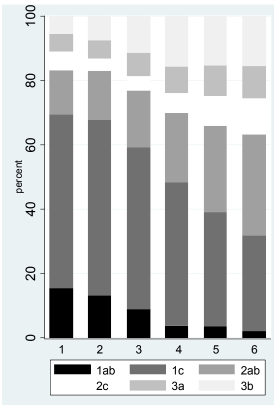
Across cohorts, educational distributions change more than class distributions. As argued above, 1ab and 1c qualifications decline strongly, while especially intermediate and higher levels of general secondary education combined with vocational training increase. For the studied cohorts, educational change does not yet involve massive tertiary expansion. In all cohorts, women obtain fewer 3a, 3b and 1c qualifications than men. Instead, they receive just the compulsory minimum of 1ab education especially in the early cohorts, and in all cohorts they excel men in secondary qualifications. Across all cohorts, the educational disadvantage of women clearly declines. In the two youngest cohorts, they do better than men in moving beyond the elementary 1abc level, yet still remain behind men in tertiary degrees. In all cohorts and for both genders, proportions of service class destinations are larger than tertiary education proportions. Therefore, probably only little pressure existed for tertiary education graduates to move into non-service-class jobs.

It is well known—and confirmed by analyses not reported here—that labor force participation is more likely among women with higher levels of education and that it has increased over cohorts. Women in the LF represent a positive selection in terms of education, and to a smaller degree also in terms of origin class, especially in the first three cohorts. The variation over origin class is almost completely mediated via education. Once education is taken into account, there is no further significant variation between origin classes.

This changing selectivity by observable but also by further unobserved characteristics[6] of women in the labor force has to be taken into account when comparing women's mobility to that of men and across cohorts.

To summarize: We can derive a few stylized expectations from the elementary distributions shown in figure 1. In all cohorts, men are likely to have experienced more upward than downward moves. Women's class destinations, especially in the older cohorts, are clearly less favorable than those of their fathers (and brothers). Thus, downward mobility will prevail in the women's older cohorts, but less so in the younger cohorts. For both genders and in each cohort, the share of attained service-class destinations is larger than the share of tertiary degrees in education. Thus, at least for people with tertiary degrees, the risk of not finding an adequate employment should be rather limited.

Figure 1: Marginal distribution changes of O, E and D over cohorts 1–6

<table>
<tr><th>Origin class men</th><th>Destination class women in LF</th><th>Destination class men</th><th>Class categories</th></tr>
<tr><td>
</td><td>
</td><td>
</td><td>I Upper service
II Lower service
IIIa Routine non-man
IVab Self-employed
IVc Farmer
V/VI Skilled worker
VII/IIIb Unskilled worker</td></tr>
<tr><th>Education all women</th><th>Education women in LF</th><th>Education men</th><th>Education categories</th></tr>
<tr><td>
</td><td>
</td><td>
</td><td>3b University
3a Univ. of appl science
2c Full secondary
2ab Intermed. secondary with/without voc. training
1c Elementary with vocational training
1ab Elementary without vocational training</td></tr>
</table>

In figures 2a–2c, we look separately at each of the bivariate associations between O, E, and D. We begin with the total OD association in figure 2a, showing the absolute rates of mobility between origin and destination. For a given origin class and cohort, the class destination probabilities are indicated by the shadings in each bar. Because further analyses indicate little variation in the first three cohorts, they are combined.

6 Further analysis of all women show, for instance, that working class daughters who are found in the labour force in adult life have obtained higher qualifications than those who do not work, indicating positive selection along unknown characteristics.

To simplify, class categories are also shown in four groups only: the working classes V-VIIab, the self-employed IVabc, the routine non-manual class IIIa, and the service classes I/II. The main impression is that offspring of a given origin have typical class destinations that change little from cohort to cohort. Yet, corresponding to the general growth of service class destinations, offspring of non-service class origin (particularly women) tend to reach service class destinations slightly more often in the last three cohorts than in the combined first three cohorts. This is not the case for service class offspring. Their chances to arrive in service class destinations appear to have declined for men and to have remained more or less unchanged for women. Consequently, the OD association appears to have slightly weakened.

Figure 2a: Class destination by class origin and absolute mobility rates over cohorts

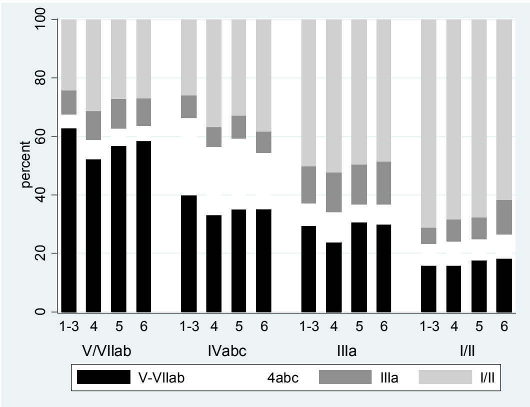
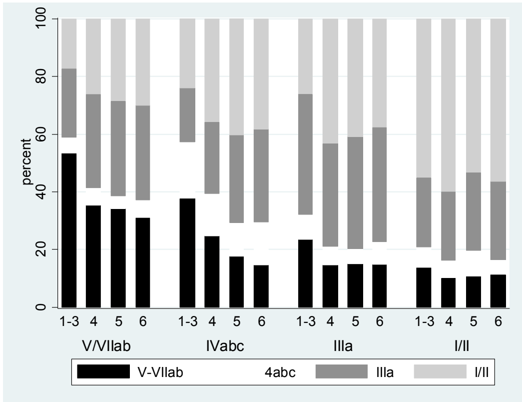
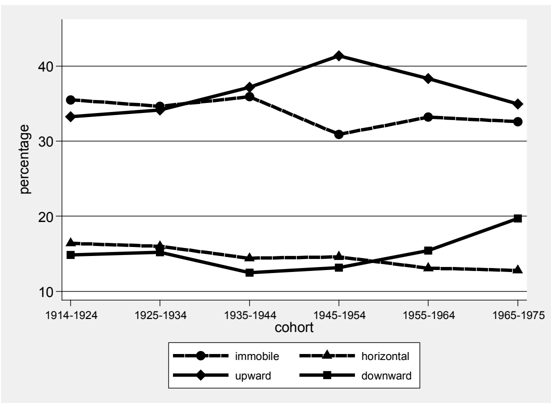
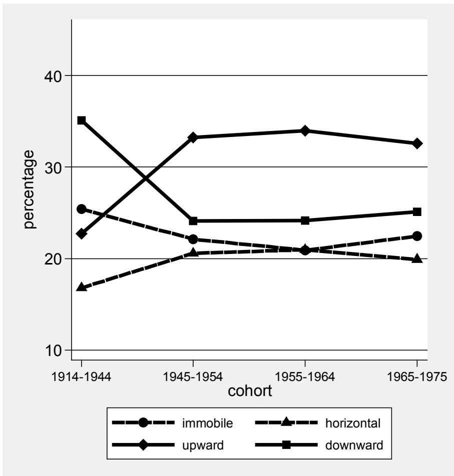
OD Male	**OD female**
	

Figure 2a (continued): **Absolute mobility rates**

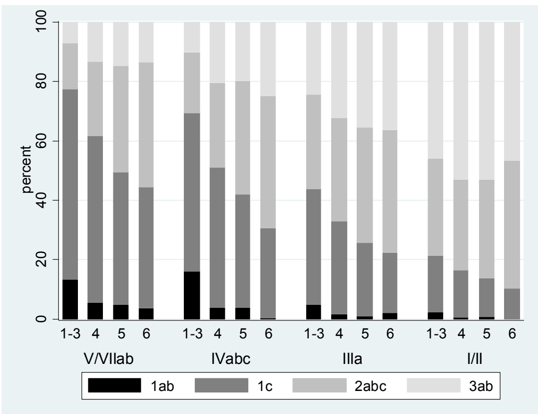
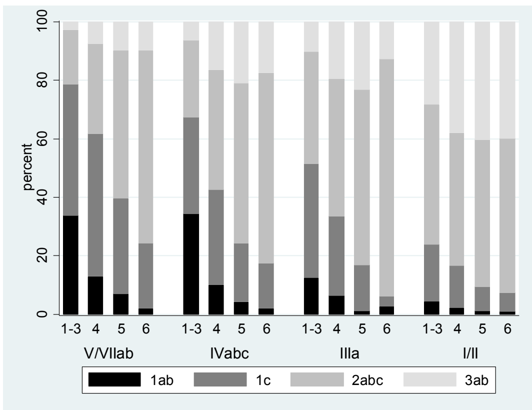
Men	**Women**
	

Differences between men and women largely correspond to the gendered labor market segmentation already seen in the class distributions: Women are less likely to have service and working class destinations than men are. They are more often found in the routine non-manual class, and daughters are less likely to inherit farms or other business than sons are.

The lower part of figure 2a shows the changes in various absolute OD mobility rates over cohorts (calculated from the full set of the seven Casmin class categories shown in figure 1). Men most likely either move up or remain immobile. Upward mobility increases up to the 1945–54 cohort, but declines in the last two cohorts. Downward mobility, in contrast, increases in the two youngest cohorts. The replacement of less upward by more downward mobility mirrors the contrasting development of continued growth over cohorts of service class origins and stagnating shares of service class destinations among the youngest three cohorts. Daughters, compared to their fathers, are generally more mobile than sons are: in the older cohorts they more often experience downward mobility. However, over cohorts, their downward mobility declines and upward mobility increases, mostly due to the more frequent entry into service and routine non-manual class destinations of women from origins outside the service class. Mobility rates of women became more similar to men's; but even in the youngest cohorts, daughters are more often downwardly mobile than sons are. They are also more often horizontally mobile, while sons are more often immobile, indicating that sons have jobs in the same class as their fathers, while daughters have jobs in a different class but at the same vertical level.

As to the origin-education association, the offspring of all class origins profit from the decline of elementary education and the growth of intermediate and higher education (figure 2b). For all class origins, elementary 1abc qualifications decline and especially secondary as well as tertiary qualifications increase. Change towards higher (especially secondary) education is stronger among intermediate and working class offspring than among service class offspring. In this respect, the inequality in educational attainments between the different origin classes clearly declines. This is true for both genders. For men, a slight trend towards equalization takes place also regarding access to tertiary education. For women, the rapprochement in educational attainments mainly consists in the stronger decline of only elementary 1ab and 1c qualifications among the lower and intermediate classes than among the service classes.

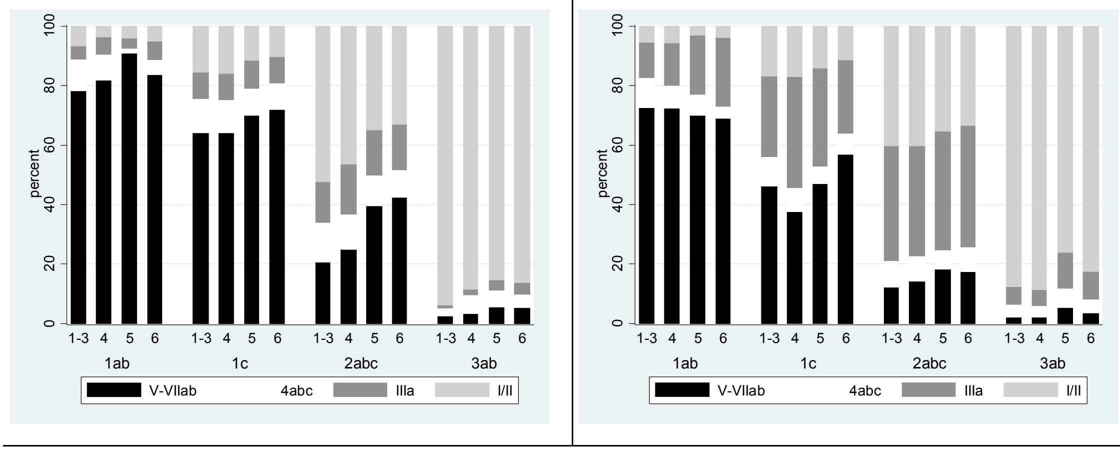
Figure 2b: Education by class origin over cohorts 1–6 (oldest to youngest)

OE male	**OE female**
	

For ED, figure 2c shows the very strong association between education and class destination which is well known for Germany. This "meritocratic" or "credentialist" link is in any case remarkably stronger than the links to class origin.[7] Compared to graduates with only elementary general education (1ab, 1c), those with secondary education already have substantial chances to arrive in a service class position, and the large majority among the tertiary graduates does so. Among the first four cohorts, the typical class destination pattern for each of the qualifications remains rather stable but changes slightly for the two youngest cohorts in the direction of declining class returns to education: Secondary (2abc) graduates less often reach a service class position; to a smaller extent this is also true for tertiary graduates. Differences between men and women again correspond to the gendered job segregation. At the same level of education, women have more often routine, non-manual jobs and men more often working class jobs. Compared to men, women are also more often found in lower rather than upper service class positions (data not shown).

Figure 2c: Class destination by education over cohorts 1–6

ED male	ED female



How is educational expansion reflected in the changing destination patterns? In Germany, tertiary education can hardly be said to have lost its advantageous labor market prospects. There is little indication of tertiary education inflation. The results might be interpreted as an indicator for displacement from above, in the sense that the growing number of tertiary graduates entering service class positions makes it harder for holders of lower qualifications to enter such positions. However, as argued above, in the German case the change towards slightly less advantageous positions among holders of secondary and elementary qualifications most likely results from increased requirements of higher levels of general education in the competition for apprenticeship contracts, even for apprenticeships in occupations which usually lead to skilled working class positions. This could be a consequence of increased qualification requirements in given jobs (skill-biased technological change) or it might result from employers' "creaming off" from among an over-supply of school leavers searching for an apprenticeship place. If we were able to distinguish between vocational training for manual and service jobs in our data, we probably would end up with a pattern of ED association more stable over time.

7 The linkage between education and later class position appears even stronger when distinguishing skilled and non-skilled working class destinations (not shown) because of a large gap in these destinations between 1ab and 1c qualifications: Workers with vocational qualifications in addition to basic general education (1c) have much smaller risks of being constrained to unskilled work than their 1ab counterparts.

7 Education and social fluidity

So far, we have looked at bivariate associations in terms of (absolute) transition rates and how they changed from cohort to cohort. We now move to relative rates, using odds ratios to assess inequalities in educational attainment (E) and class destination (D) between people from different class origins (O). As a first step, we fit log-linear models and assess changes over cohorts in social fluidity, educational inequality, and returns to education. In these models, we use the detailed categories as shown in Figure 1 for origin, education, and destination.[8] Change is assessed with the uniform difference model. This model assumes that the pattern of odds ratios is constant in the OD, OE, and ED association tables we compare between cohorts, but that the strength of all corresponding odds ratios varies from cohort to cohort in a uniform way by a factor $ß_c$ (see table 2a). For both genders and all three bivariate associations, assuming uniform difference change improves the fit compared to the model assuming constant association strength (as measured by the G^2 goodness-of-fit statistic). For men, uniform difference is the preferred model in all associations also according to the BIC criterion; for women this is true in the case of ED. Yet, in none of the three associations the uniform difference model fits the data, indicating that there is some additional variation over time in the association pattern not covered by the uniform difference assumption.

Table 2a: Log-linear models of change over cohorts in the bivariate associations of OD, OE and ED

		men					women				
Matrix	**Model**	**G^2**	**DF**	**P**	**BIC**	**ΔG[a]**	**G^2**	**DF**	**P**	**BIC**	**ΔG[a]**
COD	M1 CO CD OD	308.3	180	0.00	-1461.4	RefM1	178.3	108	0.00	-818.1	RefM1
	M2 CO CD $ß_c$OD	246.0	175	0.00	-1474.5	62.3***	153.8	105	0.00	-815.0	24.6***
COE	M3 CO CE OE	233.5	150	0.00	-1241.2	RefM3	167.1	90	0.00	-663.2	RefM3
	M4 CO CE $ß_c$OE	178.7	145	0.03	-1246.9	54.8***	140.4	87	0.00	-662.3	26.7***
CED	M5 CE CD ED	286.1	150	0.00	-1188.6	RefM5	134.6	90	0.00	-695.8	RefM5
	M6 CE CD $ß_c$ED	228.2	145	0.00	-1197.4	58.0***	105.9	87	0.08	-696.8	28.7***

*** Indicates statistically significant at $p < .001$.

[a] The figures in this column show the difference of the goodness-of-fit statistic G^2 between the model under consideration and the model taken as reference.

Table 2b and figure 3 shows the estimates for the uniform difference coefficients. For men, the strength of all the associations weakened over cohorts. The most pronounced decline occurs between the cohorts born up to 1944 and those born after WWII, except for the OE association, for which we see some decline already from the first to the second cohort. For women, change in OD and OE is similar: a clear decline after the cohorts 1914–1944; only ED differs in that, in the youngest cohort, the coefficient returns to more or less its initial level. All these findings are consistent with what we have seen in the descriptive figures: the strength of the associations declines in the younger cohorts. So as a main result, we do indeed see an increase in social fluidity across birth cohorts for both men and women.[9]

8 For cohorts (C), we use six categories in the case of men. For women, the first three cohorts are collapsed because of small numbers in the two oldest cohorts. Analyses using all six cohorts return the same basic results as those reported here.

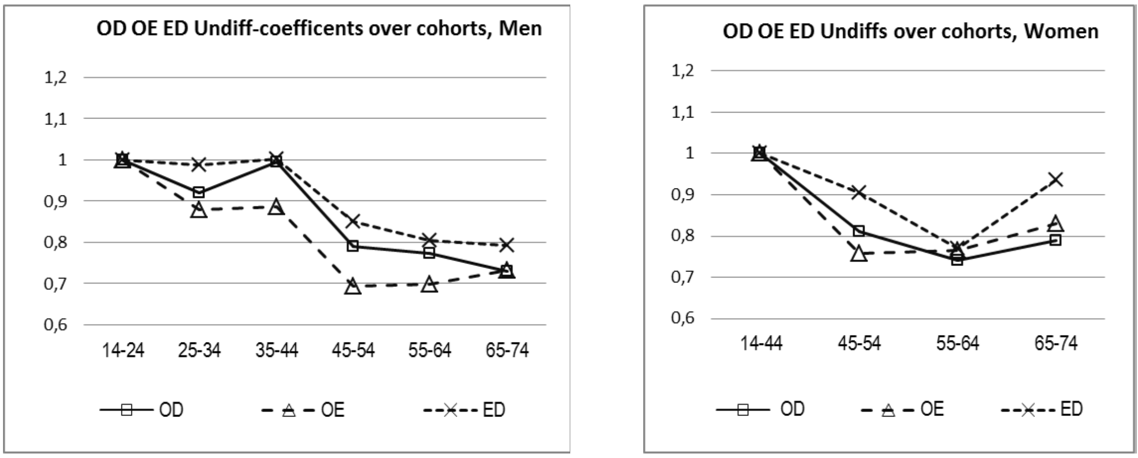
9 This is in line with the results from Müller and Pollak (2004), Pollak (2009), and Hertel (2016).

Table 2b: Uniform difference coefficients $ß_c$ for models M2 in table 2a

men	cohorts					
	14–24	25–34	35–44	45–54	55–64	65–74
$ß_c$ OD	1	0.919	0.994	0.789	0.772	0.730
$ß_c$ OE	1	0.880	0.885	0.693	0.698	0.731
$ß_c$ ED	1	0.987	1.002	0.849	0.804	0.792

women	cohorts			
	14–44	45–54	55–64	65–74
$ß_c$ OD	1	0.789	0.772	0.730
$ß_c$ OE	1	0.693	0.698	0.731
$ß_c$ ED	1	0.849	0.804	0.792

Figure 3: Uniform difference coefficients for change over cohorts in OE, OD, and ED from models M2 of table 2



The difference between the (pre-)WWII and the post-WWII cohorts is not just a difference between social conditions before and after WW II. We have to keep in mind that father's class is measured at respondent's age 15, which is also the crucial age at which it is decided whether the child stops education at the end of compulsory schooling or continues for higher qualifications. Occupational maturity, i.e. a largely stable class position, is reached at even later ages. Thus, the historical period in which the more fluid stratification pattern emerges is the 1960s and the subsequent years. In Germany, this coincides with the significantly improved living conditions in the years of the *Wirtschaftswunder* and also with the period in which educational policies started to facilitate access to higher education, e.g. by opening many more schools at the intermediate and *Gymnasium* level. Interestingly, we do not see a major reversal of the more fluid pattern in later years, when economic conditions became harsher again due to the oil crisis and other crises.

With table 3, we move to the core questions of how destination depends both on origin and education, how conditions of social origin are mediated through education, how they influence destination in a direct way, and how all these patterns have changed over cohorts. For this purpose, we model the COED matrix. In all models, the COE term accounts for OE change over cohorts in a saturated way. In model M1, both OD and ED are included in addition to COE. Therefore, ED captures direct effects of education on destination controlling for origin, and OD captures direct effects of origin controlling for education. Each of the terms included in the model contributes in a highly significant way to improving the fit. ED does this to a much stronger extent than the other terms (results of tests not shown). This means that class destination is clearly more strongly associated with education than with origin and also more strongly than education is with origin. The fact that also the inclusion of OD significantly improves the fit indicates that, beyond the mediation of origin effects through education, substantial direct origin effects remain. M1 fits the data and BIC prefers this model to all other models. Nevertheless, the fit can be significantly improved by more specific models. In these additional models, our strategy is to first account for the theoretical hypotheses discussed above that origin and education might interact in affecting destination. We subsequently test whether we still find change over time. With β_eOD in M2, we test the *'educational expansion' hypothesis* (Hout 1988) that the direct effects of O on D are lower for subjects with higher than for subjects with lower levels of education. With β_oED, M3 tests for the alternative view, i.e., the *'differential educational impact' hypothesis* discussed by Goldthorpe and Jackson (2008). This hypothesis assumes that the strength of the ED link differs for persons of different origin (e.g., that education plays a smaller role in class destination for service class offspring than for working class offspring).

Table 3: Log-linear models of change over cohorts in the OED triangle (COED matrix)

Model	G2	DF	P	BIC			
Men							
M1 COE CD OD ED	1444,1	1410	0,26	-12418,4	Ref M1		
M2 COE CD β_eOD ED	1431,6	1405	0,30	-12381,8	12,57 *	Ref M2	
M3 COE CD OD β_oED	1436,9	1404	0,27	-12366,7	7,3 ns		
M4 COE CD β_eOD β_cED	1388,0	1400	0,59	-12376,2	56,1 ***	43,6 ***	Ref M4
M5 COE CD $\beta_c\beta_e$OD β_cED	1377,8	1395	0,62	-12337,2	66,4 ***		10,2 +
Women							
M1 COE CD OD ED	1002,1	918	0,03	-7467,5	Ref M14		
M2 COE CD β_eOD ED	991,1	913	0,04	-7432,4	11,03 *	Ref M2	
M3 COE CD OD β_oED	994,9	912	0,03	-7419,4	7,2 ns		
M4 COE CD β_eOD β_cED	968,3	910	0,09	-7427,6	33,9 ***	22,8 ***	Ref M4
M5 COE CD $\beta_c\beta_e$OD β_cED	966,0	907	0,09	-7402,2	36,1 ***		2,3 ns

Note: Statistical significance: + $p < .10$; * $p < .05$; *** $p < .001$; ns = non significant.

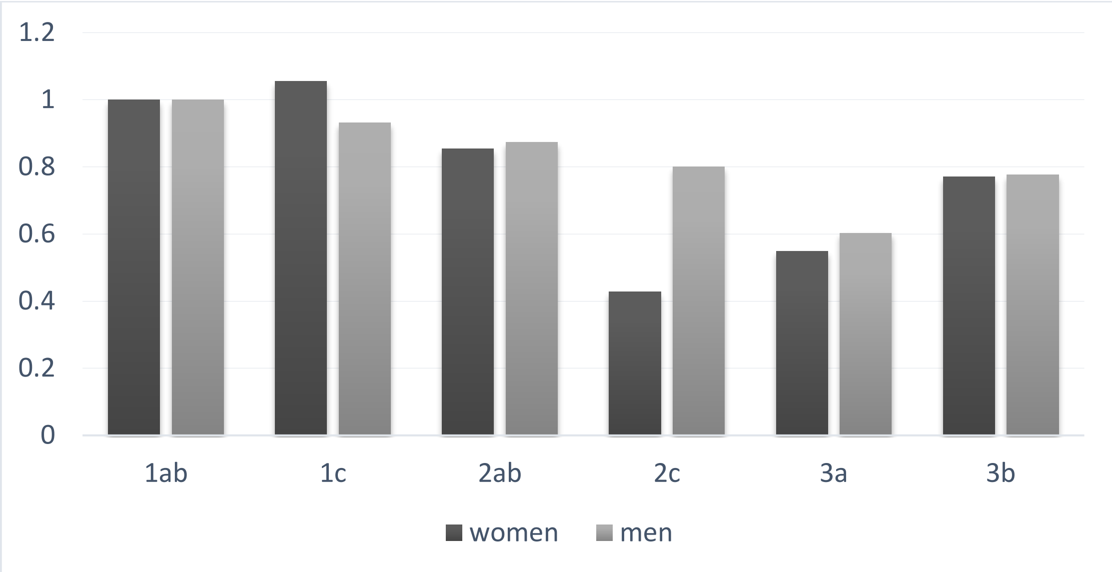
With the models M2 and M3, we find for both men and women statistically significant support for the educational expansion hypothesis (M2), but not at the conventional level of significance for the differential educational impact hypothesis (M3). Therefore, we do not include the β_oED term when testing for change over cohorts in further models. For ED, we find significant uniform difference change (compare M4 to M2 as reference), but additionally accounting for uniform difference change in OD does not improve the fit (compare reference M5 to M4) at the conventional 5% significance level (for men it would be significant at the 10% level). Thus, we keep M4 as the final model for both genders.[10] As to the interpretation of the OED interaction discussed at the end of section 2 above, the constellation of the data seem to lend more support to the *'educational expansion'* interpretation than to the *'differential educational impact'* interpretation, as the β_eOD-term in M2 turns out to be significant while the β_oED-term in M3 does not, i.e., direct effects of origin vary by education rather than educational impact by origin. We can also note that further tests (not shown here) indicate that the β_eOD-term remained constant over the educational expansion that took place from the older to the younger cohorts. We could not find any indication that "the capability of advanced education to weaken

10 β_eOD also adds significantly to the fit when we add this term to a model which already includes β_cED.

the ‘ascriptive effect’ has declined” (Vallet 2004: 142). The final model thus shows that ED changes significantly over cohorts, while OD only varies over educational levels. While there clearly are direct, non-education-mediated origin influences on destination, they do not change over cohorts. The increase in social fluidity observed in the bivariate analysis (declining $ß_c$-coefficient for OD in M2 of table 2) is thus completely explained by education-related developments.

Figure 4 shows the $ß_e$OD- coefficients from model M4[11], indicating how direct origin influences on destination vary over different levels of education. They are clearly lower at higher than at lower levels. They are especially low for male respondents with lower tertiary qualifications (3a), essentially graduates from “Fachhochschulen”, and for women with *Abitur*-level general education and usually secondary vocational qualifications in addition (2c). As in the succession of cohorts, elementary 1abc qualifications strongly declined and secondary and tertiary qualifications expanded; this compositional change in the educational distribution contributes to weakening the role of direct OD effects for intergenerational class stability.[12] Explaining this pattern for the German case would require a more detailed study than is possible here.[13]

Figure 4: Uniform difference variation of direct OD effects over education levels



All in all, fluidity in intergenerational social mobility has risen. This increase appears to derive from at least two education-related developments. On the one hand, it results from compositional consequences of educational expansion: direct influences of class origin on class destination are smaller among the growing numbers of higher qualification holders than they are among holders of lower qualifications, whose numbers decline. On the other hand, social fluidity has also increased on the indirect route from origin to education and from education to class destination as the strength of these links are smaller in the younger than in the older cohorts. These processes appear to work in very similar ways for men and women. Which is the contribution to increased fluidity of each of these processes will be explored in a simulation exercise further

11 For both men and women the coefficients for $ß_c$ED in M4 tend to be minimally higher than the corresponding coefficients for the $ß_c$ED in M2 of table 2, shown in figure 3. However, the difference is at most 0,02 indicating that taking into account the compositional impact of educational expansion on direct influences of O on D lets the decline over cohorts in the ED association practically unchanged.

12 The u-shaped pattern in figure 4 resembles the findings for men in recent US cohorts (Torche 2011), but in Germany it does not seem to have emerged as recently as in the US (further models not shown do not indicate respective change over cohorts for Germany).

13 One hypothesis to be further pursued could relate to the fact that, for men and women alike, direct origin influences on destination are lowest for the highest vocationally-oriented (non-university-level) qualification, which is most frequently obtained by each gender (2c in the case of women and 3a in the case of men, according to figure 1). These are also the highest qualifications most often attained by working class offspring.

below. Before that, we examine in the next section which proportions of the total OD association are mediated via education and which remain as direct effect of O on D when we control for education.

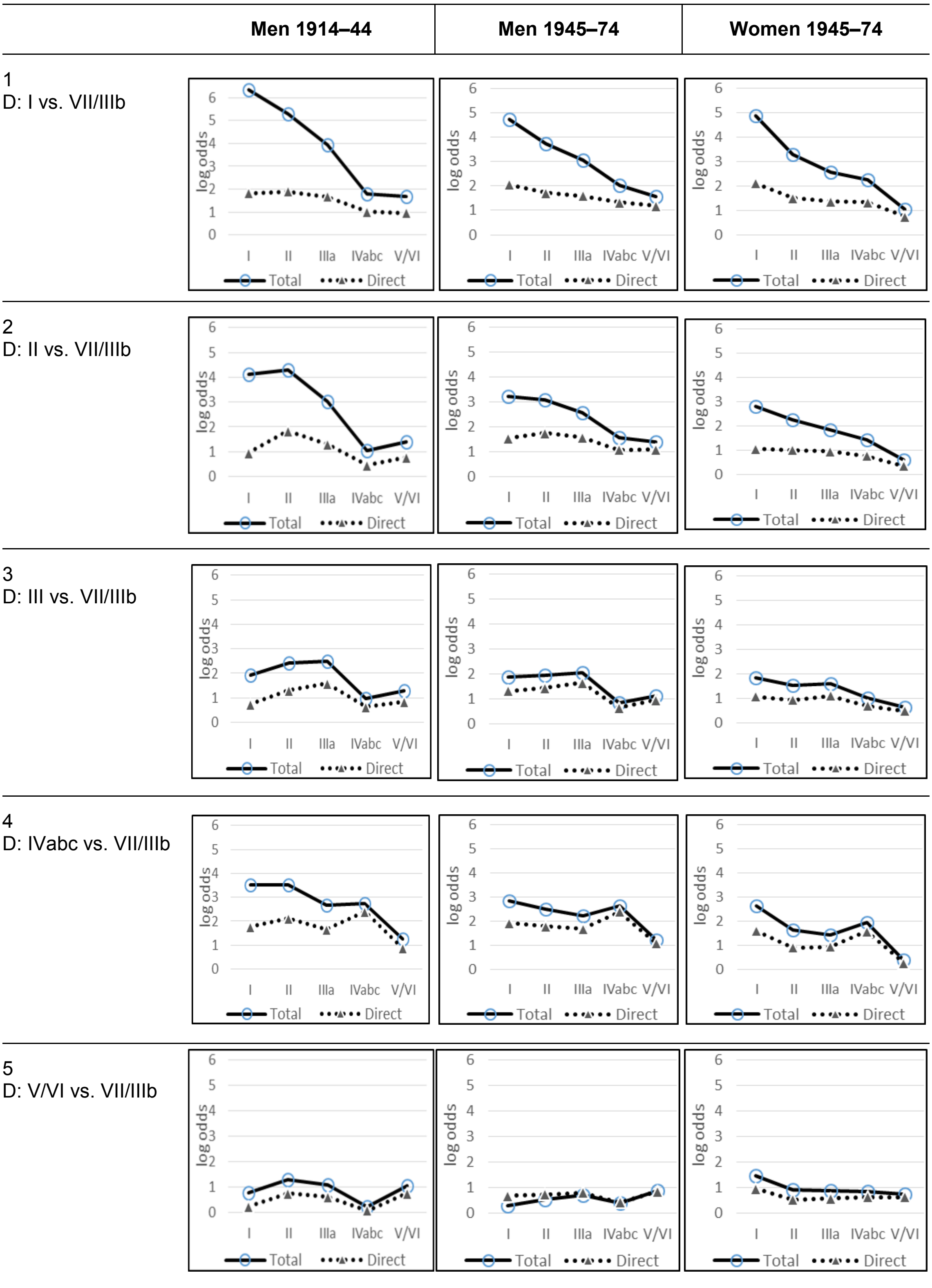
8 Decomposition of total OD effects into direct and education-mediated paths

From earlier studies (Ishida et al. 1995, Müller and Pollak 2004), we know that, in Germany, large parts of the total OD association are mediated via education, but that the contributions of direct and education-mediated paths vary, depending on the origin and destination classes involved. We use the KHB decomposition method (Breen et al. 2013a, Kohler and Karlson 2010) to examine this issue in more detail. This method allows us to decompose the various log odds ratios of an OD mobility table into the education-mediated and the remaining direct path. According to Figure 3, changes mainly occurred between the three older and the three younger cohorts, and so we present results for men for these two cohort groups. For women, we only show results for the combined younger three cohorts because of the small sample sizes in the older cohorts.

Each graph in Figure 5 shows how the odds of reaching one particular destination rather than the reference destination (class VIIab+IIIb) vary between individuals from a particular origin compared to those from the reference origin class (again class VIIab+IIIb). The variation of origin contrasts is shown in the horizontal dimension of each graph, while each row of graphs refers to a different destination contrast. The solid line stands for the total effect of O on D, while the broken line shows the direct effect that remains when education is controlled; the difference between the two lines represents the part of total OD mediated by education. Taking the graphs of the top panel as an example, we see: The total log odds to reach the most advantageous destination (class I) rather than the least advantageous (class VIIab) is increasing with the vertical distance of the origin classes to the reference origin class (VIIab). This is not surprising; the interesting point is that the increasing inequality mainly results from inequality mediated via education. Thus, larger total OD effects between origin classes at a larger vertical distance are primarily generated by larger differences in educational attainment between the classes and the implications education has for class destination. Service class offspring are much more likely to reach a service class position than working class children, mainly because the former are much more likely than the latter to have the education leading to such a destination. As visible from the panels further below, the total log odds and especially the part mediated by education is also larger when the compared destinations lie further apart from each other. The education-mediated part is largest when we contrast access into the upper service class (I) rather than into the unskilled working class (VIIab) and smallest when contrasting access into the skilled (V/VI) rather than the unskilled working class (bottom panel).

The size of direct effects, in contrast, varies less with the vertical distance between the compared classes. Their variation shows a different pattern: In most figures the direct effect tends to be largest when the destination class corresponds to the origin class. This probably indicates that these effects essentially capture the propensity to immobility, i.e., the attachment to one’s class of origin. A further observation is consistent with this view: Especially when two destination classes have similar class attributes, the OD association is essentially a direct one and education does rather little in mediating origin effects. This is most clearly visible when comparing the skilled and unskilled working class in the last panel. The total effects are small and largely due to non-educational mechanisms. The education-mediated part is small, because the offspring of unskilled and skilled workers have very similar educational attainments, and therefore education can hardly mediate the differences of origin. For similar reasons, access into either the upper or lower service class by the offspring of these classes mainly depends on direct consequences of having parents in the upper or lower service class and not on differences in education (in this case, direct effects make up 64% of the total effect and education-mediated ones only 36%; data not shown). Consequently, both within the working class and within the service class, access to the higher or lower segment of these classes mainly depends on direct mechanisms of class “inheritance” and less on differences in education of the class offspring.

Figure 5a: Total and direct effects of origin on destination from multinomial regression using KHB-decomposition



Direct inheritance also plays a particular role when it comes to the self-employed classes.[14] Here, direct effects tend to be stronger than in any other case. Even for the contrast with the unskilled working class (second last panel), direct effects are stronger than education-mediated ones, especially in the case of origin in self-employment.

Thus, the relative size of the direct and indirect paths varies substantially in different areas of the OD association. The larger the vertical distance between the compared classes is, the more education appears to mediate origin effects on destination. This is consistent with the finding of Müller and Pollak (2004) that education above all is responsible for the hierarchy effects in the core model of social fluidity (Erikson and Goldthorpe 1992).

The size of effects and the relative contribution of direct and education-mediated paths are astonishingly similar between the two male cohorts, and between men and women of the younger cohort that are compared in the three columns of figure 5b. The most systematic difference between the older and younger cohorts of men consists in reduced education-mediated origin effects on practically all contrasts, especially those involving access from other classes to one of the two service classes (panels 1 and 2). In contrast, there is hardly any difference between the cohorts in direct effects.

Comparing also the younger cohorts of men with those of women reveals little difference, and when it does, differences are plausible. Direct effects of origin (father's class) appear to matter slightly less for daughters than for sons, most likely because of the general differences between male and female labor markets. This is especially true when it comes to access into self-employment, mainly because sons "inherit" firms and farms, but not daughters (panel 5).

Figure 5b shows the proportions of total origin effects that are mediated by education in the origin and destination contrasts in figure 5a. The figure is structured as follows: The bars in the first block for men born 1914–44 show how the education-mediated part in access to class I (rather than VIIab) varies depending on origin class (marked by the different bar shadings; this block thus corresponds to the left graph in the top panel of figure 5a).The second block of Figure 5b shows access to class II rather than class VIIab, and so on. We do not show the proportions when one of the effects is statistically not significant.[15] Figure 5b essentially confirms what we have seen in figure 5a. The proportion of inequality in access to the various classes mediated by education varies greatly. Mediation via education is large when the distances between the contrasted destination or origin classes are large, but it is smaller in the case of mobility or immobility among the working classes or among the two service classes (the latter is not shown), and especially for access to self-employment from self-employed origin. Comparing the older and younger cohort in figure 5b also confirms the conclusion from figure 5a that in the younger cohort the education mediated proportion of inequality has declined. The gender comparison confirms that in some aspects of the mobility regime education plays a somewhat stronger role for women than for men.

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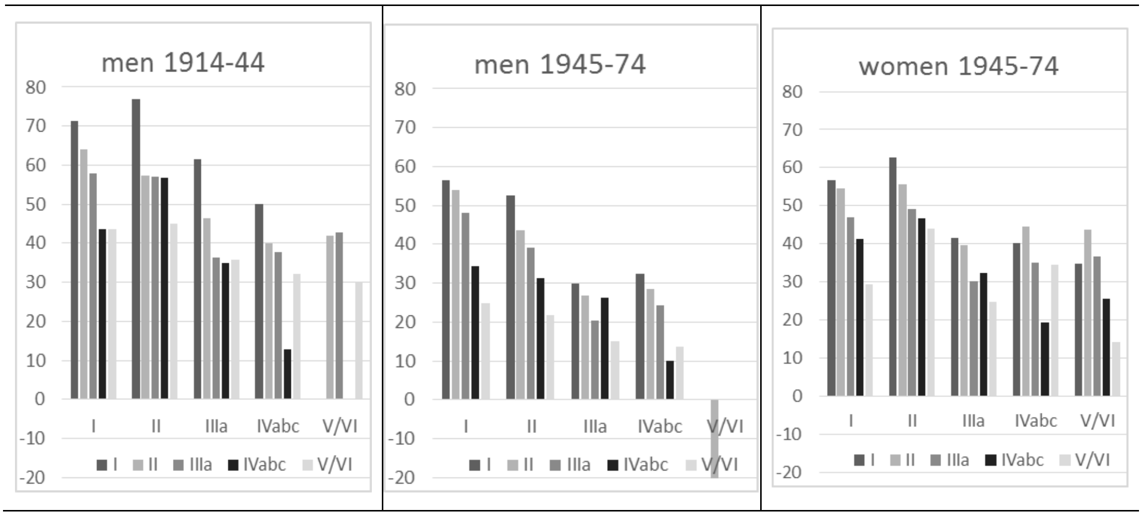
14 Because of the relatively small sample size, farmers and self-employed outside agriculture are combined in this analysis. This reduces the part of direct effects.

15 This is the case for both cohort groups of men in some instances of access to the skilled working classes (V/VI), in which several odds ratios are particularly small.

Figure 5b: Proportion of total origin effect mediated via education



As for many of the reported odds ratios the proportion of education-mediated effects is below 50%—and hence the proportion of direct effects above 50%—, the impression could arise that, at large, the contribution of direct effects to the total OD association prevails. However, this would be a wrong conclusion because, in the illustration chosen here, we concentrate on destinations and origins in contrast to the unskilled working class taken as a reference. Seen from this reference point at the bottom, inequalities in access to the intermediate classes are relatively small and not overwhelmingly mediated via education. In contrast, when we take the service class as reference and look downwards from the top inequalities are large and mainly mediated via education not only in access to the working classes but in access to the intermediate classes as well.[16] In terms of mobility chances the intermediate classes are closer to the working class than to the service class. And the big advantage in educational attainment service class offspring have as well as the crucial role education plays for access into the service classes explains why this is so and why in the view from the top the part of education mediated effects is found to be stronger than in the view from the bottom. Taking both views together, an approximate estimation is that all in all about two thirds of total effects arise via education and one third remains as direct effects.

Integrating the findings of figure 5a and 5b leads to the following conclusion: There is less inequality in the younger cohorts, because in these cohorts education transmits less inequality from the parental to the filial generation; total inequality for men and women is largely similar; yet, in the case of women relatively more of it is transferred via education than via direct effects. In general, education plays a strong role in mediating origin inequalities in access to the service classes. Yet, in various areas of the mobility table we also find direct origin effects that can weigh more than education-mediated ones.

9 Simulation

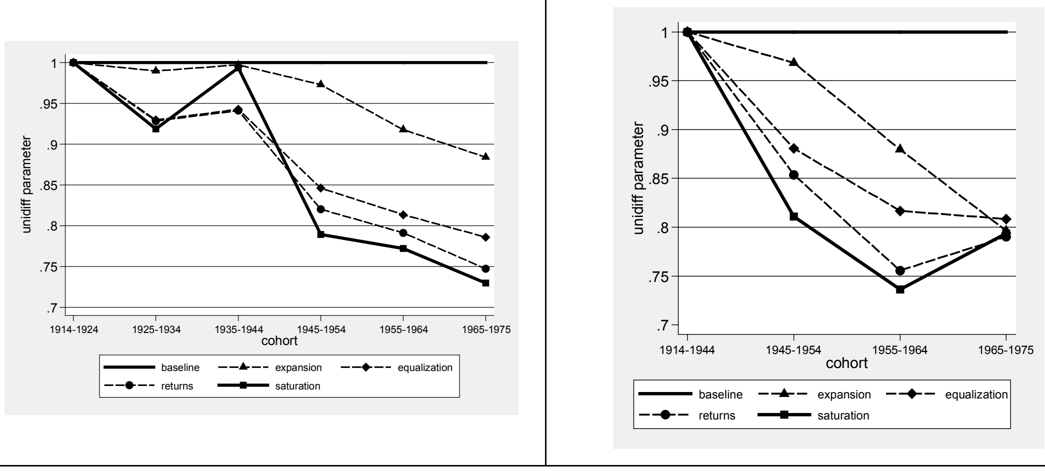
The previous section shows the relative contribution of the direct and education-mediated paths for specific odds of the father-son/daughter mobility tables. But how did the increase in social fluidity, as indicated by $ß_{c}$OD in table 2 and figure 3 above, depend on the dynamic processes of educational expansion, changes in educational inequality, changes in educational returns, and changes in direct effects of social origin (net

16 This is the clear result of an alternative analysis, in which the upper service class is taken as reference and the focus lies on access to other classes rather than these classes and from other origins rather than this origin (not shown).

of education)? In order to explore this issue, we have pursued a simulation exercise adapting previous work by Breen (2010). As a starting point, we take our COED table and start with a model (baseline) that does not include any terms for educational expansion, educational equalization, changing returns, or changing direct effects (cf. appendix). We write out the hypothetical cell frequencies and use these cell frequencies of the hypothetical COD table to run a unidiff model. Given that the baseline model does not include any term that would allow the gross OD association to change, the unidiff model does not show any change over cohorts (horizontal line at value 1 in figure 6). We now gradually introduce terms of educational expansion, educational equalization, changing educational returns, and changing direct effects. Each time, we write out a hypothetical COD table and calculate, based on the respective estimates, a unidiff model.

Figure 6: Unidiff parameters taken from simulation models

Men	**Women**



When including educational expansion, the results suggest that educational expansion does have a positive effect on social fluidity, but this is mainly true for the last three cohorts. Taking educational equalization into account, we see that the unidiff parameters are coming much closer to the observed unidiff parameters (saturated model). Changing returns to education and changing direct effects of social origins have an equalizing effect as well, but these mechanisms are less important compared to expansion and equalization. To give an idea of the magnitude of these effects, we can calculate the area between the baseline model (no change) and the observed development (saturated model) and report for each additional parameter the size of the area that is successively covered. In the case of men, some 27% of the area to "explain" is covered when taking into account only educational expansion. When allowing for educational equalization as well, we cover about 87%. With changing returns to education, it goes up to 98%, and the changing direct effects cover the remaining difference to the saturated model. These numbers should only be seen as an illustration of the importance of the various developments with respect to the overall development of social fluidity. Mainly educational equalization fosters social fluidity. In addition, educational expansion becomes more important for the later cohorts. Changes in educational returns or direct effects of social origins are less influential for the development of social fluidity. These main results hold true even when changing the order of the simulation models.

For women, the area explained by educational expansion is relatively larger than the area explained by equalization, reflecting the fact that women experienced much stronger educational upgrading and expansion than men. However, in terms of historical sequence, the equalization component precedes the expansion component in the same way as it does for men.

10 Sensitivity analyses

The analyses in this chapter involve several possibly problematic issues. In order to explore whether they may bias our conclusions, we have carried out various tests for robustness of the findings. In the following, we briefly outline the problems and summarize the design and results of the tests.

- Our database consists of a collection of surveys that partially differ in survey procedures. For instance, beside the variables used for the analyses in this chapter, the surveys also include other contents. The latter vary between the surveys. While all surveys are based on random samples of the population, randomness is established by different procedures (primarily random walk procedures or random selection from population registers). Different survey organizations have collected the data of single surveys. The surveys extend over a long period of time, from 1976 to 2010. While our analytic interest relates to change over birth cohorts, specific developments in particular periods could affect the findings from surveys taken at different periods in time. Does the pooling of the data systematically bias the results or do they hold even when controlling for survey differences?

  As described in detail in appendix B, we replicate the analyses of tables 2 and 3, controlling for each single of the 34 pooled surveys in order to test whether the variations that we find in the basic associations over cohorts and levels of education vanish when controlling for variation in the surveys. We do find quite substantial variation between the surveys; yet, when controlling for them, the conclusions do not change in their substance. One minor difference is that in M5 for men in table 3 above, the inclusion of $ß_c$ for OD returns a marginal improvement of fit. When controlling for survey effects, this coefficient turns significant at the 5% level. This could indicate that social fluidity has increased over cohorts not only because education-mediated origin effects became smaller but also due to reduced direct OD effects. Furthermore, the analyses controlling for survey effects provide indication that the diminishing returns to education which we found for the younger cohorts is probably due to diminishing returns in the period after the mid-1990s, which mainly affected the younger cohorts.

- A further problem results from the fact that destination class of different cohorts is observed at different ages. When results systematically differ depending on the age at which cohort members are observed, this would invalidate cohort comparisons that do not control for age. We address this issue in appendix C and find no systematic age effects that would require controlling for age in the analyses.[17]

- In the log-linear analyses in which we use the uniform difference model, we assume that the association pattern in the tables of the different cohorts is the same and that only the strength of the association varies. The comparisons of the younger and older cohorts of men in figure 5 allow a partial assessment of the extent to which this assumption is valid for our data, since all data points in these graphs represent single log odds ratios. The pattern of these ratios is very similar in the older and younger cohorts, and the corresponding values in most panels are similarly smaller in the younger than in the older cohorts. This can be taken to assure that there are no serious violations of the uniform difference assumptions.

- Finally, the comparability of coefficients in log-linear models is inhibited by the scaling problem that arises when outcomes to be explained differ in unobserved heterogeneity. For this reason, in appendix D we compare the OD, OE and ED associations in the older and younger cohorts in terms of non-linear correlations, which can meaningfully be compared even in the case of different unobserved heterogeneity. The results are in agreement with our general conclusion that the strength of the associations in the mobility triangle declined over cohorts.

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17 This is in agreement with the findings of Stawarz (2013) that in Germany the very large part of intergenerational mobility is already achieved at entry into working life and little change occurs during working life.

11 Conclusions

Germany has been found to be one of the economically advanced countries with lowest social fluidity (Erikson and Goldthorpe 1992, Breen and Luijkx 2004). In this paper, we have pursued a long-time perspective and compared cohorts born in the first quarter of the 20th century up to cohorts born in the 1970s. We find that social fluidity has increased for the younger cohorts. The most significant increase is observed for the cohort born in the first decade after WWII. In their later childhood, members of this cohort experienced improved living conditions connected with the German *Wirtschaftswunder*. They were attending school when, especially at the secondary level, educational expansion took off, and they started their working careers under the relatively good labor market conditions before the first oil crisis. The two succeeding cohorts were confronted with harsher labor market conditions and the surplus of service class position between their own and the parental generation was smaller. Yet they profited from continued educational expansion and from a lower degree of educational inequality, which did not change from that achieved by the preceding cohort. Social fluidity also remained stable at the same level as in the preceding cohort.

Several developments have contributed to the increase in fluidity. The two most important ones are educational equalization and educational expansion. The decline in educational inequality has contributed to reducing the indirect, education-mediated part of the total impact that social origin conditions have on the class position in adult life. Educational expansion, in contrast, has contributed to reducing direct, extra-educational influences of class origin on class in adulthood, because such influences appear to be smaller among holders of secondary and tertiary education than among those with only basic general and vocational qualifications. This consequence of expansion is independent of the potential role it may have for change in educational inequality. Interestingly, educational equalization had its main impact on enhancement of social fluidity for the first post-war cohort, and little further impact on fluidity change for the following cohorts. This resembles the temporal pattern in the historical development of educational equalization seen in figure 3. Educational expansion, on the other side, was most effective for the two youngest cohorts, which profited most from the upgrading of educational attainment. If we can take the findings of the simulations as a basis for reflecting some real developments, also declining returns to education and declining residual direct effects slightly fostered social fluidity. Compared to expansion and reduced educational inequality, the latter developments were of minor importance. As even the residual direct effects appear to have declined, it is hard to believe that something could have worked with major impact in the direction of strengthening direct influences of class origin on class attainment in Germany`s recent past.

We have found some decline in returns to education, but with little indication of tertiary education inflation in Germany. Returns declined mainly for intermediate-level qualifications, which—corresponding to the specific German way of educational organization—expanded most. The dominating pattern in the large majority of the population to obtain a vocational qualification after the completion of general school education has been maintained, but the level of general education required for securing a vocational training place has been raised for many occupations. In the German labor market—strongly structured along occupational lines—the occupation trained for is likely to provide more or less unchanged job prospects even if vocational graduates have moved up on the educational ladder by having obtained a higher level of general education before starting vocational training. This is the most likely story behind declining returns to education in Germany. It is highly akin to the logic of the German type of education and training system, as is the deferral of expansion at the tertiary level. Interesting questions then arise of whether these developments are a response to truly raised qualification requirements for intermediate-level jobs, as it have skill-based technological change arguments (Autor et al. 2003, Spitz-Oener 2006), or whether they resulted from “creaming off” by employers from among a rising supply of school leavers who increasingly obtained higher-level secondary education in a rat race for good training opportunities.

Whatever the answer to these questions is, in a German-type system of the ‘qualification-space‘ logic in the links between education and labor markets, education can be expected to mediate to a large part the consequences that origin class resources have for class destination in adult life. The education path is dominant in mediating access to destinations far apart from origin. In contrast, direct origin effects especially foster inheritance in all classes and class reproduction within the ‘big classes’, the service class, and the working class. The circumstance that education plays an important role in Germany is also shown by the fact that the changes in intergenerational social fluidity have been mediated more or less completely by the changes that occurred in education: equalization and expansion.

In the period covered in this study, the social world for women has changed much more dramatically than it did for men. In the older cohorts, the social roles of women were largely defined by home-making and motherhood. Families invested much less in the daughters’ education than in the sons’ education. In the youngest cohort, women have a largely similar level of education as men and most of them participate in the labor market to the same extent as men do for large parts of their active life. While for the older cohorts it made little sense to see the social position of most women defined by their own job, this increasingly does make sense in the younger cohorts. Still, several crucial differences remain, especially with respect to the labor market. Compared to men, women more often work only part time, and in non-manual and service jobs rather than in jobs producing material goods. Even though educational growth has been much higher for women than for men, gender differences in education still persist, most notably—and corresponding to the different work areas—in the chosen fields of education and training.

Along with the changes in education and participation in the labor market, absolute mobility among women has changed much more markedly than it did for men. The rates of downward mobility—much higher in the older cohorts among women than among men—have declined and became similar to those of men. The lower rates of upward mobility have increased and as well became similar to those of men. Even though women are still slightly disadvantaged compared to men, the progress towards gender equality has been strong in this respect. The remaining gender inequalities are small compared to the inequalities in educational and class attainment between children born in families of different classes.

Given the certainly more fundamental change in many aspects of women’s life, it can be surprising how little difference we find between men and women when looking at the role played by class origin and education in relative terms. With two minor exceptions, there are hardly any differences. Origin advantages and disadvantages are transformed in similar ways by education and over direct paths into more or less-advantaged positions in adult life when controlling for the gendered labor market segregation. Intergenerational social fluidity has increased for both genders; the improvement took place for the same cohorts of men and women, and it resulted from the same education-related processes: essentially educational equalization and expansion. One minor difference is that for women, compared to men, the relative impact of expansion was slightly stronger than that of equalization, simply because of women’s catching up to the men’s earlier educational advance. The second difference is that for men direct effects are slightly more important, while for women origin affects destination slightly more via education.

The fact that social fluidity has increased over the long run certainly does not mean that Germany has become a country of equal opportunities. Figure 2a at the start makes it more than clear that the changes over a time span of some sixty years are small compared to the remaining disparities. Also, adopting a two-generational parent- child perspective does not catch all contributions to inequalities from more extended family contexts. There is growing evidence that a child’s future not only depends on the circumstances in the nuclear family but also on the position and resources of other kin, such as grandparents, uncles or ants, even though such additional kin effects tend to be small once the nuclear family conditions are taken into account (Hertel and Groh-Samberg 2014, Knigge 2015). Furthermore, the estimates obtained are more likely to overestimate fluidity rather than immobility. For, measurement errors in the assessments of class and education are likely to “produce mobility” and to attenuate associations. Also, relying on one single indicator of social background (as we do here with father’s class position) will underestimate the full impact conditions of social origin have for children’s future because other aspects of origin resources (mother’s characteristics, parental education, parental income, wealth and others) tend to have their own independent influence. Their effect may change differently across cohorts (Bukodi and Goldthorpe 2012, Mood 2017). Thus, we must keep in mind that our results only refer to effects of social class background and their change over time. Yet, at least concerning one important other background characteristic—father’s education—we have evidence that strengthens our conclusion. Its influence on child’s education—the crucial intervening step in intergenerational mobility—also declines over cohorts and when controlling for it the effect of father’s class still declines (Breen et al. 2009). In addition, compared to the youngest cohorts included in this study, the even younger ones born up to 1990 have experienced further educational equalization (Klein et al. 2010). Whether this will also cause higher social fluidity once they have reached a stable class position remains to be seen.

Finally, the extent of social mobility and immobility found in a country depends on the class schema used. The more differentiated the schema is, the more mobility and the less immobility one will find. The schema used in this paper is a slightly aggregated version of classification proposed by Goldthorpe (2007). There are two strong arguments for it. It is theoretically well founded schema (Goldthorpe 2007) and it became a widely used standard for international comparisons. Yet, there are also arguments for its further differentiation across highly detailed occupational lines (Jonsson et al. 2009) or across broad sectoral divisions (Oesch 2006). To allow for such horizontal within-class divisions might change the relative weight of direct vs. education mediated effects of social origin. On the one side, independent of education children’s occupational preferences tend to be affine to parents occupations and parental network contacts are likely to favor occupational inheritance. On the other side, we know that at least within the service class access to managerial and administrative occupations depends less on education than access to professional and expert occupations (Klein 2011). For both reasons, the relative weight of direct effects might become somewhat stronger when occupational or sectoral distinctions would be taken into account. In contrast, a further differentiation of education by field of study would probably somewhat strengthen the part of origin effects mediated by education.

Nevertheless we think that these considerations to not invalidate our general conclusions, but they certainly indicate areas for further research.

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Appendix A

Table A1: Number of cases by survey period (S), cohort (C) and survey series (men)

Period in which data were collected										
Cohort and survey series	76–79	80–84	85–89	90–94	95–99	2000–04	2005–10	all periods	% of total	% of survey within cohort
1914–1924										
ALLBUS+ZUMA*ISJP	657	585	83					1325	7,1	97,9
SOEP			41					41	0,2	2,1
NEPS										
1925–1934										
ALLBUS+ZUMA*ISJP	801	869	316	453	60			2499	13,4	88,4
SOEP			328					297	1,8	11,6
NEPS										
1935–1944										
ALLBUS+ZUMA*ISJP	839	1037	379	715	330	375	53	3728	20,0	83,5
SOEP			536		46	185	13	780	4,2	17,3
NEPS										
1945–1954										
ALLBUS+ZUMA*ISJP		260	335	755	350	493	384	2577	13,9	58,9
SOEP			351		75	438	93	933	5,1	21,7
NEPS							862	8657	4,6	19,7
1955–1964										
ALLBUS+ZUMA*ISJP				224	323	664	489	1700	9,1	44,9
SOEP					96	598	109	803	4,3	21,1
NEPS							1288	1288	6,9	34,0
1965–1975										
ALLBUS+ZUMA*ISJP						160	392	552	3,0	32,0
SOEP						122	98	220	1,2	12,8
NEPS							952	952	5,1	55,3
Total	**2297**	**2751**	**2369**	**2147**	**1280**	**3035**	**4733**	**18612**	100,0	
Total ALLBUS	2297	2751	1113	2147	1063	1692	1318	12381	66,5	
Total SOEP			1256		217	1343	313	3129	16,8	
Total NEPS							3102	3102	16,7	

Table A2: Number of cases by survey period (S), cohort (C) and survey series (women)

Period in which data were collected										
Cohort and survey series	76–79	80–84	85–89	90–94	95–99	2000–04	2005–10	all periods	% of total	% of survey within cohort
1914–1924										
ALLBUS+ZUMA*ISJP	224	95						319	3,1	100,0
SOEP										
NEPS										
1925–1934										
ALLBUS+ZUMA*ISJP	357	378	75	36				846	8,3	86,0
SOEP			138					138	1,4	14,0
NEPS										
1935–1944										
ALLBUS+ZUMA*ISJP	498	536	210	286	104	48		1682	16,6	79,7
SOEP			334		31	63		428	4,2	20,3
NEPS										
1945–1954										
ALLBUS+ZUMA*ISJP		131	197	467	224	276	155	1450	14,3	59,5
SOEP			240		61	334	59	704	6,9	28,9
NEPS							282	283	2,8	11,6
1955–1964										
ALLBUS+ZUMA*ISJP				125	185	472	355	1137	11,2	29,1
SOEP					70	524	116	710	7,0	11,6
NEPS							1110	1110	10,9	59,3
1965–1975										
ALLBUS+ZUMA*ISJP						104	290	394	3,9	29,1
SOEP						79	78	157	1,6	11,6
NEPS							803	803	7,9	59,3
Total	**1079**	**1140**	**1194**	**914**	**675**	**1900**	**3258**	**10160**	100,0	
Total ALLBUS	1079	1140	482	914	513	900	800	5828	57,4	
Total SOEP			712		162	1000	262	2137	21,0	
Total NEPS							2195	2195	21,6	

Appendix B Issues a): Survey variation and period effects

Table B1: Log-linear models of change over cohorts and variation over surveys

Table	Model	G^2	DF	P	BIC			
Men								
CSOD	1 CSO CSD OD	4237,09	7308	1	-67612	Ref 1		
	2a CSO CSD β_SOD	4118,9	7275	1	-67406	118,19 ***	Ref 2a	
	2b CSO CSD β_COD	4169,06	7303	1	-67631	68,03 ***		Ref 2b
	2c CSO CSD $\beta_C\beta_S$OD	4097,7	7270	1	-67378	139,4 ***	21,2 ***	71,3 ***
CSEO	1 CSO CSE OE	*3847,36*	*6090*	1	-56027	Ref 1		
	2a CSO CSE β_SOE	3748,9	6057	1	-55801	98,46 ***	Ref 2a	
	2b CSO CSE β_COE	3788,9	6085	1	-56036	*58,46* ***		Ref 2b
	2c CSO CSE $\beta_C\beta_S$OE	3713,59	6052	1	-55787	133,77 ***	35,31 ***	75,31 ***
CSED	1 CSE CSD ED	3199,65	6090	1	-56675	Ref 1		
	2a CSE CSD β_SED	3051,9	6057	1	-56498	147,75 ***	Ref 2a	
	2b CSE CSD β_CED	3146,19	6085	1	-56679	53,46 ***		Ref 2b
	2c. CSE CSD $\beta_C\beta_S$ED	3047,25	6052	1	-56453	152,4 ***	4,650 ns	98,94 ***
Women								
Table	**Model**	**G^2**	**DF**	**P**	**BIC**			
CSOD	1 CSO CSD OD	2719,31	4860	1	-42120	Ref 1		
	2a CSO CSD β_SOD	2645,7	4827	1	-41889	73,61 ***	Ref 2a	
	2b CSO CSD β_COD	2696,54	4857	1	-42115	22,77 ***		Ref 2b
	2c CSO CSD $\beta_C\beta_S$OD	2641,8	4824	1	-41866	77,6 ***	3,9 ns	54,8 **
CSEO	1 CSO CSE OE	*2362,33*	*4050*	1	-35004	Ref 1		
	2a CSO CSE β_SOE	2282,51	4017	1	-34779	79,82 ***	Ref 2a	
	2b CSO CSE β_COE	2336,06	4047	1	-35002	*26,27* ***		Ref 2b
	2c CSO CSE $\beta_C\beta_S$OE	2273	4014	1	-34761	89,33 ***	9,51 *	63,06 ***
CSED	1 CSE CSD ED	2008,24	4050	1	-35358	Ref 1		
	2a CSE CSD β_SED	1939	4017	1	-35123	69,24 ***	Ref 2a	
	2b CSE CSD β_CED	1977,8	4047	1	-35361	30,44 ***		Ref 2b
	2c CSE CSD $\beta_C\beta_S$ED	1926,98	4014	1	-35107	81,26 ***	12,020 **	50,82 *

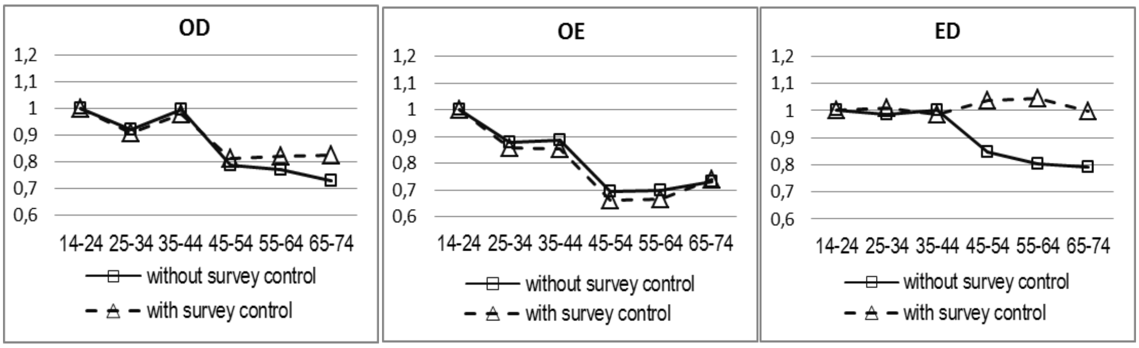
Note: Statistical significance: * $p < .05$; ** $p < .01$ *** $p < .001$.

In order to test whether the results concerning associations in the OED triangle and their change over cohorts are affected by peculiarities of particular surveys pooled in our database, we replicate the analyses controlling for every single of the 34 surveys of which data are included. Since the surveys were conducted in different years between 1976 and 2010, control for the survey implicitly also controls for peculiarities of the period in which the survey was conducted. Changing differences between cohorts when controlling for survey effects can be due to either methodological differences between surveys or substantial differences in the conditions prevailing in the periods in which the surveys are conducted, or to both. Technically, we replicate the analyses reported in tables 2 and 3 but now specify the models in ways to control for uniform difference variation over the various surveys. In table B1, this is done for the bivariate models of table 2.

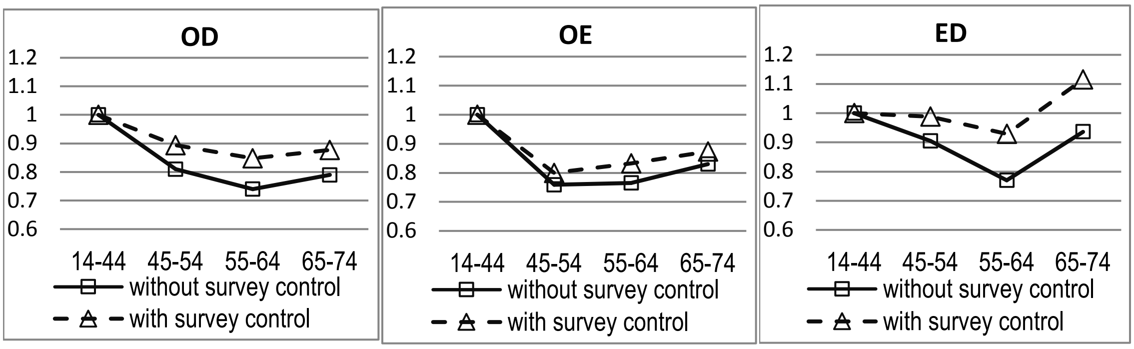
For each association, we find highly significant variation over surveys (comparing M2a with M1) and also change over cohorts (comparing M2b with M1) when either $ß_c$ or $ß_s$ is added to the no-change model M1. Yet, a crucial test is whether the $ß_c$ coefficients significantly contribute to fitting improvement when included in M2c which simultaneously controls for $ß_s$, and how the values for $ß_c$ differ in this case from the values without controlling for survey variation (as in table 2). With two exceptions (ED for men and OD for women), the contributions of $ß_c$ remain significant in all cases. How its values differ from those found in table 2 and in figure 3 can be seen in figure B1.

Figure B1: Uniform difference change across cohorts without and with simultaneously controlling for uniform difference variation across surveys

Men



Women



For men, the results for $ß_c$ remain the same for OD and OE, but the declining cohort trend of ED disappears (corresponding to the non-significance of this term). A closer look at the between-survey variation in $ß_s$ helps to understand these findings. For all three associations, $ß_s$ varies significantly and quite substantially from survey to survey. In the case of OD and OE, this variation is unsystematic and random, while $ß_s$ for ED systematically declines in the surveys collected from the mid-1990s onwards. Consequently, the ED association is systematically weaker in the surveys which provide the data of the more recent cohorts. This decline thus “explains” why the cohort trend in ED vanishes when controlling for survey variation. What this means depends on whether the decline in $ß_s$ arises for purely methodological or substantial reasons. We cannot see any clear methodological reason for a systematic decline of ED in the more recent cohorts. If this was the case, we should also see systematic change across surveys in the other associations. Consequently, if the decline in $ß_s$ is mainly for substantial reasons (i.e., because of actually weaker ED associations in the more recent periods), the vanishing of the decline of $ß_c$ does not imply that the younger cohorts did not experience weaker education-destination bonds than the older cohorts; it only means that the changing experiences of the more recent cohorts result from a weakening trend in the ED association in the period after the mid-1990s.

The results for women are similar to those for men; yet, the uniform difference coefficients for OD decline less across cohorts and the change indicated by them is not statistically significant when controlling for survey variation. One reason might be that the survey controls also catch some of the educational expansion effects for OD, which are particularly strong in the case of women. In the more recent surveys, compared to older surveys, many more women have a higher education, which likely contributes to reducing the OD association.

This latter observation is apparently confirmed in table B2, in which we replicate the analyses of table 3 while controlling for survey variation. For both men and women, the final model (for men model 8 and for women model 7) includes a significant $ß_e$OD-coefficient. For women, this final model corresponds to the final model in table 3, with an additional significant coefficient for survey variation in ED. As in table 3, the $ß_e$OD coefficient thus replaces (and explains) the significant change of OD over cohorts (found in the bivariate analysis of table 2) when simultaneously controlling for education. In the case of men, $ß_s$ED accounts for the entire cohort change in ED (no $ß_c$ coefficient for ED). However, in contrast to the final model in table 3, accounting for uniform difference change in OD ($ß_c$OD) in addition to variation of OD over levels of education ($ß_e$OD) improves the fit according to the conventional level of significance; in table 3 $ß_c$OD is marginally significant. For both men and women, the pattern for $ß_e$OD found in figure 4 keeps the same form. Testing in model 9 (with $ß_{ce}$OD) whether the pattern of $ß_e$OD varies over cohorts does not improve the fit.

Thus, all in all, the finding of considerable variation in the measured associations in the different surveys does not disconfirm that inequality of educational attainment has declined and social fluidity has increased over cohorts.

Table B2: Log-linear models of change over cohorts and variation over surveys for CSOED table

CSOED table	**G^2**	**DF**	**P**	**BIC**						
1 CSOE CSD OD ED	12922,9	50118	1	-479815,3	**Ref 1**					
2 CSOE CSD OD $ß_{s}$ED	12789,5	50085	1	-479624,3	133,4 ***	**Ref 2**				
3 CSOE CSD $ß_{s}$OD ED	12871,6	50085	1	-479542,2	51,3 ***		**Ref 3**			
4 CSOE CSD $ß_{s}$OD $ß_{s}$ED	12742,7	50052	1	-479346,6	180,2 ***	46,8 +	128,9 ***			
5 CSOE CSD $ß_{e}$OD $ß_{s}$ED	12777,5	50080	1	-479587,1		12,0 *		**Ref 5**		
6 CSOE CSD OD $ß_{s}ß_{o}$ED	12783,3	50079	1	-479571,4		6,2 ns				
7 CSOE CSD $ß_{e}$OD $ß_{s}ß_{c}$ED	12774,3	50075	1	-479541,1				3,19 ns	**Ref 7**	
8 CSOE CSD $ß_{e}ß_{c}$OD $ß_{s}$ED	12765,7	50075	1	-479549,8				11,8 *		**Ref 8**
9 CSOE CSD $ß_{ce}$OD $ß_{s}$ED	12746,5	50050	1	-479323,2						19,2 ns
Women	**G^2**	**DF**	**P**	**BIC**						
1 CSOE CSD OD ED	7687,36	33390	1	-300375,9	**Ref 1**					
2 CSOE CSD OD $ß_{s}$ED	7623,93	33357	1	-300134,9	63,43 ***	**Ref 2**				
3 CSOE CSD $ß_{s}$OD ED	7640,89	33357	1	-300117,9	46,47 +		**Ref 3**			
4 CSOE CSD $ß_{s}$OD $ß_{s}$ED	7577,01	33324	1	-299877,3	110,4 ***	46,9 +	63,9 ***			
5 CSOE CSD $ß_{e}$OD $ß_{s}$ED	7612,07	33352	1	-300100,6		11,9 *		**Ref 5**		
6 CSOE CSD OD $ß_{s}ß_{o}$ED	7619,03	33351	1	-300084,4		4,9 ns				
7 CSOE CSD $ß_{e}$OD $ß_{s}ß_{c}$ED	7600,37	33349	1	-300084,6				11,7 **	**Ref 7**	
8 CSOE CSD $ß_{e}ß_{c}$OD $ß_{s}$ED	7609,97	33349	1	-300075,0				2,1 ns		**Ref 8**
9 CSOE CSD $ß_{ce}$OD $ß_{s}$ED	7592,86	33334	1	-299953,7						17,1 ns

Note: Statistical significance: + $p < .10$; * $p < .05$; ** $p < .01$ *** $p < .001$; ns = non significant.

Appendix C Issue b): The role of age in estimating change across cohorts

In our data, measurements for the different cohorts are taken at different ages of the cohort members (data for the more recent cohorts are collected at much young ages of respondents than for the older cohorts). Could this lead to biased results? As we have included only respondents aged 35–64 in all analyses, essentially only destination class may vary with age at measurement, because at age 35, practically all respondents will have reached their highest level of education, and the father's class is measured for age 15 of respondents in any way. But because age at measurement is correlated with cohort in the data, we may find some spurious correlations with age when not controlling for cohort.

More specifically, estimates for OE should not vary within cohorts with age of respondent at measurement; but when cohort is not controlled, we should expect that the OE association increases with age, when among older cohorts the association is stronger than among younger cohorts; i.e., when we have declining inequality of educational opportunities over cohorts. The most likely candidate for real change over age is ED, because we know that the link between education and class tends to be strongest at entry into the labor market and to weaken somewhat in the further course of the work career, which reflects the influence of various other career determinants beyond education. We thus can expect that the association will appear stronger among cohorts measured at younger ages than among cohorts measured at older ages. Thus, when ED declines from older to younger cohorts, this decline tends to be underestimated when age is not controlled. For OD, change with aging is more difficult to predict. When a significant extent of counter-mobility exists (people from high class origin start working in positions below the parental level but move back to it in the course of the career), we would expect that OD increases with age. Therefore, when age is not controlled, a decline from older to younger cohorts would be overestimated. But in view of the expectations formulated in connection with ED, we could also have a bias in the other direction: If ED is stronger at younger ages, educational advantage of offspring of higher classes should lead to a closer OD association at younger rather than older age. Both potential tendencies could balance each other out. But even if in reality OD does not change with age but diminishes from the earlier to the later cohorts, then—as with OE—we should expect an OD trend increasing with age in models in which cohort is not controlled.

As to survey variation: Because survey is not correlated with age (all surveys include age groups in representative proportions), controlling for survey should not affect the estimation of age effects if survey variation is merely statistical noise. Yet, when survey effects vary in a systematic way (especially when they vary with period and when period developments affect younger workers differently than older workers), issues reach a complexity that cannot be studied with the database used in this paper.

Results of analyses informing on the role played by age, cohort, and survey variation are given in table C1 for men. For each of the three associations OE, OD and ED, results derive from a multi-level data matrix in which the association is differentiated by 34 surveys * 6 cohorts * 3 age groups (35–44, 45–54, 55–64). While model M1 gives the statistics for the constant association model, M2 (compared to M1) shows that there is considerable survey variation in each of the associations. Leaving aside this issue for a moment, models M3 and M4 look separately at the variation by age and cohort and M5 at the additive effects of both these factors. The right side of the table gives the unidiff parameters estimated by the corresponding model.

For OE and OD we find essentially the same results. They correspond to the expectations formulated above. Without simultaneously controlling for cohort, we find significant uniform difference change for age. Furthermore, the association appears to increase with age (because the older age groups come from earlier cohorts in which the association was stronger). When controlling simultaneously for age and cohort, age effects become insignificant and the unidff age coefficients differ little. Cohort effects are always significant and remain essentially the same, irrespective of whether we control for age or not. This is clear evidence that change occurs in the sequence of cohorts for both OE and OD and that age can be neglected. While the results found here are clearly expected for OE, the result for OD is an empirical finding which indicates that within the studied cohorts OD remained rather constant when cohort members got older. Also for both OE and OD, results for age remain essentially the same irrespective of whether we control for survey or not. As survey variation is uncorrelated with age and merely statistical noise, this result was expected. Comparing the estimates for the cohort unidiff parameters from M4 and M6 shows that controlling or not controlling for survey variation has little effects on these estimates as well, except for the last cohort in the case of OD (corresponding to what is found in figure B1 above).

For ED the findings are different. When not simultaneously controlling for cohort, ED appears not to vary with age. Comparing M1 and M3, uniform change of ED along age turns out to be not significant. When controlling for cohort change of ED, age becomes significant (compare M4 and M5), and the ED undiff coefficients slightly decline with age. Furthermore, with control for age, ED diminishes slightly more over cohorts than without control for age. This corresponds to the expectation formulated above: The link between education and class destination declines with the working career, and because the more recent cohorts are measured at a younger age, decline of ED over cohorts is underestimated when age is not controlled.

As survey variation is not correlated with age, age results are not affected by survey control (compare unidiff parameters of M3 and M6). However, as discussed in section 7 of the paper, controlling for survey variation wipes out cohort change in ED because the systematically downward trend in ED estimates found in the latest surveys capture the declining linkage of class positions to education in recent years.

All in all, controlling or not controlling for age has no consequences for the results on change over cohorts in OE and OD. Not controlling for age only leads to a slight underestimation of the decline over cohorts in ED. This must be kept in mind when interpreting the findings on cohort change. However, as the differences implied are quite small, we decided to pursue the core analyses of the paper without further consideration of age. This simplification should not lead to serious distortions of conclusions, and it is also advisable because, as the models M8 of table C1 indicate, estimates become highly unstable due to multicollinearity when we attempt to estimate survey, cohort, and age effects simultaneously.

Table C1: Goodness-of-fit and uniform difference parameters of models including age and survey variation (men)

SCAOE-Matrix	G^2	DF	P	BIC								
1. CSAO CSAE OE	5136,1	18330	1,000	-175076	β_a age groups		35–44	45–54	55–64			
2. CSAO CSAE β_sOE	5038,67	18297	1,000	-174849	β_c cohorts		1915–24	1925–34	1935–44	1945–54	1955–64	1964–75
3. CSAO CSAE β_aOE	5124,73	18328	1,000	-175068		β_a	1	1,028	1,1149			
4. CSAO CSAE β_cOE	5078,98	18325	1,000	-175084		β_c	1	0,867	0,888	0,693	0,683	0,714
5. CSAO CSAE $\beta_c\beta_a$OE	5078,3	18323	1,000	-175065		β_c	1	0,878	0,905	0,703	0,705	0,732
						β_a	1	0,996	1,027			
6. CSAO CSAE $\beta_s\beta_a$OE	5026,5	18295	1,000	-174842		β_a	1	1,037	1,131			
7. CSAO CSAE $\beta_s\beta_c$OE	5004,3	18292	1,000	-174835		β_c	1	0,854	0,854	0,664	0,667	0,736
8. CSAO CSAE $\beta_s\beta_a\beta_c$OE	5003,0	18290	1,000	-174816		β_c	1	0,882	0,926	0,754	0,803	0,919
						β_a	1	1,045	1,099			
Difference 1–2	97,43	33	0,000									
Difference 1–3	11,37	2	0,003									
Difference 1–4	57,12	5	0,000									
Difference 3–5	46,43	5	0,000									
Difference 4–5	0,68	2	0,712									
Difference 2–6	12,17	2	0,002									
Difference 2–7	34,37	5	0,000									
Difference 7–8	1,3	2	0,522									
Difference 4–7	74,7	33	0,000									
Difference 6–8	23,5	5	0,000									

Table C1: Goodness-of-fit and uniform difference parameters of models including age and survey variation (men) (continued)

SCAOD-Matrix

1. CSAO CSAD OD	5699,6	21996	1,000	-210555	β_a age groups		35–44	45–54	55–64			
2. CSAO CSAD β_sOD	5582,9	21963	1,000	-210348	β_c cohorts		1915–24	1925–34	1935–44	1945–54	1955–64	1964–75
3. CSAO CSAD β_aOD	5686,8	21994	1,000	-210549		β_a	1	0,981	1,117			
4. CSAO CSAD β_cOD	5633,2	21991	1,000	-210573		β_c	1	0,905	0,99	0,781	0,759	0,715
5. CSAO CSAD $\beta_c\beta_a$OD	5628,1	21989	1,000	-210558		β_c	1	0,936	1,006	0,797	0,789	0,71
						β_a	1	0,933	0,996			
6. CSAO CSAD $\beta_s\beta_a$OD	5571,2	21961	1,000	-210340		β_a	1	0,988	1,089			
7. CSAO CSAD $\beta_s\beta_c$OD	5562,4	21958	1,000	-210319		β_c	1	0,905	0,974	0,812	0,818	0,817
8. CSAO CSAD $\beta_s\beta_a\beta_c$OD	5555,4	21956	1,000	-210306		β_c	1	0,982	1,119	0,988	1,08	1,11
						β_a	1	1,02	1,156			
Difference 1–2	116,7	33	0,000									
Difference 1–3	12,8	2	0,002									
Difference 1–4	66,4	5	0,000									
Difference 3–5	58,7	5	0,000									
Difference 4–5	5,1	2	0,078									
Difference 2–6	11,7	2	0,003									
Difference 2–7	20,5	5	0,001									
Difference 7–8	7,0	2	0,030									
Difference 4–7	70,8	33	0,000									
Difference 6–8	15,8	5	0,007									

Table C1: Goodness-of-fit and uniform difference parameters of models including age and survey variation (men) (continued)

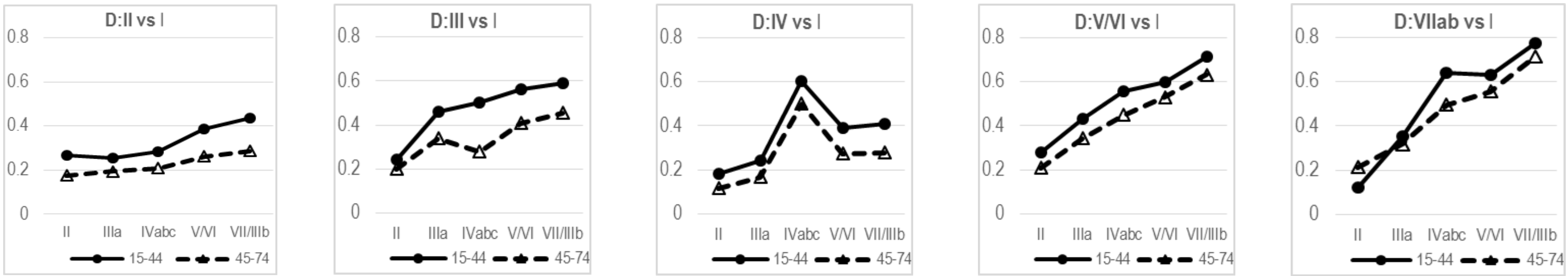
SCAED-Matrix	G²	DF	P	BIC								
1. CSAE CSAD ED	4061,38	18330	1,000	-176151	β_a age groups		35–44	45–54	55–64			
2. CSAE CSAD β_sED	3908,91	18297	1,000	-175979	β_c cohorts		1915–24	1925–34	1935–44	1945–54	1955–64	1964–75
3. CSAE CSAD β_aED	4056,4	18328	1,000	-176136		β_a	1	0,951	1,014			
4. CSAE CSAD β_cED	4008,98	18325	1,000	-176154		β_c	1	0,969	0,984	0,852	0,796	0,782
5. CSAE CSAD $\beta_c\beta_a$ED	3993,54	18323	1,000	-176150		β_c	1	0,965	0,943	0,828	0,766	0,704
						β_a	1	0,908	0,902			
6. CSAE CSAD $\beta_s\beta_a$ED	3905,72	18295	1,000	-175963		β_a	1	0,975	1,02			
7. CSAE CSAD $\beta_s\beta_c$ED	3904,7	18292	1,000	-175934		β_c	1	0,987	1,012	0,965	0,953	1,003
8. CSAE CSAD $\beta_s\beta_a\beta_c$ED	3900,8	18290	1,000	-175918		β_c	1	1,046	1,118	1,105	1,151	1,234
						β_a	1	1,023	1,111			
Difference 1–2	152,47	33	0,000									
Difference 1–3	4,98	2	0,083									
Difference 1–4	52,4	5	0,000									
Difference 3–5	62,86	5	0,000									
Difference 4–5	15,44	2	0,000									
Difference 2–6	3,19	2	0,203									
Difference 2–7	4,21	5	0,520									
Difference 2–8	8,1	7	0,323									
Difference 7–8	3,9	2	0,142									
Difference 6–8	4,9	5	0,426									
Difference 4–7	104,3	33	0,000									

Appendix D Sensibility analyses related to the scaling problem in log-linear models

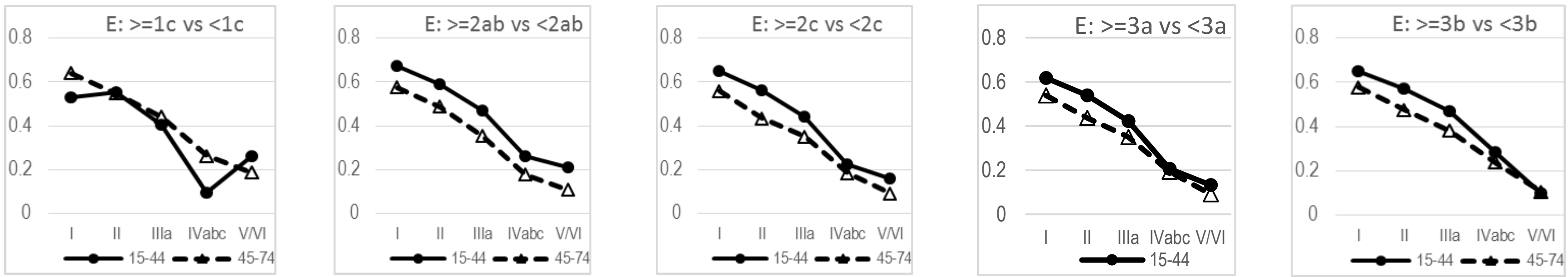
Due to the scaling problem, estimates of coefficient of log-linear models are not comparable when outcomes to be explained differ in unobserved heterogeneity. This is likely the case for the estimates of the uniform difference coefficients that we have used to compare different cohorts. In order to check whether the general conclusions are robust in spite of possible differences in unobserved heterogeneity of different cohorts, we rely on non-linear correlations (Breen et al. 2013b) using the nlcorr Stata-ado (Kohler and Karlson 2011). These correlations are comparable across samples. As the most substantial difference among our cohorts is the change between those born up to 1944 and those born later, we compare these two groups of cohorts. For these two groups of cohorts, figure D1 shows binary contrasts representing specific origin-destination odds in the three bivariate association tables OD, OE, and ED. For all three associations, the large majority of all correlations are lower in the younger than in the older cohorts, indicating a decline of the association.

Figure D1: Non-linear correlations for binary logit contrast by birth cohorts 1915–44 compared to cohorts 1945–74

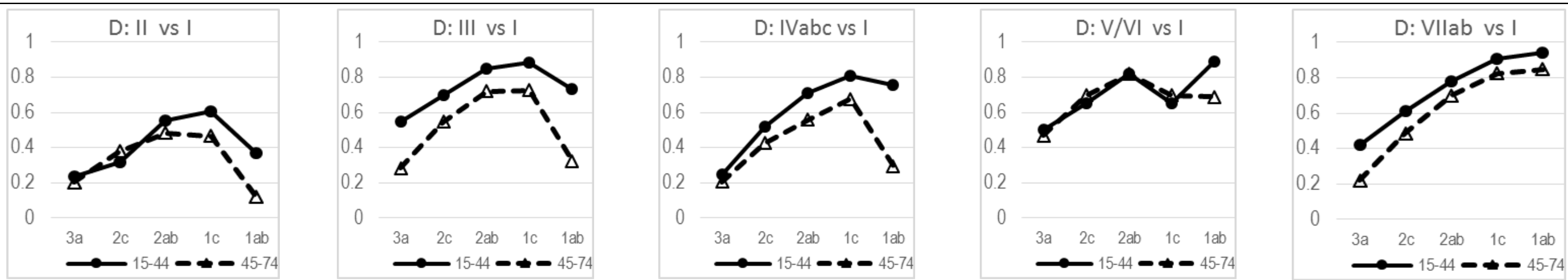
OD: reference category for O: I



OE: reference category of O: VIIab/IIIb



ED: reference category of E: 3b



Appendix E Simulation exercise

For our simulation exercise, we use a four-way table that includes cohorts (C), origins (O), education (E), and destination (D). In our first counterfactual model (baseline 1), we estimate cell frequencies from a model that only includes an effect of cohort by origin and education by origin for the subtable OED, and an effect of cohort by destination and origin by destination for the full COED table. In the subsequent counterfactual models, we add one new parameter each time, gradually including more dynamic effects (like expansion, equalization) to the models. For each model, we write out the estimated COD table based on our counterfactual model. Note that the two last models are identical in terms of the fitted cell frequencies, because we include a COD term and therefore fit this subtable completely. Thus, the last two models represent the empirical observation of trends in social fluidity in Germany.

1.1 Baseline model

mod E|OC {OE}

D|COE {CD OD}

1.2 Expansion

mod E|OC {CE OE}

D|COE {CD OED}

1.3 Equalization

mod E|OC {COE}

D|COE {CD OED}

1.4 Returns

mod E|OC {COE}

D|COE {CED OED}

1.5 Direct effects / saturated model

mod E|OC {COE}

D|COE {CED OED COD}