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Education and Societal Change in Germany, 1925– 2008

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Abstract: Education and Societal Change in Germany, 1925–2008

The aim of this study is to unravel the impact of societal change in terms of modernization, labor market fluctuation and historical conditions in Germany on educational trajectories and attainment as well as the on the degree of inequality of educational opportunity for cohorts born between 1919 and 1986. We want to analyze *whether* and *how* long term societal trends have modified educational trajectories of consecutive birth cohorts. This perspective provides an understanding of historical variations in educational attainment associated with societal processes such as modernization in social, political, economic, and cultural spheres on the one hand and by macroeconomic cycles on the other hand. The empirical basis of our investigation are clusters of time series for macro changes and retrospective data from 11 birth cohort studies from the German Life History Study and the National Educational Panel Study for educational outcomes. We apply piecewise exponential event history models to analyze the impact of societal change on educational trajectories.

Keywords: educational trajectories, educational opportunities, societal change, modernization, event-history data, event history analysis

1 Introduction

In their responses to the seminal study by Blossfeld and Shavit (1993) on the development of inequality in educational attainment in the second half of the 20th century, Breen et al. (2009) emphasize that the trend of modernization was one of the main social processes resulting in educational expansion and change of inequality of educational opportunities. Following Erikson and Jonsson (1996), these authors argue that the general improvement in conditions of living in the course of economic development, welfare-state protection and its expansion, the expansion and reforms of educational institutions have reduced differences in educational attainment between the offspring of different social classes (Breen et al. 2009, p. 1479). Economic growth, reduction in family size, extended educational opportunities, lengthening of compulsory education and declining costs of education shaped the differences between children from different social classes in their propensity to continue on to higher levels of education (Breen et al. 2009, p. 1479-1480). However, in the case of Germany as for other of the countries they are examining, Breen and his co-authors did not *directly* test the impact of overall societal change – in particular, economic, political, cultural and social modernization – on educational inequalities.

Therefore, by utilizing life course data on 11 birth cohorts, it is the aim of our study to unravel the impact of societal change in terms of modernization in Germany on educational trajectories and attainment as well as the on the degree of inequality of educational opportunity for cohorts born between 1919 and 1986. We want to analyze *whether* and *how* long term societal trends have modified educational trajectories of consecutive birth cohorts. Overall societal change has often been viewed as the complex process labeled “modernization”, i.e. the unidirectional transformation in regard to industrialization and mass consumption, democratization and social security, urbanization and technological change, demographic metabolism in terms of declining birth rates and increasing life expectancy as well as tertiarization (Lerner 1968; Parsons 1971; Zapf 1994). We are well aware of the critical debate about the theoretical concept of modernization, e.g. in regard to Eisenstadt’s (1966, 2000) work on multiple modernities, but in this study we still find it useful to postulate – in the spirit of Max Weber (1978) – something like an overall societal change propelling traditional societies in the direction of “modern” and “postmodern” societies. It cannot be ruled out theoretically that modern state’s investments into the educational system and individual’s efforts in education are also preconditions of societal changes in terms of modernization, but we can draw on empirical research that the major thrust of causation goes the other way around (e.g. Treiman 1970). As a second component of societal change we will look at cyclical fluctuation (Dartenne 2016; Windolf 1997; Blossfeld 1986). Our empirical analysis will therefore be augmented by also considering the significance of changing labor market situations for shaping educational trajectories and achieving educational certificates. *If* labor market situations are significant incentives for individuals’ investment in education, the question arises *how* the demand of the labor market for qualifications in times of economic boom (Becker and Blossfeld 1991; Helberger and Palamidis 1992) and contraction of labor market in periods of recession (Blossfeld 1986) affect educational trajectories. As a third component of our analysis we will consider the very specific historical pathway of Germany during much of the twentieth century and its impact on educational outcomes. The inclusion of relatively narrow bands of birth cohorts will allow us to examine some of these historical contexts. We will in the end discuss whether this amounts to yet another piece of evidence for a German ‘*Sonderweg*’ of the occidental way of modernization (Zapf 1994). All in all, we are seeking to reconstruct the consequences of these historical trends for individuals’ behavior and decisions in regard to their education resulting in changes of educational trajectories and inequality of educational opportunities for different birth cohorts across 80 years of German history.

This perspective fosters an understanding of the historical variations in educational attainment associated with societal processes such as modernization in social, political, economic, and cultural spheres on the one hand and by macroeconomic cycles on the other hand. We are seeing this as a part of a larger research and intellectual enterprise reconstructing social history by means of (longitudinal and cohort) microdata in general (Mayer 2015) and the social history of Germany more specifically (Mayer and Hillmert 2004).

The remainder of our contribution is organized as follows: In the second section, the theoretical part, several theoretical explanations are discussed in order to derive hypotheses to be tested in the empirical part. The description of the data set, variables, design, and statistical procedures constitutes the third section while the empirical results are presented in the fourth section. The summary and conclusion will be found in the final section.

2 Theoretical background

Brief history of education in Germany in the 20th century

As a legacy of the territorial and religious fragmentation of Germany after the Thirty Years' War 1618-1648 and as a legacy of the stalled economic liberalization in the 19th century, Germany started the 20th century with an educational system with universal compulsory education, a highly selective Gymnasium starting at age 10, and a highly restrictive access to university as professional training for state licensed Gymnasium teachers, medical doctors, civil servants and priests (Leschinsky and Roeder 1976; Müller et al. 1987). Apprenticeships survived the demise of the artisanal “Zünfte” and were not only taken over in the commercial area, but were also maintained in industrial manufacturing and partially in the state sector (e.g. railroad and public services such as electricity and water supply). This allowed Germany to develop a highly skilled workforce without going comprehensive or expanding upper secondary schools. In this respect economic development and expansion of general schooling were decoupled until the second part of the 20th century (Müller et al. 1997).

In the Third Reich (1933-1945), i.e. in the years under the Nazi governance, the system of higher education (Gymnasium and universities) was intentionally neglected to the advantage of general schooling and VET resulting in a decline of enrollment in tertiary education. After the foundation of the Federal Republic of Germany, in the course of harmonization of schools of general education (Düsseldorf Agreement 1955; Hamburger Agreement 1964), the implementation of universities of applied sciences (1968), the reorganization and expansion of the grammar schools on the upper secondary level (1972), the (very partial) implementation of comprehensive schools (1973), and the extension of the university sector in the 1960s educational expansion finally took off. This expansion resulted from strong forces and turned into a sustained development in the following decades (Leschinsky and Cortina 2008; Hadjar and Becker 2009): i) educational aspirations as a means for status and upward mobility long thwarted by the economic recession and war(s) and as a means to redress regional, gender and religious educational disparities (Lutz 1983; Peisert 1964); ii) the demand for more highly qualified manpower (Edding 1963); iii) the demand for many more teachers for the baby boom cohorts (Picht 1971); and, iv) the need for more academically trained people for public service expansion in the 1970s (Becker 2003; Becker and Blossfeld 1991; Müller and Haun 1994).

Socioeconomic and sociological explanations of educational development

From the view of *sociological industrialization theory*, Parsons (1951) and Treiman (1970) assume that educational attainment becomes increasingly important due to the rising qualificational requirements in the process of industrialization. Correspondingly the

educational system and the enrolment in compulsory education and training have expanded in response to the functional requirements of an industrial society. Since educational qualification became more important for access to the labor market and the occupational placement the investments of both workers and employers could be expected to have shaped educational trajectories (Treiman 1970, p. 217). These processes of educational expansion should have been strengthened in the course of increasing tertiarization of industries and jobs (Bell 1973) leading to increasing enrolment in certified vocational education and training, to increasing attainment of higher education in the school and university systems, and to decreasing inequality of educational opportunities (Treiman 1970, p. 221). Therefore, it is assumed that the linear trend of modernization correlates with the educational upgrading across historical periods and birth cohorts (*hypothesis 1*). On the one hand, the likelihood of transition to advanced education and training as well as the propensity for obtaining higher educational certificates should have been enforced by the societal change in terms of modernization (*hypothesis 1a*). On the other hand, in the course of modernization the direct link between social origin and social status or class should have weakened and the direct link between education and class destination should have been strengthened (*hypothesis 1b*).

In accordance with *human capital theory* (Becker 1975), it is obvious that the trend of modernization has an impact on the labor market modifying the incentives for acquiring qualifications and the mode of labor market entry (Becker and Blossfeld 2017). In the previous decades, the process of delayed industrialization after WWI and, in particular, the modernization trend after WWII was confronted with the lack of qualified manpower resulting in the investment into the educational system and – as a consequence – in the educational expansion (Hadjar and Becker 2009). That means that modernization enhances the demand for qualifications. Education and training have become formalized skills and serve as credentials in the access to vocations and jobs (Müller and Haun 1994, p. 7; Lutz 1983, p. 232; Collins 1979). In Germany, this is brought about by the high degree of regulation and standardization of vocational education and training (VET) and the highly institutionalized connection between the VET system and the labor markets (Soscice 1994). Since there are direct and indirect effects of the modernization (push factors) as well as the economic and structural development of the labor market demanding for vocational qualifications (pull factors), it is therefore assumed according to *signaling theory* (Spence 1973) that the labor market situation provides signals – namely the employers’ demand for the employees’ qualifications – depending on the economic cycle (Walters and Rubinson 1983; for the German case: Windolf 1997; Becker and Blossfeld 2017). If the labor market and education system are mutually regulating systems, the demand of the labor market for skills should be the driving force for educational expansion. For Germany after 1945, there are strong indications that there unemployment exerted a delayed effect on the enrolment in upper secondary schools (*Gymnasium*) and universities (Becker and Hadjar 2013, pp. 537, 539, 541; Dartenne 2016) while the economic growth have contributed to expansion of university sector and increased enrolment in tertiary education (Windolf 1997). Therefore, we assume that advantageous labor market situations lead to increasing human capital investments in schooling, VET, and university training (*hypothesis 2*).

There are at least two competing *sociological theories* on the relationship between long term social change and educational development. The first is the *conflict theory* that the relative demand for educational attainment and educational certificates is not so much related to skill requirements of the economy but to the attempt to maintain status distinctions. Max Weber (1978) already emphasized that education is being used as a means of status reproduction in the course of societal modernization (*‘rationalization’* and *‘bureaucratization’*). In his view, social elites systematically organize status reproduction by different social, economic and political processes resulting in closure of educational opportunities to the disadvantage of

lower social status groups. Therefore, education regulates and distributes economic and political power as well as social status via the educational system. Especially in a highly credentialed society (Collins 1979) like Germany, educational (and training) certificates signify corresponding levels of social status. In Germany, the social hierarchy and hierarchy within firms almost until most recently were and are partially still identical with the educational hierarchy (Lutz 1983). One major barrier is at the bottom level between unskilled and skilled worker viz. lower middle class defined by a successful industrial or commercial apprenticeship. The other major barrier is the one at the top, namely the ‘academic line’ defined by the *Abitur* (high-school diploma, higher education entrance certificate) and university degree. Educational expansion is therefore a battle to preserve or undermine the class structure – with the Social Democratic Party as the political force pushing for comprehensive high schools for a more expanded access to tertiary education (Leschinsky and Mayer 1990). Following this theoretical line of argument, we would expect no or only weak associations between both economic growth and business cycles with educational outcomes, but rather periods of educational expansion and stagnation related to political cycles and party coalitions.

Corresponding to such a perspective of the German history of education, long cycles of both the expansion of the educational system and the participation in education across generations have been detected for Germany since the 19th century (Dartenne 2016; Titze 2000). After the WWI, the expansion of the university system gained its own momentum since its internal dynamics became independent from control by the state (Titze 1999, 2004). To the extent that the enrolment in university training is driven by social and cultural reproduction (Bourdieu and Passeron 1977; Collins 1979) by a very close intergenerational transmission of higher education, certification for university training, participation in university training and attainment of university degrees should be independent from the trends of modernization (*hypothesis 3*).

A second competing sociological theory of educational development is the *neo-institutionalist theory* by John Meyer (2001) and his co-authors (Meyer et al. 1992; Meyer and Ramirez 2000). Emphasizing the rise of mass education and the modern educational system in the course of the formation of modern nation states as well as the rise of modern cultural and normative beliefs such as that education is an integral part of a universalistic cultural model of societal development and justice, they see educational expansion as part and parcel of a universal cultural trend towards more autonomous individuals with broad, educationally based civic rights to democratic political and cultural participation. Both the internal logic of educational systems and their momentum, and their normative principles and organizational realities are correlated with the educational expansion. They are further strengthened by the worldwide diffusion of the belief in education as a significant ‘motor’ for the national development and educational expansion. This diffusion process has started in the 19th century by the adoption of successful educational strategies by economically and politically successful nations and – then after 1945 – has been accelerated by educational programs popularized by international organizations such as OECD, UNESCO or World Bank. Societal changes such as rationalization, scientification, and professionalization of education might have contributed to this development. According to Meyer and Ramirez (2000), over time all these development has resulted in decreasing impacts of particular internal, national, political, social and economic conditions on education and educational systems. Again following this theory, we would expect educational developments to be mostly independent from economic developments, but – as a universal trend – also less dependent on particular political constellations (*hypothesis 4*).

3 Data, variables, design, and statistical procedure

Data sources

The empirical analyses are based on two longitudinal data sets. The first one is the event-history data set of the *German Life History Study* (GLHS) conducted between 1979 and 2005 in the Special Research Unit 3 of the German Science Foundation (DFG) and at the Max Planck Institute for Human Development in Berlin (MPIfB). The GLHS directed by Karl Ulrich Mayer provides information on educational trajectories and attainment of the birth cohorts 1919-21, 1929-31, 1939-41, 1949-51, 1954-56, 1959-61, 1964 and 1971 (Mayer 2008, 2015). The educational careers will be analyzed across different political regimes – Weimar Republic, Nazi regime, Federal Republic of Germany, and unified German after the breakdown of the GDR – in the historical period from 1925 (the school entry of the cohort 1919) to 1999 (the youngest cohort's year of interview). The cohort born 1919-21 includes 1,005 West German women and men interviewed between November 1987 and August 1988 by CATI as well as of 407 West German persons interviewed personally between August 1985 and August 1986. The cohorts born around 1930, 1940 and 1950 are comprised of 2,171 West German men and women interviewed between October 1981 and March 1983. 2,008 West Germans born around 1955 and 1960 were interviewed between October 1988 and November 1989. Finally, the data for 2,909 women and men born 1964 and 1971 has been collected between June 1998 and February 1999.

The second data set we are using comes from the project “*Working and Learning in a Changing World*” (ALWA: *Arbeiten und Lernen im Wandel*) of the Institute for Employment Research in Nuremberg (Kleinert et al. 2011) which is now part of the National Educational Panel Study (NEPS). In this project, 10,404 individuals born between 1956 and 1988 were interviewed between August 2007 and April 2008, among else, about their schooling, vocational education and training. For our purpose, we have selected 4,346 West German citizens in the birth cohorts 1959-61, 1964-66, 1969-71, 1974-76, 1979-81, and 1984-86 and their educational careers in the 1965-2008 periods. The interview schedules of the ALWA study are based on the ones of the most recent GHLS studies and therefore highly comparable. Moreover field work has been conducted by the same survey research institute, INFAS (www.infas.eu). For both data sets, the GLHS and ALWA data, the analysis is restricted to West German citizens while foreigners and immigrants have been excluded.

The selection of the birth cohorts was theoretically inspired by the work of Mannheim (1928) on political generations, Ryder (1965) on demographic birth cohorts, and the precursor Norwegian Life History Study by Natalie Rogoff Ramsøy (1973). Thus, the individuals' imprinting by historical events in important phases of their life course is the main selection criterion.¹ Besides political caesurae, most of these phases are also related to periods of social, political and cultural development as well as the business cycles, and changes in the labor market conditions (Mayer and Huinink 1990).² The women and men in the cohort 1919-21

¹ Pragmatically the selection of cohorts followed and 10 year distance age-period-cohort design as a sequel to the additional survey of the micro census 1971 (Mayer 1977; Müller 1978) as well as the findings on specific historical cohorts in this study (Mayer 1995; Brückner und Mayer 1987). Specific historical circumstances led to the inclusion of the 1954-56 and the 1964 cohorts.

² According to the research program of sociological life-course research (Mayer 2015, 2009 political circumstances and social institutions (Mayer and Müller 1986; Mannheim 1928), historical breakdowns and political turmoil (Diewald et al. 2006; Elder 1974), societal developments such as modernization, economic cycles, and changing labor markets (Becker and Blossfeld 2017; Blossfeld 1986) do imprint social characters (Mayer and Diewald 2009; Elder 1995; Weber 1978) as well as have long-term impacts on the social structures of life courses (Mayer 1990) and educational careers (Becker and Hadjar 2015, 2013).

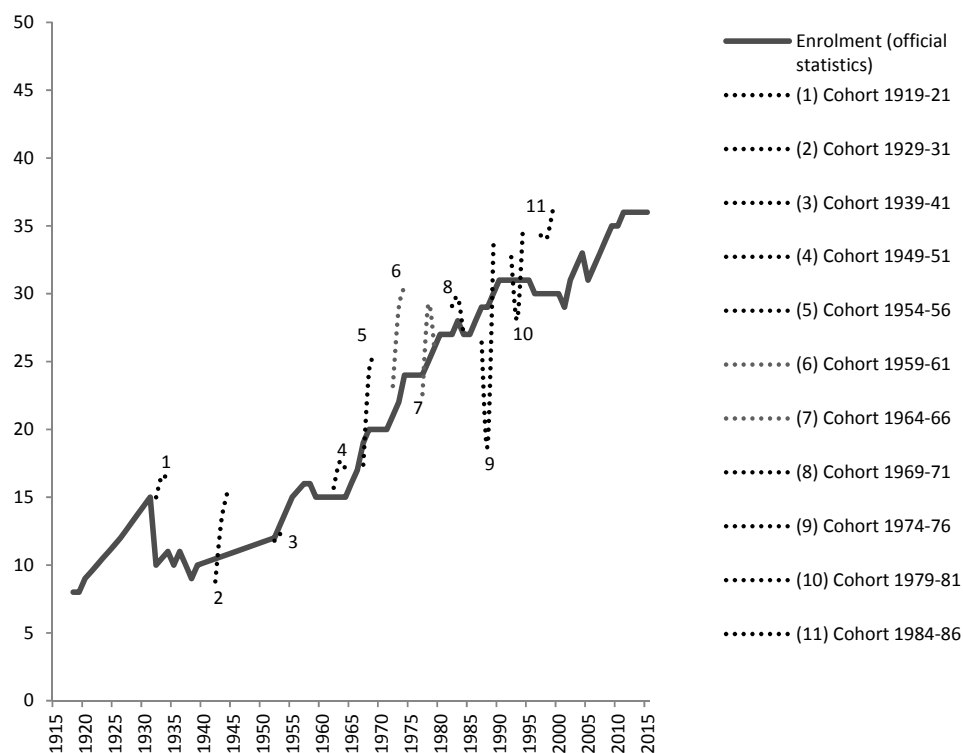
were born immediately after the WWI, the breakdown of the monarchy as well as the foundation of the Weimar Republic. They grew up in times of the aftermath of the war, the political turmoil, the economic crisis such as hyperinflation in 1923 and the Great Depression of 1929; they were socialized in times of the first democratic government in Germany and witnessed its breakdown in 1933. Their youth and political socialization were imprinted by the rise and fall of the Nazi regime (Rosenberg 1980), the Second World War, the re-education by the Allies, and the division of Germany into two parts during the cold war after 1949. Some members of these cohorts were already drafted into the Wehrmacht, died in war or were made prisoners of war (Allmendinger 1994). Individuals born between *1929 and 1931* experienced their childhood in the Third Reich, their youth and political socialization during the WWII as well as in the first post-war years of reconstruction and foundation of the Federal Republic of Germany. The political socialization of the *1939-41 cohort* could be characterized by the well-established era of Chancellor Adenauer (German economic miracle, Korean war, rearmament of West Germany and the Cold War) while the *1949-51 cohort* was influenced by the mobilization of Federal Republic of Germany (Vietnam war, first economic recession, the first Great Coalition and debates on educational reforms) (Brückner 1990). The cohorts born between *1954 and 1956* as well as between *1959 and 1961* were the generations which witnessed the prosperity, educational expansion, the social-liberal coalition (Chancellor Willy Brandt), and economic, political and cultural upheavals such as the 1968 revolution, the RAF terrorism, the oil price shocks (and recessions), the replacement of Brandt by Chancellor Helmut Schmidt, the debates on atomic power plants and Pershing rockets, and the end of the social-liberal government coalition (Brückner and Mayer 1995). For the *1964-66 cohorts*, the central moments of their socialization were their large absolute size in the end of the baby boom, the peace and environmental movement, the recession in the 1980s as well as the political success of the Green party and finally the “Gorbachev perestroika” in the former USSR. The individuals born between *1969 and 1971* belong to the low-birthrate cohorts and have been imprinted by the social and economic situation in the 1980s and 1990s (Mayer and Schulze 2009). Their main moments are: Chernobyl, migration of refugees and ethnic German emigrants, the fall of the Berlin wall (“*Wende*”), the economic recreation after the German reunion, the economic crisis since 1995, the end of the Chancellor Kohl era, and the red-green coalition of the Chancellor Schröder. The individuals born between *1974 and 1976* as well as the *1979-81* and *1984-86* cohorts were politically socialized by the period after German unification in 1990: reconstruction of East Germany, withdrawal of allied forces (1994), new government (1998), terrorism (September 11, 2001), wars in Afghanistan and Iraq, supersession of Chancellor Schröder by Angela Merkel, the expansion of Internet and social media, the ascent of China to a modern industrial nation, the housing bust and bank crisis (2007) and the 20th anniversary of the fall of the wall on 9th November 2009 (Diewald et al. 2006).

The respondents’ information on their educational trajectories was collected *retrospectively* like the other areas of their life course (Brückner 1990; Mayer 2008). They were asked to reconstruct both their schooling and vocational or academic training with exact time references for the start and end of each of the episodes in their educational history (Brückner 1994). Institutionalized states and events such as education and training usually are memorized in a quite reliable manner (Reimer 2005). In order to minimize memory problems as well as to maximize validity and reliability of the information, especially in regard to time references and the sequence of educational episodes, for the most recent cohorts, special techniques were used to support the memory process of the interviewees (Brückner and Mayer 1995; Matthes et al. 2012). As an example, in the modules on life areas such as schooling and training, autobiographical cues were presented and already available information was used for filtering. Additionally, a tool for the checking and amending of data for temporal consistency was used in the CATI for example (Allmendinger 1994). Finally,

careful preparation of interviews and data collection (Matthes et al. 2007), systematic inquiries, intensive editing process and close inspections of the information on the life courses for chronological consistency vouch for the quality of the data (Brückner 1995; Brückner and Mayer 1998; Matthes et al. 2012).

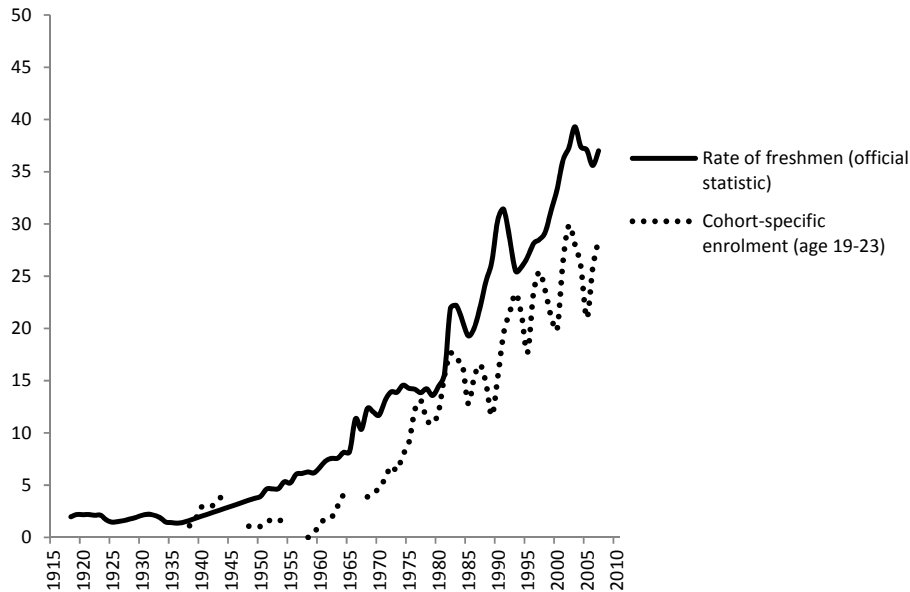
The quality of retrospective data has been challenged by scholars of survey methodology (e.g. Sudman et al. 1996). Therefore, it seems to be necessary to demonstrate briefly the quality of the employed event-history data on educational trajectories. For the enrolment in upper secondary school (*Gymnasium*) at age of 13 years, they are compared with data from official statistics. In *Figure 1*, it is shown that the differences between the different data are not systematic for each of the cohorts. The dissimilarity indices are rather low, but it has to be stressed that for cohorts born around 1960 and 1985 the enrolment in the *Gymnasium* will be somewhat over-estimated.

Fig. 1: Enrolment of children in Gymnasium (in % at age 13) – comparison of official statistics and cohort-specific individual data of GLHS and ALWA (1932-1999)



Regarding the enrolment in university, the finding is reverse for individuals at ages between 19 and 23 years (*Figure 2*). For almost each of the birth cohorts our microdata tend to underestimate the enrolment compared to the time series published by the official statistics. However, it has to be taken into account that the latter comparison is limited due to different measures. The official statistic makes use of different birth cohorts in age 19-23 for each of the years; i.e. for each point in time along the historical periods, five birth cohorts are taken into account in order to measure the enrollment in university training while for the GLHS and ALWA data sets just three birth cohorts maximally are considered per date. This might be the main reason of the observed difference. However, it should be emphasized that the patterns of changing enrollments are rather similar for the official time series and the cohort data.

Fig. 2: Enrollment in university training (in % at age 19-23) – comparison between official statistics and cohort-specific individual data of GLHS and ALWA



Both these comparisons demonstrate the high data quality of the event-history data in regard to educational enrolment and attainment. Both longitudinal data sets provide detailed event-oriented information on the respondents' episodes of school education as well as vocational and academic training in institutionalized contexts of the educational system changing often in the varied history of Germany between 1918 and 2008. On the one hand, this makes it possible to test our hypotheses in a theoretically and methodologically adequate manner. On the other hand, we are able to take into account the multiple time dependence of the educational trajectories in terms of age, period, and cohort on different levels as well as to reconstruct causal impacts of structural changes on the macro level on individual patterns of education observed on the micro level (Mayer and Huinink 1990; Pötter and Blossfeld 2001; Becker and Hadjar 2013).

Dependent and independent variables

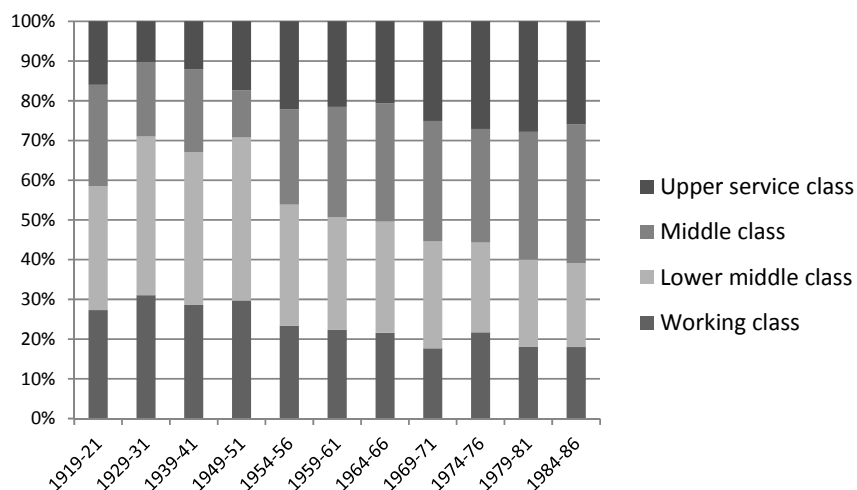
We are distinguishing two kinds of *dependent variables*. On the one hand, we are looking at *educational transitions* at the branching points of the educational system and the *enrolment* in different contexts of education and training. Examples are the tracking into the secondary schools after the elementary school or the continuation of the educational trajectory in the vocational training or in the general academic education after compulsory schooling, and finally the enrolment in university training. On the other hand, we will focus on the *attainment of certificates* such as the eligibility for university access, university degrees or degrees of higher vocational education and training.

Beside the respondents' *cohort membership* and *gender*, one of the explanatory variables is their *social origin*. It is measured by the *educational level* of the father or step-father since that they typically got the same or higher degrees than women in the decades under consideration. The certificates in schooling and vocational training have been measured in a rank order indicating their level. For the secondary school qualification we distinguish between four alternatives: (1) no completion of compulsory education, (2) lower secondary school graduation (*Volks-* resp. *Hauptschulabschluss*), (3) intermediate secondary school graduation (*Realschulabschluss* resp. *Mittlere Reife*), and (4) higher education entrance

qualification (i.e. eligibility for university training [*Abitur*] or training at university of applied sciences [*Fachhochschulreife*]). For vocational and tertiary training we are distinguishing between (1) no certified occupational training, (2) general vocational education and training (*Lehre, Fachschule*), (3) advanced vocational training (e.g. foreman, technician), and (4) academic university degree or degree of university of applied sciences (Diploma, M.A., state examination). The attainments in schooling and vocational training are combined in the logic of the CASMIN scheme (Braun and Müller 1997).

The *class position* of parental home is measured by the *German Employment Class Schema* (GEC) developed by Mayer and Aisenbrey (2007, p. 132). Considering the German situation on the one hand and following the proposal by Goldthorpe (1983) for the operationalization of social class, it is operationalized by the father's resp. step-father's employment relationship (self-employed vs. employed), allocation in the hierarchy of the firm (blue-collar worker, employee, civil servant etc.), and employment in the private or state sector at the respondents' age of 15 years. The GEC schema distinguishes hierarchically ordered social classes such as working class, lower middle class, middle class, and upper service class. The *working class* comprises family workers, small farmers (< 10 hectare), unskilled workers, less skilled workers and employees and less skilled civil servants. The *lower middle class* includes skilled workers, foreman, self-employed with one employee as well as middle farmers (< 50 hectare). Industrial supervisors, qualified employees, lower qualified civil servants, self-employed with maximal 9 employees and farmers with huge acres (≥ 50 hectares) belong to the *middle class*. In the *upper service class* we find highly qualified employees without or with leadership role, highly qualified civil servants, academics, professionals and self-employed with 10 employees and more.

Fig. 3: Birth cohort pattern of social origin in West Germany (Source: GLHS and ALWA – own calculation)



For our analysis, it has to be kept in mind that the class position of the family of origin does not only correspond to what parents aspire for their children and the resources of the parental home important for investments into their children's education but also the impact of several dimensions of the modernization process on educational aspirations and attainment. The distribution of parental class positions mirrors the social contexts in different historical periods in which their children grew up. This is documented in *Figure 3*. It shows the historical change of the class structure in Germany specific for each of the birth cohorts considered in this study as well as the decreasing share of the working and lower middle classes and the increase of middle and upper service classes across generations.

Table 1: Factor loadings (pattern matrix) and unique variances

Variables	Factor 1: Modernization	Factor 2: Labor market conditions	Uniqueness	Kaiser-Meyer- Olkin scores
Raw birth rate	-0.8123	-0.4027	0.1780	0.9634
Educational spending	0.9811	0.1229	0.0223	0.9028
No. of teacher on upper secondary schools	0.9396	0.3297	0.0084	0.9571
No. of grammar schools (<i>Gymnasium</i>)	0.9474	0.2383	0.0457	0.9389
No. of professors	0.9216	0.3636	0.0185	0.9002
No. of universities	0.9840	0.1034	0.0210	0.9472
Share of employees in tertiary sector	0.9487	0.3075	0.0053	0.9116
No. of medical doctors	0.9452	0.2930	0.0207	0.9232
No. of automobiles	0.9155	0.3541	0.0365	0.9204
Monthly income of blue collar workers	0.9680	0.2182	0.0153	0.9912
National income	0.9680	0.2182	0.0109	0.9071
Per capita national income	0.8835	0.4411	0.0248	0.8736
Gross domestic product	0.9812	0.1376	0.0182	0.8766
Private consumption	0.9821	0.1280	0.0191	0.8983
Public consumption	0.9817	0.1291	0.0197	0.9396
Investments	0.9648	0.1910	0.0326	0.8926
Unemployment rate	0.2740	-0.6570	0.4933	0.2366
No. of firms	-0.4172	-0.7560	0.2543	0.8431
Firm size	0.4119	0.8807	0.0547	0.7854
Overall				0.9105
Eigenvalue	16.0975	1.6028		
Variance	14.6769	3.0234		

The *effects of societal changes* in terms of *modernization and labor market conditions* – the so-called *period and cohort effects* – have been measured following the procedure suggested by Blossfeld (1986). Long time series of official statistics have been utilized for indicators of modernization (Zapf and Flora 1971). On the one hand, they measure *modernization* in terms of the historical change in several social systems such as educational system, labor market, medical care, transport, economic and social welfare, economic productivity, and in demography (see *Table 1*). On the other hand, the (cyclical) *labor market conditions* are indicated by the number of firms, unemployment rate, and firm size.³

In order to prevent the identification problem in multivariate estimates resulting from highly correlating or invalid time series, confirmatory factor analysis was applied to the 19 time series (Harrington 2009). Two factors – *modernization* and *labor market conditions* – were extracted by means of the main component method and orthogonal factor rotation. Both factors explain almost 94 per cent of the variance in these different time series (*Table 1*).

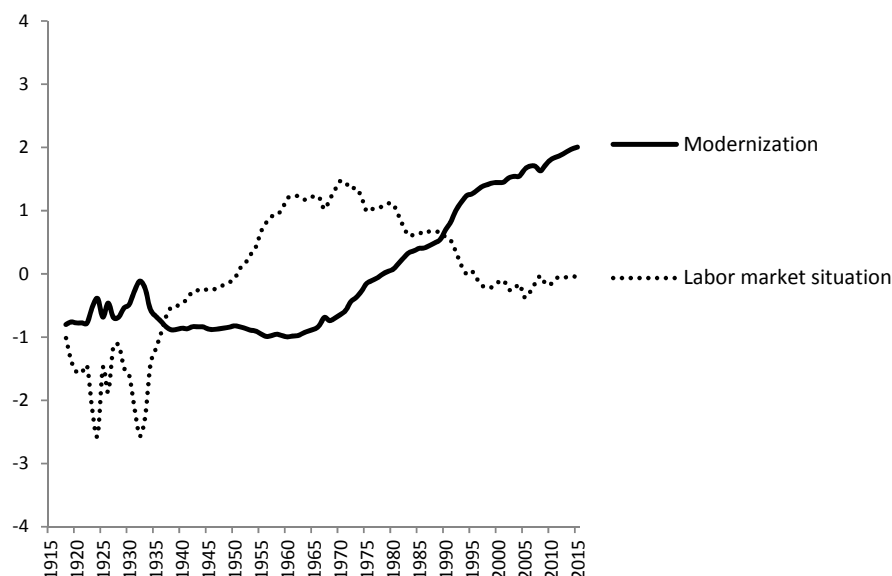
The period-specific factor scores are documented in *Figure 4* for the historical time from 1918 to 2015 (the time series of the original indicators are presented in *Figure A-1 in the Appendix*). They reflect the societal development in terms of modernization and labor market conditions associated with economic business cycles (Blossfeld 1986; Becker and Blossfeld 2017).

On the one hand, we are observing the cyclical trend of modernization in the Weimar Republic, the decreasing level of modernization in the Third Reich and the almost linear trend of modernization after 1960. On the other hand, the development of the labor market conditions is cyclical due to its strong dependency on business cycles such as the hyperinflation (1923), the Great Depression (1929-32), the recession after the German economic

³ The time series employed are documented in the German System of Social Indicators and Historical time series hosted by GESIS (<http://www.gesis.org/histat/en/index>). The data were completed with time series published by the Federal Office of Statistics in Wiesbaden (<https://www.destatis.de/EN/Homepage.html>) on their website, in their yearbooks or in special issues (e.g. Statistisches Bundesamt 1972). German historical time series published by Rahlf (2015a, 2015b, 2016), Bolt and Van Zanden (2014), Metz (2005), Titze et al. (1987); Herrlitz et al. (1995), Diebolt (1997), Sensch (2007, 2008), and Franzmann (2006) has been used. Economic data has been found in the Picketty-Zucman Wealth-Income data set (Picketty and Zucman 2014) and in the Angus Maddison Project (<http://www.ggd.net/maddison/maddison-project/home.htm>).

miracle (1966-67), the 1973-75 and 1980-82 recessions in the course of the two oil price shocks (1973, 1979), and the latest economic recessions and crisis (1991-94, 2001-03 and 2008-09).

Fig. 4: Modernization trend and development of labor market situation (1918-2015)



Design and statistical procedure

In order to combine the period-specific factor scores and the cohort-specific educational trajectories we are using the well-established procedure of *episode splitting* (Blossfeld et al. 2007; Blossfeld 1986). Each of the episodes in the individual's educational trajectory was divided into yearly sub-episodes and linked to the corresponding yearly factor scores of modernization and labor market condition (Becker and Blossfeld 2017) (see Fig. 1). At the start of each of the sub-episodes the factor score of the previous legal year has been deployed in order to capture *period effects*. They measure the impact of time-continuous change of modernization and labor markets on educational trajectories in the historical trend. They can be identified as one of the causal factors for educational participation and attainment. In this way it is possible to model structural change on the macro level in its impact on the individuals' educational opportunities (Blossfeld and Rohwer 1997). Furthermore, the levels of modernization and labor market conditions at the start of educational trajectories (e.g. first day of school, end of compulsory schooling, etc.) are being considered as *cohort conditions*. Finally, by this procedure, the educational trajectory is being treated as a stochastic process in the highly institutionalized context of the educational system. On the one hand, dropping out from the educational system or changes of educational tracks are theoretically possible at each point in time. On the other hand, we are dealing with the problem of unobserved heterogeneity since educational aspirations are not directly measured as could be the case in a prospective design. By this way, the impact of societal change on the unmeasured parental aspirations on their children's educational will be taken at least indirectly taken into account at least. In contrast, a comparative-static model such as a binary logit regression in a cross-sectional design would tend to underestimate the impact of societal change. In our case, the time-continuous progress of modernization and the cyclical change of labor market conditions influence transitions and attainments via the individuals' formation of educational aspiration viz. the adaptation of their aspirations to societal change (Becker and Hadjar 2013).

It has to be stressed that the episode splitting and the way of data compilation described above do have influences neither on the observed durations nor on the estimates of the other variables (Blossfeld 1986). In the logic of *dynamic multi-level analysis* it is possible to model the time-dependent characteristics of the macro and meso levels as predictors for events on the individual micro level by utilizing parametric procedures of *event-history analysis*. It is the aim of this kind of modeling to specify the likelihood of events in the educational trajectory, i.e. the hazard rate, as a stochastic and time-variant function of individual resources (micro level), of societal change in terms of modernization and economic cycles (macro level) and of labor market conditions (meso level). This rate is defined as the marginal value of the conditional probability to have such an event – like the transition from school to vocational training or attaining a credential – in the time interval $(t, t+\Delta t)$ provided that this event has not occurred before (Blossfeld et al. 2007). In our case, following the study by Becker and Blossfeld (2017), the rate will be estimated on the basis of an *exponential distribution*: $r(t|x(t)) = \exp(\beta'x(t))$, whereby $x(t)$ is the time-dependent vector of the exogenous variables whose unknown coefficients β have to be estimated. For each of the short sub episodes (maximum of 12 months) we are assuming a constant hazard rate.

4 Empirical findings

The empirical analysis and assessment of the hypotheses will be conducted in two steps. First, the cohort-specific patterns of educational trajectories and attainment will be described briefly for the 1925-2008 historical period. For this task, the most significant educational trajectories and attainments have been selected (for details: *Table A-1 in the appendix*). Second, the impact of modernization and changing labor market conditions on educational trajectories, achievement, and inequality of educational opportunity will be focused on in the dynamic analysis.

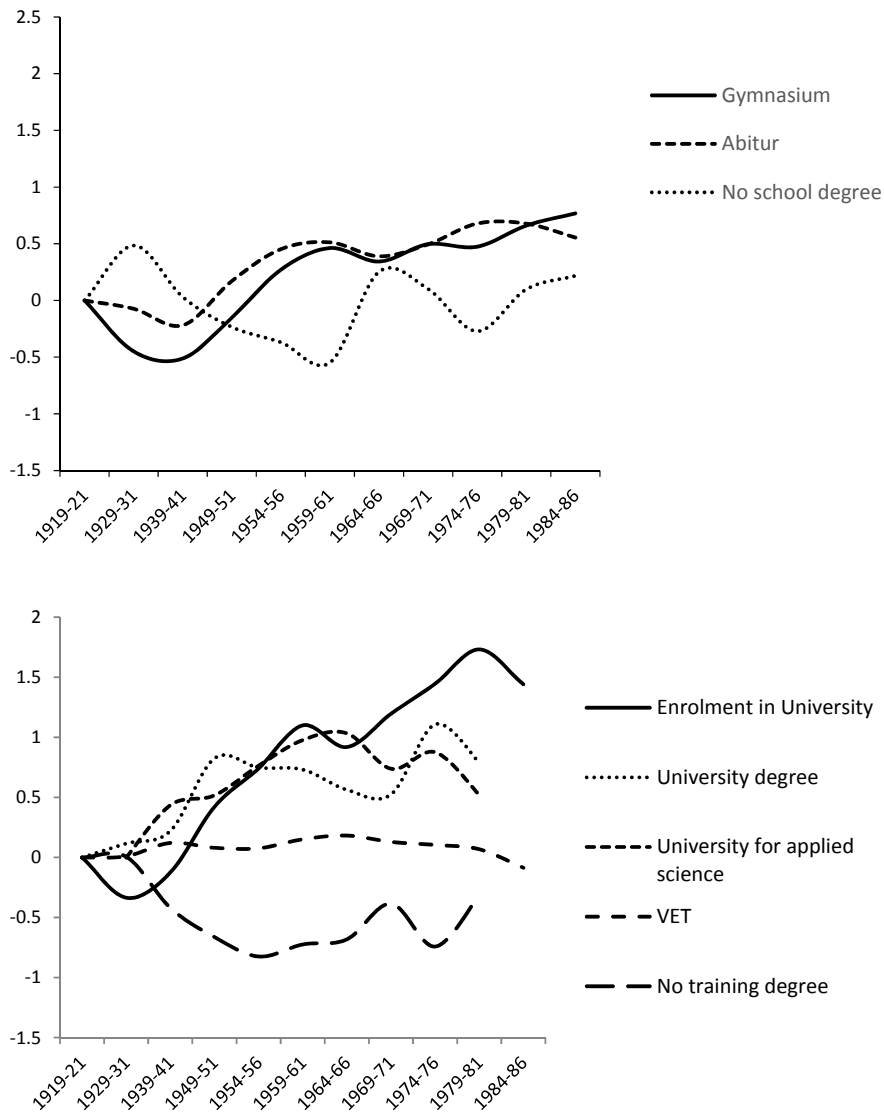
Cohort patterns of educational trajectories and attainments in Germany

If one is looking at the transition from elementary school to *Gymnasium* (most prestigious upper secondary school), there is a remarkable cohort differentiation reflecting an educational expansion across a long historical period (*Figure 5*, upper chart).⁴ Compared to the cohorts born around 1920, the cohorts born in the last years of the Weimar Republic and during the WWII have had less opportunities to visit the *Gymnasium* than the post-war cohorts born after the establishment of the Federal Republic of Germany in 1949 (for details: *Table A-1 in the appendix*). However, the cohorts born after 1951 have witnessed higher likelihoods for achieving the *Abitur* and becoming eligible for university studies. For the individuals who dropped out from the school without any certificate, there is no monotonic cohort pattern.

However, on the one hand, due to WWII and its immediate aftermath, the cohorts born around 1930 had the highest risk not to complete compulsory schooling in contrast to all other cohorts (Müller 1978). On the other hand, the baby boomer cohorts born around 1960 were least likely to leave school without a school certificate. In spite of the educational expansion in the post-war periods the percentage of school-leavers without a lower secondary school certificate has increased across the younger birth cohorts (Solga 2017). This is the downside of the educational expansion. In sum, apart from the very exceptional circumstances of the cohort born around 1930 and the slow postwar recovery for the cohorts born around 1940 we find evidence for a very general trend of educational expansion supporting hypothesis 1. This is also true for vocational education and university training.

⁴ In *Figure 5*, the β -coefficients estimated by the exponential model are presented. These estimations are documented in *Table A-1* in the appendix.

Fig. 5: Educational career patterns and attainment across birth cohorts (estimates in Table A-1 in Appendix)



Regardless of becoming eligible for university training, the cohorts born around 1930 and 1940 had the least opportunities to enter university while the younger cohorts born after the foundation of the Federal Republic of Germany in 1949 increasingly advanced to university (*Figure 5*, lower chart). This is also true for gaining a university degree or a degree after studying at a university of applied sciences (implemented in the early 1970s and heavily expanded after 1990). Across all of the cohorts, VET (basic vocational education and training as well as advanced VET) became the standard degree after the implementation of the dual system of vocational education and training in the early period of the Weimar Republic and has been remarkably stable (Jacob and Solga 2015). If the individuals eligible for university training are not taken into account, the cohort differentiation for enrolment and attainment of a vocational education and training certificate is rather low.⁵ On the one hand, for cohorts born after the rise of the Nazi regime, the likelihood for VET is increasing gently, while this

⁵ If all individuals in the cohorts are taken into account, we observe a decline of VET after the end of the WWII. That means that the continuation of education on the upper secondary schools (Gymnasium) and the university training became more attractive for the postwar cohorts.

likelihood decreases for the cohorts born after the middle of the 1960s. On the other side, keeping gender differences in mind (Brückner and Mayer 2005), there is a decline of the percentages of individuals who leave the educational system without any training certificate. In sum, these findings confirm hypothesis 1, too.

Effects of modernization and labor market development on schooling

In order to detect the role of modernization and changing labor market conditions on general schooling, we are examining the transition to secondary school at the end of elementary school phase (*Gymnasium* [upper secondary school] versus *Volks-* resp. *Hauptschule* [lower secondary school] and *Realschule* [intermediate secondary school]) (table 2). Controlling for gender (which indicates the gender reversal in educational opportunities after 1949 (Becker and Müller 2011; Becker 2014) and social origin (parental education and class), we find significant effects of modernization and the labor market situation for the transition to the upper secondary school (models 1 and 2).

Table 2: Period and Cohort effects in educational careers – schooling in Germany (Source: GLHS and ALWA – own calculations)

Models	Transition after primary school: Gymnasium		Attainment of Abitur ¹		Attainment of Abitur ²	
	1	2	3	4	5	6
<i>Gender</i>						
Male	-0.039 (0.042)	-0.043 (0.042)	-0.037 (0.029)†	-0.069 (0.030)*	0.013 (0.027)	-0.007 (0.029)
<i>Social origin</i>						
Education of father	0.176 (0.011)***	0.173 (0.011)***	0.122 (0.007)***	0.072 (0.008)***	0.081 (0.007)***	0.040 (0.007)***
Working class	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Lower middle class	0.076 (0.086)	0.078 (0.086)	0.116 (0.073)	0.155 (0.072)*	-0.004 (0.071)	0.060 (0.072)
Middle class	0.808 (0.080)***	0.803 (0.080)***	0.515 (0.066)***	0.492 (0.065)***	0.194 (0.063)**	0.232 (0.064)***
Upper service class	1.042 (0.089)***	1.046 (0.089)***	0.583 (0.071)***	0.696 (0.070)***	0.228 (0.067)***	0.392 (0.068)***
<i>Cohort effects</i>						
Modernization	0.085 (0.039)*		0.258 (0.026)***		0.127 (0.025)***	
Labor market situation	0.117 (0.029)***		0.239 (0.029)***		0.163 (0.026)***	
<i>Period effects</i>						
Modernization		0.150 (0.035)***		0.887 (0.035)***		0.745 (0.032)***
Labor market situation		0.146 (0.030)***		0.211 (0.040)***		0.169 (0.032)***
<i>Intercept</i>	-4.749 (0.080)***	-4.750 (0.077)***	-4.240 (0.067)***	-4.262 (0.069)***	-3.526 (0.065)***	-3.605 (0.067)***
log likelihood L ₀	-12057.058	-12057.058	-5635.033	-5635.033	-4071.424	-4071.424
log likelihood L ₁	-11243.010	-11232.552	-5279.559	-4921.759	-3973.393	-3740.154
LR chi ² (d.f.)	1449.17 (7)	1455.88 (7)	1472.24 (7)	2543.50 (7)	490.30 (7)	1326.74 (7)
Number of sub-episodes	86,720	86,720	66,858	66,858	42,442	42,442
Number of events	2,697	2,697	2,587	2,587	2,309	2,309

† p ≤ 0.1; * p ≤ 0.05; ** p ≤ 0.01; *** p ≤ 0.001; hazard rates estimated by exponential model (including episode splitting)

¹ after elementary school

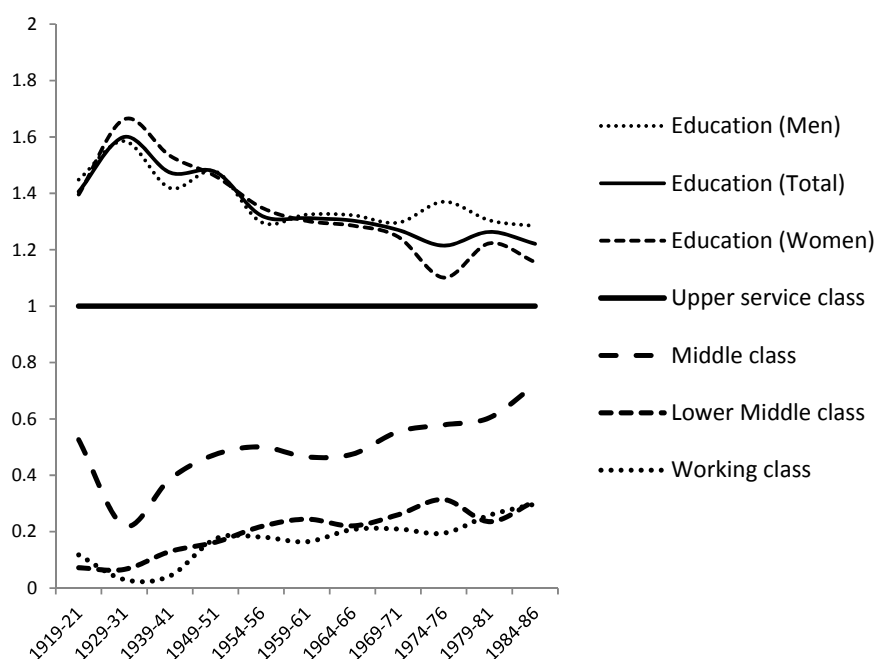
² without individuals in lower secondary school (Volks- resp. Hauptschule or special schools or miscellaneous schools)

The higher the level of modernization at the time of enrolment into the elementary school (cohort effect) and the more advanced modernization was in the periods until the first transition (period effect), the more likely is it that the children continue their schooling in the *Gymnasium*. In addition, the better the labor market situation, the stronger is the push toward the *Gymnasium*. These results confirm hypothesis 1a and 2. It has to be emphasized that the impact of modernization is greater than the labor market situation's one, so that hypothesis 1 is supported again. Furthermore, it is interesting that the period effects are more pronounced

that the cohort effects. That seems to indicate that more current dynamics of modernization and labor market conditions influence individuals' educational aspirations, choices, and opportunities more significantly than previous societal conditions.

This conclusion is also true for fulfilling the requirements for university entry (*Abitur*) considering modernization and labor market conditions at the transition from elementary to secondary school as the cohort effects.⁶ Persisting modernization and advantageous labor market conditions across historical periods contribute strongly to the likelihood of attaining the *Abitur*. The results are similar for different samples – e.g. the total birth cohorts (models 3-4 of unconditional opportunity) – and for the estimates excluding the children in the lowest secondary school (models 5-6; conditional opportunity). This provides evidence in favor of hypothesis 1 resp. 1b rather than hypothesis 2. Finally, the results do not support hypothesis 4 with its assumption that the educational expansion does not correlate at all with economic development.

Fig. 6: Changing IEO at transition to Gymnasium at age 10-13 by social class across birth cohorts



If we are reanalyzing the transition to the Gymnasium after elementary school for each of the birth cohorts considering the effect of social class only, we find a decline of inequality of educational opportunity (IEO) in the postwar periods (*Figure 6*). This is corroborated by the finding of a decline of IEO if the educational level of parental home is taken as the measure of social origin. However, compared to the service classes in particular, the children from working and lower middle classes are still disadvantaged in the early stages of their educational trajectory. Women have profited more from the educational expansion since the 1960s than men resulting in the gender reversal of educational attainment in the postwar period (Becker 2014). In sum, these results are in line with the findings by Breen et al. (2009) for Germany.

⁶ From the methodological perspective it is interesting that the comparative-static logit estimations as well as the dynamic discrete-time logit regression are similar to the dynamic estimations by the exponential model (*Table A-2 in the Appendix*). The only exceptions are estimates for the transition to the Gymnasium by the static binary logit regression (models 1 and 2). On the one hand, the results are theoretically invalid, and on the other hand, they are compatible with previous results (Becker and Hadjar 2013).

Effects of modernization and labor market conditions on VET and university training

Controlling for gender and social origin, the attainment of vocational education and training certificates (VET) is also influenced by trend of modernization and changes in labor market conditions (models 1-2 in *Table 3*). On the one hand, in line with hypothesis 2 – the assumption that advantageous labor market situations lead to increasing human capital investments in VET – there are stronger period than cohort effects of changing labor market conditions on the likelihood for entering VET. On the other hand, we find that there is a decreasing propensity for VET in the course of modernization.

This is also valid for individuals leaving the educational system without any training degree (models 11-12). In regard to the cohort and period effects, there is a remarkable effect of labor market conditions while the impact of modernization is rather negligible. The better the labor market conditions, the more likely are the enrolment and attainment of an academic or non-academic training degree. This finding also is in line with the human capital theory (hypothesis 2), and it could be assumed that worse labor market conditions lead to worse training opportunities, in particular for VET within firms, since employers in the private sector are not interested to invest into VET in times of economic crisis.

Furthermore, the estimates for the transition to university (models 3-4), the enrolment in university training (models 5-6), and for attaining an academic university degree (models 7-8) or degree of university of applied sciences (models 9-10) are not in line with hypothesis 3. The latter hypothesis implies that the increase in completing upper secondary education with the university entry ticket, participation in university training and attainment of university degrees are independent of the trend of modernization. The higher the modernization level and the better the labor market conditions at the year of entry to university (cohort effect) and the more pronounced the modernization trend (period effect), the more likely do young men and women enroll and finish university training. As theoretically expected, the changing labor market conditions (period effects) have no significant influences on both of these aspects of going to university, except for staying enrolled in university training (model 5-6). In sum, both human capital theory (hypothesis 2) and the neo-institutional theory of cultural modernization (hypothesis 4) match with our estimates. Again, the very general trend of modernization turns out to be a crucial societal development resulting in increasing enrollment and attainments in upper secondary higher education across historical periods.

Table 3: Period and Cohort effects in educational careers – vocational education and university training in Germany (Source: GLHS and ALWA – own calculations)

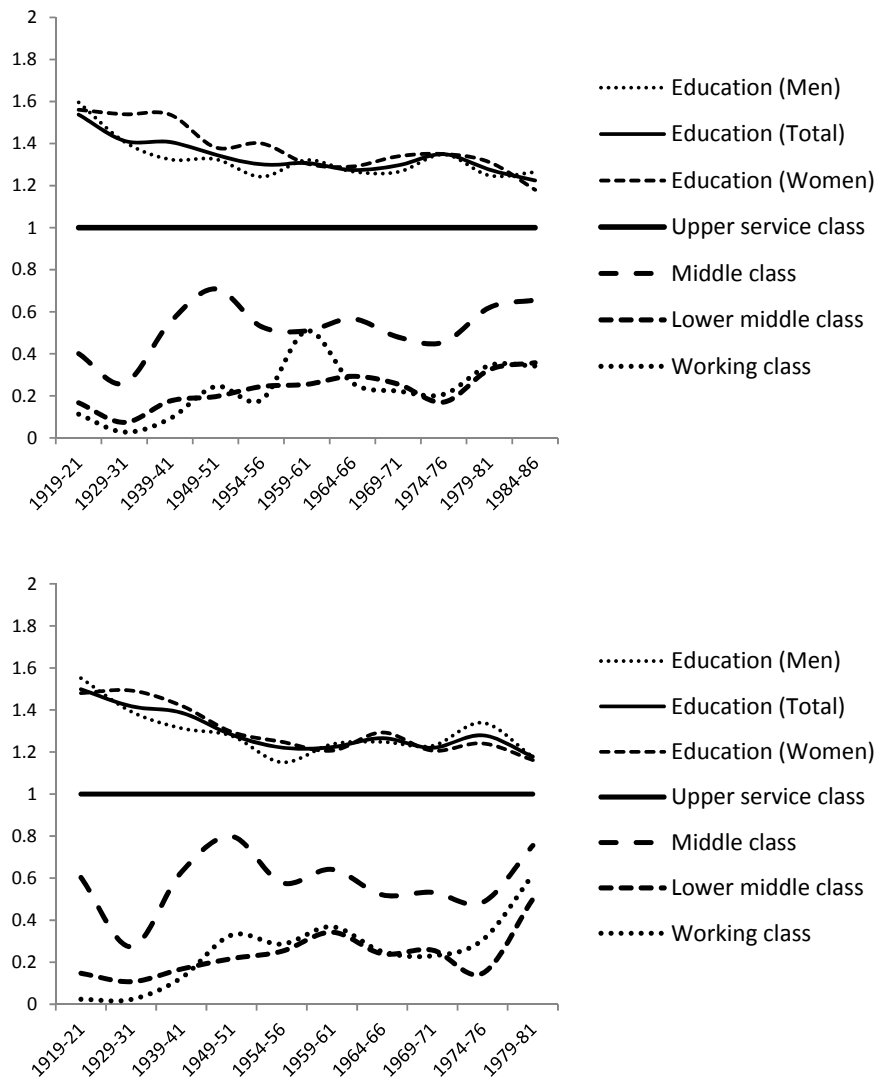
<i>Models</i>	VET		Transition: university training		Enrolment in university training		University degree ¹		University of applied sciences degree ¹		No training degree ¹	
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Gender</i>												
Male	-0.034 (0.017)*	-0.032 (0.017)	0.115 (0.035)**	0.115 (0.035)**	0.205 (0.038)***	0.206 (0.038)***	-0.056 (0.046)	-0.058 (0.047)	0.399 (0.087)***	0.391 (0.087)***	-0.307 (0.029)***	-0.305 (0.029)***
<i>Social origin</i>												
Education of father	-0.097 (0.006)***	-0.104 (0.006)***	0.052 (0.009)***	0.052 (0.009)***	0.173 (0.010)***	0.184 (0.010)***	0.157 (0.012)***	0.127 (0.012)***	-0.032 (0.023)	-0.058 (0.024)*	0.004 (0.008)	0.003 (0.008)
Working class	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Lower middle class	0.049 (0.021)*	0.053 (0.021)*	-0.128 (0.087)	-0.128 (0.087)	-0.005 (0.075)	-0.018 (0.075)	-0.164 (0.113)	-0.138 (0.113)	0.144 (0.146)	0.166 (0.146)	-0.102 (0.044)*	-0.097 (0.044)*
Middle class	-0.029 (0.024)	-0.036 (0.024)	0.079 (0.074)	0.079 (0.074)	0.495 (0.069)***	0.498 (0.069)***	0.480 (0.099)***	0.458 (0.099)***	0.387 (0.141)**	0.359 (0.141)*	-0.141 (0.045)**	-0.144 (0.045)**
Upper service class	-0.205 (0.034)***	-0.203 (0.034)***	0.109 (0.079)	0.109 (0.079)	0.683 (0.075)***	0.673 (0.075)***	0.600 (0.106)***	0.601 (0.105)***	0.404 (0.170)*	0.400 (0.169)*	-0.013 (0.053)	-0.020 (0.053)
<i>Cohort effects</i>												
Modernization	-0.159 (0.013)***		0.110 (0.040)**		0.790 (0.036)***		0.261 (0.047)***		0.667 (0.112)***		0.081 (0.022)***	
Labor market situation	0.067 (0.011)***		0.098 (0.053)		0.331 (0.041)***		0.339 (0.050)***		0.464 (0.146)**		-0.396 (0.016)***	
<i>Period effects</i>												
Modernization		-0.052 (0.012)***		0.109 (0.040)**		0.670 (0.035)***		0.554 (0.046)***		0.806 (0.110)***		0.026 (0.020)
Labor market situation		0.119 (0.012)***		0.097 (0.053)		0.348 (0.045)***		-0.005 (0.048)		0.092 (0.135)		-0.464 (0.018)***
<i>Intercept</i>	-1.603 (0.023)***	-1.614 (0.023)***	-1.137 (0.086)***	-1.136 (0.086)***	-4.031 (0.071)***	-4.057 (0.072)***	-4.819 (0.098)***	-4.651 (0.095)***	-5.383 (0.174)***	-5.199 (0.170)***	-2.108 (0.040)***	-2.082 (0.040)***
log likelihood L ₀	-12969.45	-12969.45	-2578.311	-2578.311	-11637.40	-11637.40	-4035.641	-4035.641	-2076.781	-2076.781	-10964.85	-10964.85
log likelihood L ₁	-12592.70	-12619.65	-2548.038	-2548.068	-10276.46	-10389.36	-3716.251	-3639.87	-2035.455	-1993.796	-10685.74	-10677.72
LR chi ² (d.f.)	1074.33 (7)	961.18 (7)	122.45 (7)	122.25 (7)	2531.72 (7)	2318.34 (7)	898.24 (7)	1096.85 (7)	102.77 (7)	195.96 (7)	766.88 (7)	852.33 (7)
Number of sub-episodes	52,762	52,762	3,021	3,021	39,935	39,935	50,735	50,735	47,035	47,035	50,735	50,735
Number of events	7,617	7,617	1,540	1,540	3,344	3,344	1,380	1,380	533	533	4,187	4,187

* p ≤ 0.05; **p ≤ .01; *** p ≤ 0.001; hazard rates estimated by exponential model (including episode splitting)

¹ all individual but cohort 1984-86

In line with the findings by Breen et al. (2009), we are detecting decreasing IEO for the entering (upper chart in *Figure 7*) and finishing university (lower chart) if we are measuring social origin by the educational level of the parental home. For the postwar cohorts we find no significant differences in regard to gender. For the most disadvantaged social classes, the working class and the lower middle class, we can observe a declining IEO across birth cohorts. However, the amount of IEO is still rather large in spite of the educational expansion in the course of modernization since the 1960s.

Fig. 7: Enrollment in university training, university degree and change of IEO by social class across cohorts



5 Summary and conclusions

The aim of this article was to unravel the impact of long-term societal change on micro level educational outcomes: transitions in educational trajectories, educational attainment and inequality of educational opportunity. For a long historical period of about 80 years (1925-2008), we are looking at societal change for Germany in three respects: a monotonic trend captured by 16 yearly time series on economic growth, educational investments, demographic change, and living conditions which we label “modernization” and three time series on unemployment and firm ecology (“labor market conditions”). The investigation is based on

event history data for 11 birth cohorts born between 1919 and 1986 from the German Life History Study and the ALWA-adult cohort of the National Educational Panel. Our hypotheses are derived from industrialization and human capital theory, the theory of status aspiration and reproduction and the neo-institutionalist theory of cultural universalism. Descriptively our results document the long term trend of educational expansion (in attainment) and of a decline inequality of opportunity (in access), but also retardations and reversals of these processes especially due to WWII and its aftermath. In our causal analysis we find strong effects of the level of modernization and also for human capital demand triggered by business cycles. In contrast to the predominant self-descriptions we do not find strong indications for status reproduction (insofar as could be shown by independence from linear trends and cycles).

We should also point to some limitations of our study. The first one is the missing information on the respondents' and their parents' educational aspiration and decision-making at branching points in the educational system. It would be interesting by controlling for social class to investigate whether and how do individuals perceive and evaluate the societal change as well as adapt their idealistic and realistic aspirations to the modernization trend, labor market conditions, and other significant historical circumstances. For Germany, there is evidence that individuals and their families – except the upper service class – respond to employment experiences and to labor market developments at branching points on lower and higher levels of the educational system (e.g. Becker and Nietfeld 1999). The second limitation is the exclusion of foreigners and immigrants from the analysis due to their low number of cases in the different birth cohorts (e.g. Becker and Blossfeld 2017). The third one is the exclusion of the educational trajectories in the former GDR because the official statistics were rather incomplete and less compatible to the data for the western part of Germany. However, the comparison between West and East Germany would be another story than the analysis presented in this study (Mayer and Solga 1994). The fourth limitation concerns the incomplete distinguishing between modernization and the expansion of educational system capacities as a cause and a consequence. From the perspective of an extended modernization theory, we are convinced that modernization and its correlates have strengthened the dynamics of educational expansion but that education and science were also pivotal factors reinforcing the process of modernization.

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Appendix

Fig. A-1: The Development of key indicators in Germany, 1918–2015

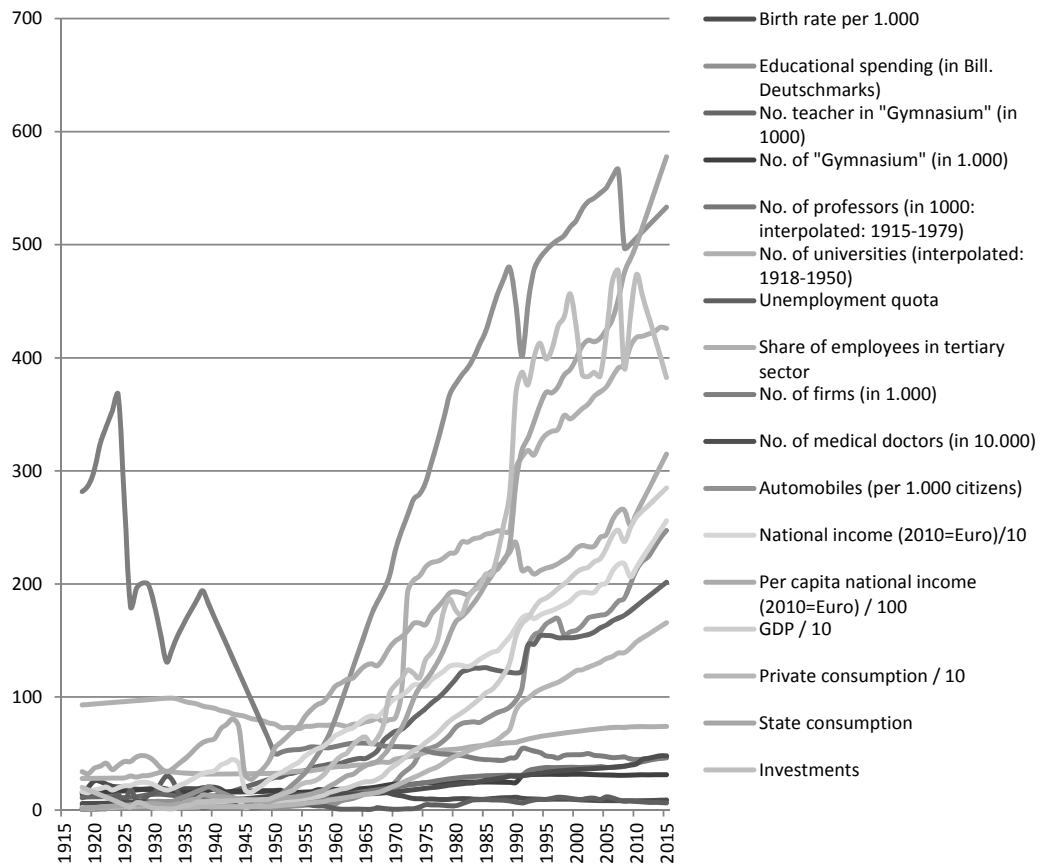


Table A-1: Educational career patterns and attainment across birth cohorts (Source: GLHS and ALWA – own calculations)

	Gymnasium	Abitur	No school degree	University freshmen ¹	Enrolment University	Enrolment University ²	University degree	University for applied science	VET	VET ³	No training degree
Cohort 1919-21	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>		<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Cohort 1929-31	-0.449 (0.128)***	-0.073 (0.147)	0.485 (0.197)*	-0.609 (0.267)*	-0.335 (0.157)*	-0.409 (0.196)*	0.117 (0.182)	<i>Reference</i>	0.003 (0.037)	0.011 (0.036)	0.007 (0.057)
Cohort 1939-41	-0.512 (0.128)***	-0.218 (0.155)	0.031 (0.212)	-0.093 (0.191)	-0.125 (0.138)	-0.109 (0.191)	0.222 (0.166)	0.436 (0.341)	0.097 (0.033)**	0.122 (0.030)***	-0.419 (0.063)***
Cohort 1949-51	-0.152 (0.114)	0.172 (0.112)	-0.234 (0.221)	0.048 (0.138)	0.422 (0.115)***	-0.230 (0.155)	0.826 (0.136)***	0.518 (0.327)	-0.081 (0.037)*	0.081 (0.032)*	-0.662 (0.064)***
Cohort 1954-56	0.271 (0.094)**	0.453 (0.094)***	-0.369 (0.223)	0.298 (0.111)**	0.741 (0.097)***	-0.028 (0.122)	0.749 (0.126)***	0.765 (0.300)*	-0.093 (0.033)**	0.077 (0.029)**	-0.824 (0.057)***
Cohort 1959-61	0.462 (0.078)***	0.513 (0.085)***	-0.547 (0.188)**	0.153 (0.105)	1.100 (0.087)***	-0.032 (0.109)	0.732 (0.118)***	0.978 (0.286)***	-0.118 (0.029)***	0.152 (0.026)***	-0.723 (0.045)***
Cohort 1964-66	0.343 (0.078)***	0.390 (0.086)***	0.254 (0.172)	-0.117 (0.108)	0.919 (0.087)***	-0.316 (0.110)**	0.564 (0.119)***	1.034 (0.284)***	-0.033 (0.027)	0.183 (0.025)***	-0.681 (0.043)***
Cohort 1969-71	0.496 (0.079)***	0.496 (0.085)***	0.101 (0.176)	0.014 (0.107)	1.196 (0.087)***	-0.133 (0.109)	0.526 (0.122)***	0.739 (0.289)*	-0.148 (0.029)***	0.130 (0.026)***	-0.384 (0.042)***
Cohort 1974-76	0.474 (0.120)***	0.679 (0.099)***	-0.271 (0.256)	0.090 (0.122)	1.446 (0.114)***	-0.108 (0.136)	1.109 (0.139)***	0.877 (0.338)**	-0.301 (0.055)***	0.105 (0.045)*	-0.741 (0.086)***
Cohort 1979-81	0.660 (0.108)***	0.678 (0.093)***	0.099 (0.216)	0.118 (0.115)	1.732 (0.104)***	-0.057 (0.124)	0.790 (0.149)***	0.521 (0.351)	-0.422 (0.054)***	0.069 (0.047)	-0.311 (0.062)***
Cohort 1984-86	0.768 (0.093)***	0.555 (0.091)***	0.218 (0.194)	0.066 (0.112)	1.442 (0.104)***	-0.080 (0.124)			-0.442 (0.051)***	-0.085 (0.046)	
Constant	-3.912 (0.066)***	-3.386 (0.080)***	-4.471 (0.162)***	-0.713 (0.100)***	-3.510 (0.079)***	-1.105 (0.101)***	-4.294 (0.109)***	-5.373 (0.275)***	-1.813 (0.022)***	-1.753 (0.021)***	-1.957 (0.031)***
N of sub episodes	119,058	52,040	86,211	3,534	53,665	11,287	66,527	60,591	68,909	44,795	66,527

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

¹ individuals eligible for university training at age 19–23

² eligible individuals only (without risk for VET)

³ without individuals eligible for university training

Table A-2: Period and Cohort effects in educational careers estimated by comparative-static logit models (Source: GLHS and ALWA – own calculations)

Models	Transition after primary school: Gymnasium (logit)		Transition after primary school: Gymnasium (discrete-time logit)		Attainment of Abitur (logit)		Attainment of Abitur (discrete-time logit)		Attainment of Abitur (logit) ¹		Attainment of Abitur (discrete-time logit) ¹	
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Gender</i>												
Male	-0.087 (0.044)*	-0.102 (0.044)*	-0.039 (0.017)*	-0.058 (0.017)***	-0.080 (0.048)	-0.109 (0.049)*	-0.039 (0.040)	-0.073 (0.041)	0.025 (0.056)	0.010 (0.056)	0.014 (0.043)	-0.007 (0.043)
<i>Social origin</i>												
Education of father	0.224 (0.012)***	0.199 (0.012)***	0.205 (0.004)***	0.166 (0.004)***	0.233 (0.013)***	0.199 (0.013)***	0.129 (0.010)***	0.077 (0.010)***	0.196 (0.014)***	0.172 (0.015)***	0.086 (0.011)***	0.044 (0.011)***
Working class	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Lower middle class	0.036 (0.078)	0.050 (0.078)	0.106 (0.033)**	0.148 (0.034)***	0.113 (0.090)	0.138 (0.091)	0.118 (0.084)	0.161 (0.084)	0.007 (0.107)	0.046 (0.109)	-0.005 (0.093)	0.065 (0.094)
Middle class	0.739 (0.073)***	0.725 (0.073)***	0.882 (0.031)***	0.879 (0.031)***	0.647 (0.084)***	0.640 (0.085)***	0.528 (0.078)***	0.510 (0.078)***	0.334 (0.099)***	0.358 (0.100)***	0.203 (0.085)*	0.245 (0.085)**
Upper service class	1.091 (0.083)***	1.138 (0.084)***	1.129 (0.034)***	1.243 (0.035)***	0.880 (0.094)***	0.970 (0.095)***	0.602 (0.086)***	0.730 (0.085)***	0.489 (0.109)***	0.594 (0.111)***	0.239 (0.092)**	0.419 (0.092)***
<i>Cohort effects</i>												
Modernization	-0.014 (0.041)		0.122 (0.016)***		0.315 (0.044)***		0.270 (0.037)***		0.178 (0.051)***		0.134 (0.039)***	
Labor market situation	-0.019 (0.031)		0.193 (0.011)***		0.292 (0.039)***		0.247 (0.036)***		0.279 (0.041)***		0.172 (0.035)***	
<i>Period effects</i>												
Modernization		0.238 (0.034)***		0.709 (0.013)***		0.777 (0.043)***		0.932 (0.039)***		0.643 (0.047)***		0.794 (0.039)***
Labor market situation		-0.146 (0.040)***		0.099 (0.011)***		0.164 (0.053)**		0.206 (0.046)***		0.193 (0.053)***		0.169 (0.044)***
<i>Intercept</i>	-2.094 (0.076)***	-1.972 (0.074)***	-2.684 (0.031)***	-2.477 (0.030)***	-2.645 (0.089)***	-2.675 (0.091)***	-4.235 (0.081)***	-4.254 (0.083)***	-1.725 (0.104)***	-1.771 (0.105)***	-3.503 (0.088)***	-3.581 (0.089)***
Cases / person years	11,215	11,215	89,942	89,942	11,215	11,215	66,864	66,864	6,014	6,014	42,442	42,442
Pseudo-R ²	0.1143	0.1207	0.1180	0.1434	0.1125	0.1395	0.0339	0.0684	0.0677	0.0866	0.0116	0.0394

† p ≤ 0.1; * p ≤ 0.05; **p ≤ 0.01; *** p ≤ 0.001

¹ without individuals in lower secondary schools (Volks- und Hauptschule)

Table A-3.1: Period and Cohort effects in educational careers of men – vocational education and university training in Germany (Source: GLHS and ALWA – own calculations)

Models	VET		Transition: university training		Enrolment in university training		University degree ¹		University of applied sciences degree ¹		No training degree ¹	
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Social origin</i>												
Education of father	-0.095 (0.009)***	-0.103 (0.009)***	0.046 (0.012)***	0.046 (0.012)***	0.153 (0.013)***	0.165 (0.013)***	0.148 (0.016)***	0.117 (0.016)***	-0.043 (0.029)	-0.068 (0.030)*	0.001 (0.012)	-0.002 (0.012)
Working class	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Lower middle class	0.047 (0.027)	0.051 (0.027)	-0.117 (0.114)	-0.118 (0.114)	-0.053 (0.096)	-0.067 (0.096)	-0.033 (0.158)	-0.000 (0.158)	0.091 (0.175)	0.112 (0.175)	-0.103 (0.068)	-0.101 (0.068)
Middle class	-0.073 (0.032)*	-0.079 (0.032)*	0.114 (0.097)	0.114 (0.097)	0.516 (0.089)***	0.522 (0.089)***	0.625 (0.142)***	0.595 (0.141)***	0.374 (0.171)*	0.338 (0.171)*	-0.013 (0.067)	-0.025 (0.067)
Upper service class	-0.258 (0.047)***	-0.253 (0.046)***	0.099 (0.106)	0.099 (0.106)	0.697 (0.096)***	0.690 (0.097)***	0.735 (0.149)***	0.737 (0.148)***	0.337 (0.207)	0.334 (0.206)	0.128 (0.078)	0.121 (0.078)
<i>Cohort effects</i>												
Modernization	-0.211 (0.016)***		0.146 (0.059)*		0.775 (0.047)***		0.241 (0.064)***		0.476 (0.119)***		0.333 (0.032)***	
Labor market situation	0.003 (0.012)		0.140 (0.079)†		0.337 (0.055)***		0.317 (0.069)***		0.322 (0.154)*		-0.318 (0.028)***	
<i>Period effects</i>												
Modernization		-0.111 (0.016)***		0.145 (0.059)*		0.655 (0.047)***		0.547 (0.064)***		0.637 (0.120)***		0.260 (0.030)***
Labor market situation		0.056 (0.014)***		0.139 (0.078)†		0.354 (0.060)***		-0.034 (0.066)		0.018 (0.144)		-0.415 (0.031)***
<i>Intercept</i>	-1.582 (0.026)***	-1.585 (0.026)***	-1.044 (0.115)***	-1.043 (0.115)***	-3.738 (0.087)***	-3.767 (0.089)***	-4.941 (0.136)***	-4.773 (0.133)***	-4.750 (0.188)***	-4.599 (0.183)***	-2.567 (0.058)***	-2.536 (0.059)***
log likelihood L ₀	-7012.264	-7012.264	-1337.002	-1337.002	-6571.072	-6571.072	-2110.755	-2110.755	-1287.852	-1287.852	-5403.224	-5403.224
log likelihood L ₁	-6775.865	-6800.261	-1323.593	-1323.628	-5848.741	-5913.881	-1947.858	-1904.573	1274.291	-1253.049	-5266.788	-5259.158
LR chi ² (d.f.)	703.36 (6)	584.02 (6)	54.09 (6)	53.91 (6)	1318.19 (6)	1197.71 (6)	449.32 (6)	558.85 (6)	31.72 (6)	73.80 (6)	318.19 (6)	330.71 (6)
Number of sub-episodes	29,150	29,150	1,534	1,534	21,672	21,672	28,017	28,017	26,066	26,066	28,017	28,017
Number of events	4,206	4,206	824	824	1,919	1,919	721	721	344	344	1,975	1,975

† p ≤ 0.1; * p ≤ 0.05; ** p ≤ .01; *** p ≤ 0.001; hazard rates estimated by exponential model (including episode splitting)

¹ all individual but cohort 1984-86

Table A-3.2: Period and Cohort effects in educational careers of women – vocational education and university training in Germany (Source: GLHS and ALWA – own calculations)

Models	VET		Transition: university training		Enrolment in university training		University degree		University of applied sciences degree		No training degree	
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Social origin</i>												
Education of father	-0.098 (0.009)***	-0.104 (0.009)***	0.057 (0.013)***	0.057 (0.013)***	0.197 (0.015)***	0.208 (0.015)***	0.166 (0.018)***	0.137 (0.018)***	-0.016 (0.039)	-0.045 (0.039)	0.003 (0.012)	0.003 (0.012)
Working class	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Lower middle class	0.046 (0.033)	0.050 (0.033)	-0.140 (0.132)	-0.140 (0.132)	0.068 (0.119)	0.055 (0.119)	-0.308 (0.163)	-0.290 (0.162)	0.254 (0.263)	0.272 (0.263)	-0.084 (0.057)	-0.080 (0.056)
Middle class	0.025 (0.036)	0.017 (0.036)	0.037 (0.114)	0.037 (0.114)	0.475 (0.110)***	0.474 (0.110)***	0.328 (0.139)*	0.312 (0.138)*	0.429 (0.251)	0.421 (0.249)	-0.264 (0.060)***	-0.261 (0.059)***
Upper service class	-0.151 (0.051)**	-0.152 (0.051)**	0.125 (0.119)	0.125 (0.119)	0.670 (0.120)***	0.657 (0.120)***	0.460 (0.151)**	0.461 (0.148)**	0.529 (0.297)	0.524 (0.294)	-0.119 (0.071)	-0.125 (0.071)
<i>Cohort effects</i>												
Modernization	-0.087 (0.020)***		0.077 (0.055)		0.817 (0.056)***		0.284 (0.068)***		1.425 (0.308)***		-0.142 (0.029)***	
Labor market situation	0.156 (0.020)***		0.060 (0.072)		0.328 (0.064)***		0.365 (0.074)***		1.253 (0.393)**		-0.432 (0.020)***	
<i>Period effects</i>												
Modernization		0.027 (0.020)		0.077 (0.055)		0.696 (0.054)***		0.559 (0.066)***		1.436 (0.289)***		-0.182 (0.027)***
Labor market situation		0.200 (0.021)***		0.060 (0.072)		0.345 (0.067)***		0.025 (0.069)		0.624 (0.364)		-0.468 (0.022)***
<i>Intercept</i>	-1.686 (0.033)***	-1.700 (0.033)***	-1.122 (0.124)***	-1.121 (0.124)***	-4.162 (0.108)***	-4.184 (0.109)***	-4.755 (0.132)***	-4.586 (0.126)***	-6.362 (0.422)***	-6.006 (0.410)***	-2.008 (0.048)***	-1.986 (0.047)***
log likelihood L ₀	-5957.186	-5957.186	-1239.066	-1239.066	-5059.755	-5059.755	-1922.424	-1922.424	-779.777	-779.777	-5507.113	-5507.113
log likelihood L ₁	-5798.684	-5803.514	-1223.446	-1223.447	-4421.607	-4469.589	-1767.137	-1734.064	-754.770	-734.918	-5336.443	-5340.274
LR chi ² (d.f.)	444.84 (6)	418.13 (6)	60.61 (6)	60.61 (6)	1215.10 (6)	1118.38 (6)	444.90 (6)	537.84 (6)	48.53 (6)	98.31 (6)	566.92 (6)	623.32 (6)
Number of sub-episodes	23,612	23,612	1,487	1,487	18,263	18,263	22,718	22,718	20,969	20,969	22,718	22,718
Number of events	3,411	3,411	716	716	1,425	1,425	659	659	189	189	2,212	2,212

† p ≤ 0.1; * p ≤ 0.05; ** p ≤ .01; *** p ≤ 0.001; hazard rates estimated by exponential model (including episode splitting)

¹ all individual but cohort 1984-86