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Original Article

Societal Change and Educational Trajectories of Women and Men Born between 1919 and 1986 in (West) Germany

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Abstract

The aim of this study is to unravel the impact of societal change in West Germany on educational attainment and its attendant social disparities for cohorts born between 1919 and 1986. Therefore, we analyse *whether* modernization trends have modified access to, and success in, general, vocational, and higher education for consecutive birth cohorts. To explain *how* these processes have affected class differentials in educational attainment, we assume that the interplay of the changing occupational structure at the macro level and intergenerational status maintenance via investment in the education of offspring is—among other influences—the key mechanism for long-term educational expansion and for decreasing inequalities of opportunity in the educational system. The empirical bases of our investigation are clusters of time series for macro changes and retrospective individual data for 11 birth cohorts from the German Life History Study and the National Educational Panel Study for educational outcomes. We apply piecewise exponential event-history models to analyse the direct and indirect impacts of societal change on educational trajectories and social disparities in educational attainment. The results provide an understanding of historical variations in educational transitions and attainment associated with modernization in the social, political, economic, and cultural spheres.

Introduction

In their recent studies on educational expansion and inequality in educational opportunity (IEO) in the second half of the 20th century, Breen *et al.* (2009, 2010) emphasize that *modernization* as an overall trend of societal development also results in educational expansion understood as increasing participation and changing class differentials in upper secondary and higher education. In several modernization theories, indeed, it is often claimed that modernization is closely correlated to the spread of mass education in terms of both the introduction of compulsory education and of tertiary education (Meyer, Ramirez and Nuhoglu Soysal, 1992; Schofer and Meyer, 2005).[1] Societal changes, such as technical and other functional requirements of modern society, are thought to strengthen the demand for well-trained manpower that then triggers the extension of the public educational system and brings about easier access to higher education for socially disadvantaged groups (Treiman, 1970). The spread of meritocratic norms in

the allocation of individuals to positions is expected to result in increased demand for formal education and certificates, while recruitment and promotion in labour markets should become less and less dependent on the direct influence of social origin.

Following Erikson and Jonsson (1996), Breen *et al.* (2009: pp. 1479–80) highlight additional mechanisms whereby modernization results in educational expansion and decreasing social disparities in educational attainment. The general improvement of living conditions in the course of economic development, the growth of welfare state protection, and the provision and reforms of educational institutions increase overall educational participation and reduce disparities in educational attainment among the offspring of different social classes. Economic growth, reduction in family size, extended educational opportunity, the lengthening of compulsory education, and declining costs of education are all factors that shape the distinct propensities of children from different social classes to continue on to higher levels of education. Emphasizing mechanisms at the individual level, these changes are taken to be responsible for modifying the relation between social origin and achievement (primary effects of stratification), as well as educational decisions (secondary effect of stratification; Boudon, 1974: pp. 29–30). As a result of improved living conditions, working-class children are expected to become less disadvantaged in their achievement compared with socially privileged children. Decreasing relative costs of continuing education and training due to improved economic welfare and reforms of the educational system might contribute to declining secondary effects in favour of lower social classes (Breen *et al.*, 2010: p. 32).

Overall, it is assumed that modernization has a considerable impact on educational systems (Windolf, 1997), educational enrolment (Flora, 1974), educational trajectories (Becker and Hadjar, 2013), and IEO (Breen *et al.*, 2009). However, in the case of Germany, as also for some of the other countries they examined, Breen and his co-authors did not *directly* test the impacts of overall societal change on educational participation and disparities. Understanding *why* and *how* modernization—mediated by politically and economically initiated reforms and extension of the educational system—has significant effects on educational enrolment, transitions, and attainment cannot be done in the 'usual static way' (Blossfeld, 1996: p. 198). Such a macro–meso–micro framework must recognize that time matters for these linkages between the societal levels. Educational trajectories are processes that are shaped by modernization (*macro level*); by the history-specific ecology of organizations, such as the educational system providing opportunities for education and firms demanding skilled graduates (*meso level*); and by purposive individuals (*micro level*). In addition to these analytical levels, different time dimensions have to be taken into account to understand the dynamics of societal change, educational expansion, and the impact of modernization on educational trajectories. At the start of their educational trajectories, individuals born in given years share general socio-economic contexts, such as the trend in and level of modernization (*cohort effects*). However, the effects of history and societal development are not restricted solely to their initial impacts: in addition to such cohort effects, they also affect educational decisions and opportunities at later points in the educational career (*period effects*). Finally, educational trajectories are enacted by individuals' cumulative experiences in the age-related institutional setting of the educational system (*age* or *duration effect*). The latter point means that, after compulsory school, individuals are more likely to attain a certificate and advance to higher levels, the longer they are enrolled in the educational system (Becker and Hadjar, 2013).

To carry out an age–period–cohort analysis in a dynamic multilevel design, longitudinal data on the educational trajectories of several birth cohorts covering a long historical period are needed (Mayer and Huinink, 1990). Therefore, utilizing life-course data, it is the aim of our study to unravel the impacts of societal change in West Germany on educational trajectories, and social disparities in educational attainment, for 11 cohorts born between 1919 and 1986, across 80 years of German history. Reconstructing social history by combing time series of macro data and longitudinal cohort microdata yields an understanding of historical variations in educational outcomes associated with overall societal processes, such as modernization in social, economic, political, and cultural spheres.

Theoretical Background

In discussing why we think modernization has significant impacts on educational trajectories, and why educational inequality has declined during the course of modernization, we add additional hypotheses regarding what we take to be the main mechanisms. As societal change at the macro level provides historically specific contexts for individual choices regarding education, the ways in which overall societal change is translated into individual motivations and decisions have to be specified. Therefore, and according to Breen and his co-authors (2009), *direct* and *indirect* effects of modernization on individuals' education must be

distinguished. Societal conditions and their change form the basis for parental motives, which dictate investments in their offspring's education. Aspirations for *intergenerational status maintenance*—that is, avoidance of downward mobility—are a major driver of families' educational strategies (Erikson and Jonsson, 1996; Breen and Goldthorpe, 1997; Stocké, 2007). In the view of these authors, families pursue a strategy that is designed to ensure that their offspring acquire a class position and a related standard of living that is at least as advantageous as that from which they originated. By investing in their children's education, they seek to avoid, for their children, any class position in life that is worse than the one which they occupy (Breen and Goldthorpe, 1997: p. 283; Becker, 2003: p. 6).

Direct Effects of Modernization

There must be a reason for the increased investment by the lower classes in their children's continued education as of 1918. As already argued, the subjectively optimal education that is suitable for avoiding status demotion is the pivotal educational motivation (Stocké, 2007). Modernization strengthens this motivation through structural changes such as the decline of farming and self-employment, investment in industrialization and the transformation to a service economy, the rise of new technologies and occupations, and the increased requirement to attain credentials to obtain employment. In modernization's trend towards higher work complexity and technical progress, as well as towards increased bureaucratization and professionalization since the start of the 20th century (Klein, 2011: p. 429), the number and level of qualifications required to ensure access to positions guaranteeing status maintenance have increased (Treiman, 1970: p. 429). As traditional jobs with low qualification requirements have been replaced by modern occupations requiring higher skills, structural mobility has been enforced (Müller, Willms and Handl, 1983). Due to significant shifts in labour demand favouring higher-skilled workers over less-skilled, the course of technical progress makes it necessary for the next generation to attain higher educational certificates to avoid social demotion. Therefore, persistent shifting of economic sectors, changing of occupational structures, and—as a consequence—upgrades in the class structure have changed the reference points of status maintenance across generations (Stocké, 2007: p. 507). An immediate by-product of modernization, in its direct impact on families' educational aspiration across birth cohorts, is the increasing necessity for families to invest more in their offspring's education. Therefore, higher levels of modernization (macro level) have resulted in an increased propensity for individuals (micro level) to attain higher educational qualifications (*Hypothesis 1*).

This *direct effect of modernization* on families' and individuals' educational aspirations and their related decisions on education might be different for each social class. Upper-service-class families will be under less pressure, as they have always been able to invest in their children's academic education or in alternative means to avoid social demotion. Therefore, they should show the lowest relative increases in educational attainment. According to the hypothesis of maximally maintained inequality, social disparities are maintained as long as privileged groups have not reached 'saturation' in mobilizing talented children (Raftery and Michael, 1993). Due to their class-related advantages in achievement and decision-making, the upper classes' demand for higher education will be more likely to be exhausted in the earlier stages of educational expansion (Breen, 2005). Families at the bottom of the class structure, in contrast, are most interested in a level of their children's educational attainment that guarantees a safe transition to the labour market and stable employment (such as a vocational apprenticeship), as unemployment might easily result in social demotion (Breen and Goldthorpe, 1997). In sum, social disparities in attainment should decrease because disadvantaged social classes are motivated to catch up in educational attainment (*Hypothesis 2*).

Beyond the general trend of societal development (which we map as modernization), more specific cyclical labour market conditions might also influence families' calculation of the costs and benefits of higher education, as well as related educational decisions shaping their children's educational trajectories. To achieve status maintenance, parents have realistic aspirations concerning which occupational, and therefore class, position their offspring may be able to attain after obtaining a certain educational certificate (Stocké, 2007). We therefore assume that the immediate labour market situation provides signals—namely, the employers' demand for the employees' qualification—depending on the economic cycle (Becker and Blossfeld, 2017). Thus, in sum, it is assumed that *labour market conditions* provide signals for families in their striving to achieve higher educational attainment (*Hypothesis 3*). We make no strong theoretical a priori assumption as to whether the levels of modernization and the cyclical labour market conditions at the start of individuals' trajectories (cohort effect) are more important than the period-specific parameters of modernization and labour market conditions during the later course of educational trajectories

(period effect). However, as lower-class families are more likely to feel certainty in regard to the cost of higher education, but feel less certain about its benefits being realized in the labour market, they might be more sensitive to up- and downswings of the labour market. It is assumed therefore that lower-class families are more likely to invest in continuing education in periods of favourable labour market conditions (*Hypothesis 4*).

Indirect Effects of Modernization

The effects of macro-level trends of modernization on individuals' educational behaviour observed at the micro level might also be mediated by societal processes at the meso level, such as the extension of educational opportunities (Becker and Hadjar, 2013). As emphasized by recent studies (Breen *et al.*, 2009, 2010; Blossfeld, Blossfeld and Blossfeld, 2015), politically induced growth and reform of the educational system were often a response to trends of modernization and provided important preconditions for individual educational opportunities and changes in IEO. This was the case for Germany (and its precursor states) after the establishment of a secularized education system controlled by the state, as well as the introduction and enforcement of compulsory school attendance for all children, which started slowly in the 18th century and accelerated in the 19th century (Müller, Steinmann and Schneider, 1997). This modern development modified the life course of generations, as regular education was integrated into the planning and shape of life courses (Mayer and Müller, 1986). The implementation of the general primary school and the intermediate secondary school alongside the separate concert of lower schools (*Volksschule*) and academic schools (*Gymnasium*), as well as the extension of compulsory school attendance, and the introduction of the dual system of vocational education and training (VET) during the Weimar Republic (1918–1933), were additional stepping stones in the extension of educational opportunities among the economic and political turmoil after the First World War. During the Third Reich (1933–1945), i.e. in the years under the Nazi government, the system of higher education (Gymnasium and universities) was intentionally neglected to the advantage of general schooling and VET, resulting in a decline in enrolment in tertiary education. After the foundation of the Federal Republic of Germany, the harmonization of schools of general education (Düsseldorf Agreement 1955; Hamburg Agreement 1964), the establishment of universities of applied sciences (1968), the reorganization and expansion of academic high schools at the upper secondary level (1972), the (very partial) institution of comprehensive schools (1973), and the foundation of new universities accompanied and fostered educational expansion. In the empirical analysis, such *indirect effects of modernization* are reflected in the increasing number of academic high schools (*Gymnasium*)—not least in rural areas—and of tertiary institutions, such as general and technical universities, universities of applied sciences, private universities, and other colleges (meso level). The more educational opportunities that are provided, the more likely it is that there will be increases in individuals' educational participation (*Hypothesis 5*).

Another indirect effect could be mediated by the educational behaviour of other collective entities, such as peer groups (Merton, 1949) or older birth cohorts growing up just before the succeeding cohort (Mannheim, 1928). The imitation of the reference groups' behaviour and the adaptation of their values and motivations regarding education might be important mechanisms in this process indicating *recursive effects of modernization trend* (Hernes, 1976). The higher the rates of enrolment in continued schooling or in tertiary education in previous periods (macro level), the higher the participation rates on the individual level in the following periods (*Hypothesis 6*).

Such reinforcement processes contribute an additional indirect effect of modernization to sustainable educational expansion. The social diffusion of knowledge about the usefulness of higher education and the increasingly salient effect of parental educational aspiration and life planning on their children are examples (Müller and Haun, 1994: p. 7; Becker, 2003). Furthermore, the enjoyment of the increased benefits of additional investments in higher education in the course of modernization and educational expansion was widespread across the social classes and genders (Becker and Blossfeld, 1991; Breen *et al.*, 2010; Becker, 2014). In the course of modernization, those graduates who profited at labour market entry and in their work history invested, in particular, in certificates of upper secondary and higher education (Becker and Blossfeld, 2017). According to Hernes (1976), contagious diffusion is an important type of social change in which the rate of adoption is proportional to those who have adopted an item such as a credential and the related returns to education (Becker and Blossfeld, 2017). As emphasized by Stocké (2007, 2013), the social networks of successful pioneers are important actors in this process, providing models for individuals who are still uncertain as to whether it pays to invest in higher education. Other people's intrinsic motivation to obtain higher education influences families' decisions regarding investment in

their children's education, provided they are integrated into such networks. As the cost of higher education has to be borne instantly, while the future benefits are more uncertain, the lower social classes are more likely to be influenced by the educational decisions of others, as an element that reduces their uncertainty. Therefore, more expanded general enrolment in upper and higher education, representing successful models in the educational system, can be expected to create an incentive for families in lower classes to invest in their children's higher education (*Hypothesis 7*).

Data, Variables, Design, and Statistical Procedure

Data Sources

The empirical analyses are based on two longitudinal, population-representative data sets. The first is the event-history data set of the German Life History Study (GLHS) (Mayer, 2015). The GLHS provides information on the educational trajectories of samples from cohorts born in 1919–1921, 1929–1931, 1939–1941, 1949–1951, 1954–1956, 1959–1961, 1964, and 1971. Thus, the educational careers that have been analysed took place across different political regimes—the Weimar Republic (1918–1933), the Third Reich (1933–1945), and the Federal Republic of Germany (since 1949)—in the historical period from 1925 (school entry of the cohort 1919) to 1999 (youngest cohort's year of interview). The birth cohort 1919–1921 includes 1,412 West German citizens. The cohorts born around 1930, 1940, and 1950 comprise 2,171 West Germans. Also, 2,008 West Germans were born around 1955 and 1960. Finally, the cohorts born in 1964 and 1971 consist of 2,909 West Germans. The second data set comes from the *Arbeiten und Lernen im Wandel* (ALWA) study of the Institute for Employment Research in Nuremberg (Kleinert *et al.*, 2011), which is now part of the National Educational Panel Study (NEPS). For our purpose, we have selected 4346 West German citizens born in 1959–1961, 1964–1966, 1969–1971, 1974–1976, 1979–1981, and 1984–1986, as well as their educational careers in the 1965–2008 periods. The interview schedules of the ALWA study are based on those of the most recent GLHS projects and are therefore highly comparable. Moreover, fieldwork was conducted by the same survey research institute.[2] Respondents' information on their educational trajectories was collected retrospectively (Brückner and Mayer, 1998; Mayer, 2008). They were asked to reconstruct their schooling and training, with exact time references for the start and end of each episode in their educational history. Overall, 223 of 12,846 respondents have been excluded due to missing time references (see details on the validity of retrospective data in *Section A* of online supplementary appendix [OSA]).

The selection of 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 Ramsøy (1973). Thus, the individuals' imprinting by historical events—such as political circumstances and institutions (Mayer and Müller, 1986), historical breakdowns and political turmoil (Mayer and Hillmert, 2003), and processes of modernization (Blossfeld, 1986)—in sensitive phases of their life course is the main selection criterion (Blossfeld, Blossfeld and Blossfeld, 2015). Most of these phases are related to periods of social, political, and cultural change (details in *Section B of OSA*).

Dependent and Independent Variables

Two kinds of *dependent variable* are distinguished. First, we look at the *transition to Gymnasium* at the first branching point of the educational system and the *transition to university training*. Second, we focus on the *attainment of certificates*, such as the eligibility for university access (*Abitur*), as well as general VET and university degrees.[3]

Besides the respondents' *cohort membership* and *gender*, one of the explanatory variables is *social origin*. The *class position* of the parental home is measured by the *German Employment Class Schema* (Mayer and Aisenbrey, 2007: p. 132). This class schema distinguishes between hierarchically ordered social classes, such as working class, lower middle class, middle class, and upper service class. Following Goldthorpe's (1983) proposal for the operationalization of social class, it is operationalized by the (step-) father's employment status, allocation in the hierarchy of the firm, and employment in the private or state sector at the point at which the respondent is 15 years of age. In case of missing values, the mostly alone (step-) mother's employment status has been used. Due to missing values on social origin, 12 per cent of 12,623 cases are excluded. According to sensitivity tests, the exclusion of missing data did not lead to any biases in the estimations.

For our analysis, it has to be kept in mind that parental class positions do not only correspond to the resources available for investment in their children's education, and to the level of parental aspirations for their offspring: their distribution also mirrors the socio-

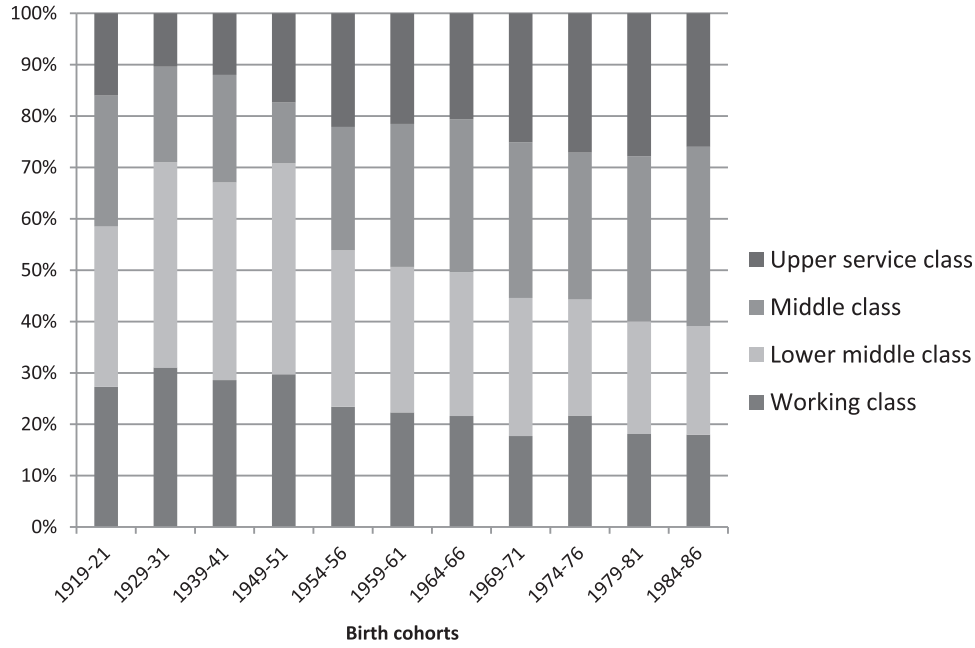

Figure 1. Birth cohort pattern of social origin in (West) Germany
Source: GLHS and ALWA study—authors' calculation

economic contexts in different historical periods in which their children grow up. Figure 1 shows the change in class structures in Germany and, most notably, the decreasing proportion of working and lower middle classes and increasing proportion of middle and upper service classes across generations. These changes are the basis for theoretically expected social processes and mechanisms, such as high structural mobility, higher qualificational requirements, and changing reference points for status maintenance. The upgrading of the class structure across cohorts indicates that there might be a need for parents to invest more in their children's education to safeguard status maintenance.

The separation of *age, period*, and *cohort effects* is not possible in a cross-sectional design, as the same scales are used for different time dimensions (Mayer and Huinink, 1990). However, according to Blossfeld (1986), event-history data provide an elegant solution to this problem, through (1) the identification of these time dimensions by time-varying indicators, (2) the combination of macro and micro data through the procedure of episode splitting, and (3) the application of dynamic multilevel models of event-history analysis. In the first step, long-time series of official statistics have been utilized for indicators of modernization (Zapf and Flora, 1971) (see Figure A3 in OSA).[4] The choice of these indicators is theoretically driven, considering recent modernization theories (Zapf, 1994) and recent studies on educational expansion and inequalities (Arum, Gamoran and Shavit, 2007; Breen *et al.*, 2009; Blossfeld, Blossfeld and Blossfeld, 2015) as well as on the returns of education (Becker and Blossfeld, 2017). They measure *modernization* in terms of historical change in economic productivity, government activity, economic structures, and social welfare, and the *labour market conditions* associated with economic business cycles (Table 1). To prevent identification problems in multivariate estimates resulting from highly correlating or invalid time series, confirmatory factor analysis was applied to these 19 time series (Harrington, 2009). The two factors have been extracted by means of the main component method and orthogonal factor rotation. They explain 95 per cent (modernization: 79 per cent; labour market conditions: 16 per cent) of the variance in these different time series.

The period-specific factor scores are documented in Figure 2 for periods from 1918 to 2010 (the original time

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

Variables	Factor 1: Level of modernization	Factor 2: Labour market situation	Uniqueness	KMO score
Social protection (at current prices)	**0.9882**	0.0782	0.0174	0.8967
Public educational spending (in Deutsche Mark)	**0.9835**	0.1446	0.0117	0.8985
Public consumption (at current prices)	**0.9847**	0.1509	0.0077	0.8758
Monthly income of blue-collar workers (2000 = 100 per cent)	**0.9617**	0.2462	0.0145	0.9880
Per capita private wealth (at current prices)	**0.9540**	0.2495	0.0277	0.8744
Private consumption of education (2010 = 100 per cent)	**0.9505**	0.2848	0.0154	0.8873
Private consumption (at current prices)	**0.9846**	0.1474	0.0088	0.9345
Absolute number of medical doctors	**0.9327**	0.3440	0.0118	0.9161
Absolute number of automobiles	**0.9070**	0.3798	0.0331	0.8660
Share of employees in tertiary sector (in per cent)	**0.9380**	0.3376	0.0061	0.9102
National income (at current prices)	**0.9129**	0.4003	0.0063	0.8887
Per capita national income (2010 = 100 per cent)	**0.8526**	0.4995	0.0236	0.8486
Gross domestic product (at current prices)	**0.9833**	0.1585	0.0080	0.9098
Per capita gross domestic product (at current prices)	**0.8969**	0.4245	0.0153	0.9714
Investments (at current prices)	**0.9673**	0.2061	0.0218	0.9418
Productivity (1950 = 100 per cent)	**0.9522**	0.2890	0.0097	0.8575
Unemployment rate	0.2785	**−0.6008**	0.5615	0.2060
Number of firms	−0.3860	**−0.7594**	0.2742	0.7565
Average firm size	0.3928	**0.8998**	0.0360	0.7481
Overall				0.8897
Eigenvalue	16.30241	1.58663		
Variance	0.7859	0.1674		

series may be requested from the authors). We observe for modernization a cyclical trend in the Weimar Republic, a decreasing level in the Third Reich, and almost a linear trend after 1960. The development of labour market conditions is cyclical due to its strong dependency on business cycles, such as hyper-inflation (1923), the Great Depression (1929–1932), the Second World War (1943–1945), the recession after the German economic miracle (1966–1967), the 1973–1975 and 1980–1982 recessions in the course of two oil price shocks (1973, 1979), and the latest economic recessions and crises (1991–1994, 2001–2003, 2008–2009). Finally, it is demonstrated that—after 1960—there is an almost linear increase in the number of academic high schools until 1990, while the number of tertiary institutions (academic universities, universities of applied sciences, private universities, and other colleges) increased stepwise across the periods—with the exception of the 1970s and 1980s. The period-specific factor scores on modernization should indicate the *direct* effect of modernization on educational trajectories, while the numbers of schools and universities are used for revealing *indirect* effects of modernization on individuals' educational trajectories by taking the trend of modernization into account. Utilizing time-series analysis we have detected that the modernization trend has resulted in the extension of the education system, while this direct effect of modernization has fuelled enrolment in higher education (see *Section D in OSA*). For the multivariate analysis, the period-specific change enrolment in higher education will be taken into account to reveal recursive effects of modernization and contiguous effects of educational expansion (see *Hypotheses 6* and *7*).

In the second step, to combine period-specific factor scores and cohort-specific educational trajectories, we use the procedure of *episode splitting* (Blossfeld, 1986). Each of the episodes in the individual's educational trajectory has been divided into yearly sub-episodes and linked to the corresponding yearly factor scores of modernization and labour market condition. At the start of each of the sub-episodes, factor scores of the legal year are used to capture *period effects*. The period effects measure the proximate, short-term impact of societal changes on educational trajectories throughout the historical trend. Furthermore, we measure the levels of modernization and labour market conditions at the start of educational trajectories (e.g. first day of school, end of compulsory schooling, or end of general

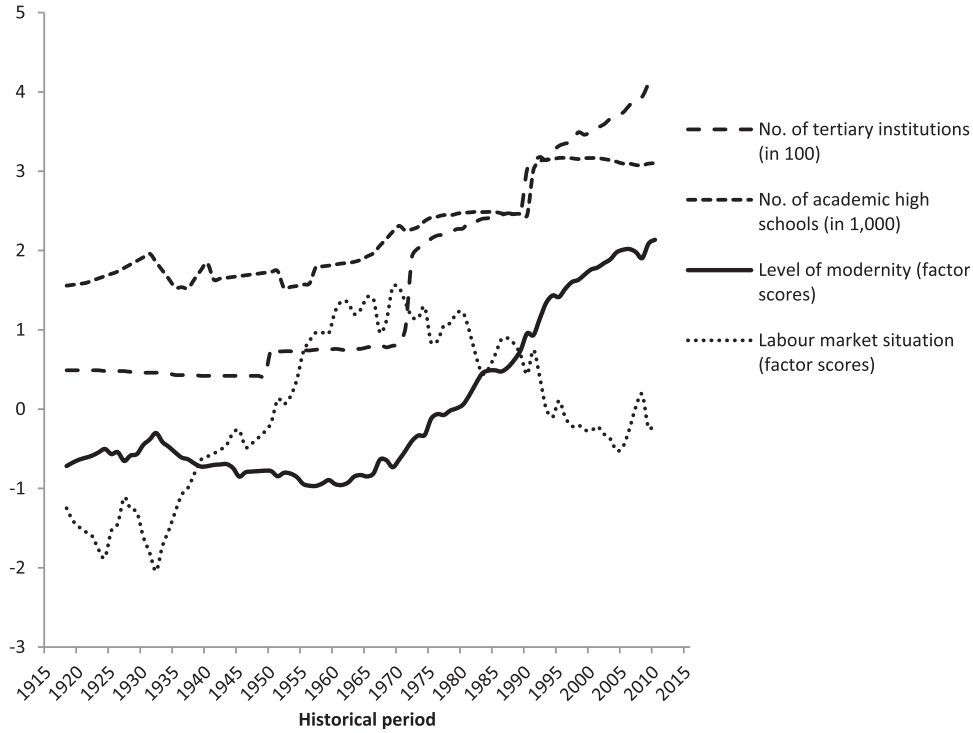

Figure 2. Trend of modernization, labour market situation, academic high schools, and tertiary institutions in (West) Germany, 1918–2010

schooling) as conditions that indicate specific *cohort effects*. They indicate more distant effects of societal change on the shape and dynamic of trajectories. The *age effect* is considered by the cumulative duration of an individual's enrolment in education. Due to utility maximization and sunk costs (Hillmert and Jacob, 2003), it is assumed that individuals are more likely to attain certificates instead of dropping out from their course the longer they have already stayed in the educational system, and as they become older.

Design and Statistical Procedure

In the third step, by means of this procedure, the educational trajectory is treated as a *stochastic process* in the highly institutionalized settings of the educational system. Dropouts or changes of educational track are theoretically possible at each point in time. In addition, the variation in enrolment and attainment across periods and ages in the individuals' educational trajectories within each of the birth cohorts will also be considered.[5] In the logic of *dynamic multilevel analysis*, it is possible to model time-dependent characteristics of the macro and meso levels as predictors for events at the individual micro level by utilizing parametric procedures of *event-history analysis* (Blossfeld, 1996). It is the aim of this kind of modelling to specify the likelihood of events in trajectories—that is, the hazard rate—as a stochastic and time-variant function of individual resources (micro level), of societal change (macro level), and of the educational system (meso level). This rate is defined as the marginal value of the conditional probability of an event—such as a transition or attaining a credential—occurring in the time interval $(t, t+\Delta t)$ provided that this event has not occurred before (Blossfeld, Golsch and Rohwer, 2007). In our case, the rate will be estimated on the basis of an *exponential distribution*: $r(t|x(t)) = \exp(\beta' \mathbf{x}(t))$, whereby $\mathbf{x}(t)$ is the time-dependent vector of exogenous variables whose unknown coefficients β have to be estimated. For each of the sub-episodes, we are assuming a constant hazard rate. In this way, we are able to model step functions that display the empirically observed hazard function for the entire educational trajectory embedded in different periods of societal change.

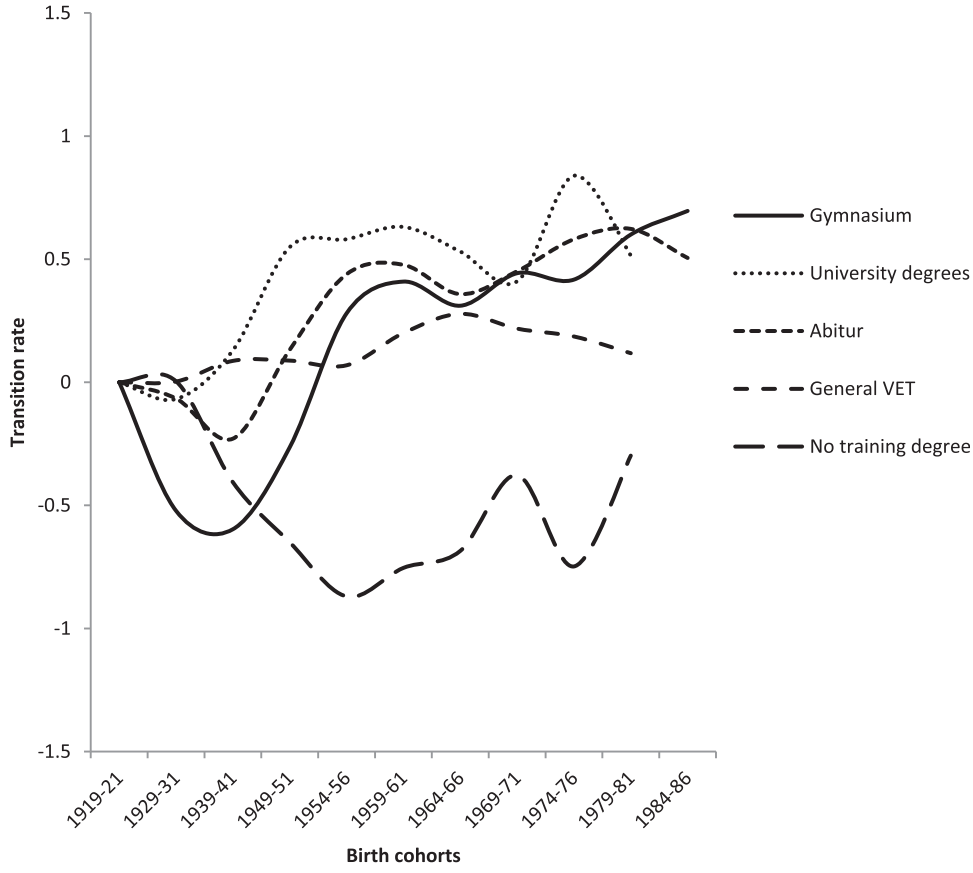

Figure 3. Educational career patterns and attainment across birth cohorts*
Note: * Estimates in Table A1 in OSA
Source: GLHS and ALWA study—authors' calculation

Empirical Results

In the first step, educational expansion is described briefly by emphasizing the cohort patterns of educational enrolment and attainment. Second, the direct effect of modernization on educational trajectories is revealed by multivariate analysis, while in the third step, the indirect effects of modernization are the focus of estimations.

Educational Expansion in (West) Germany

As has often been documented, (West) Germany, like many other countries, has experienced an overall process of educational expansion (Breen *et al.*, 2009). Across birth cohorts and historical periods, increasing numbers of young people have stayed on in full-time education beyond the minimum compulsory school age (*Gymnasium*), have entered and finished VET, have increasingly enrolled in upper secondary courses and attained eligibility for university training (*Abitur*), and have entered into some form of tertiary education (academic university and universities of applied sciences) and finished them successfully (university degrees) (Figure 3).[6] In sum, educational expansion has been realized by consecutive cohorts. This is true for upper secondary and higher education; the increase in VET has been rather moderate. Having no training certificate at all became very rare after 1945.

However, there is no linear trend of increasing access to continued education and attainment of higher degrees; rather, there are some nonlinearities and even reversals in these educational trends (Blossfeld, Blossfeld and Blossfeld, 2015). In Germany, these peculiarities are mostly related to the Second World War. Compared with those born around 1920, younger cohorts born

around 1930 and 1940 were disadvantaged due to this war and its aftermath in the immediate post-war period, while younger cohorts born after 1945 have benefited from educational expansion.

Direct Effects of Modernization on Education

Given previous findings, our multivariate analysis focuses on direct effects of societal change on both educational attainment and social disparities (Table 2). Controlling for gender and social origin, we observe positive age effects as well as period and cohort effects of societal change on the attainment of high school diplomas (*Abitur*), university degrees, or VET graduation.[7] First, due to utility maximization and sunk costs, individuals were more likely to finish their education and training in pursuit of a certified degree the longer they had already been in the educational system.

Second, cohorts who continued their educational trajectory after primary school at higher levels of societal development and in better labour market conditions were more likely to attain a high school diploma. And the higher the level of modernization and the more favourable the (cyclical) labour market conditions after finishing schooling, the more likely was the attainment of a university degree. These cohort effects reflect the long-term impact of societal change on individuals' propensity to start and to finish university training successfully. It also indicates that modernization, in particular, has distal impacts on the aspirations of parents and their children, on the planning of the educational trajectory, their educational decisions, and successful attainment in higher education, while the impact of labour market conditions is notably weaker.

In addition to these more distal cohort effects, we find significant short-term period effects of modernization that are of a similar magnitude. The period effect of modernization is stronger than the effect of labour market conditions. This means that ongoing modernization trends stabilize individuals' educational trajectories across time to a larger extent than cyclical labour market conditions. It is, moreover, worth noting that the period effect of modernization is valid for upper schooling and higher education, while for the attainment of a general VET degree, we observe neither period nor statistically significant cohort effects of modernization. This is due to the fact that upper schooling and apprenticeships tend to substitute for each other, at least partially. However, for the attainment of a VET degree, only labour market conditions create significant effects. It could be assumed that the VET degree increasingly became the standard certificate—independent from the trend for modernization—as a 'safety net' against social demotion for children from lower social classes. Overall, and as expected, the findings show that high levels of modernization and beneficial labour market conditions have resulted in an increased propensity for individuals to attain higher educational qualifications, and support *Hypotheses 1* and *3*.

Finally, we corroborate well-known patterns of social disparity. In spite of modernization and educational expansion across 80 years, inequalities in educational opportunity are persistently maintained by inequalities in social status. Children from the middle and upper service classes are more likely to attain a higher education diploma (*Abitur*) and a university degree than their counterparts in the working and lower middle classes. Which of the social classes have benefited most? Compared with the interaction of period-specific modernization and origin from the middle and upper service classes, the eligibility for university training (*Abitur*) and attainment in tertiary education have increased for the offspring of the lower middle and working classes in the course of modernization. In the process of modernization, it has become increasingly feasible for lower classes to at least close the gap with more advantaged social classes. The claim of *Hypothesis 2*, that social disparities in attainment have decreased because disadvantaged social classes have been catching up in educational attainment, is confirmed empirically. The same is true for the interaction between labour market conditions and social origin, whereby interactions between modernization and social origin are stronger for the class-related attainment of university degrees. Overall, as predicted by *Hypothesis 4*, we find that lower-class families' investment into their children's education is indeed more likely to be sensitive to favourable labour market conditions.

This conclusion is confirmed by additional analysis (Figure 4). In particular, those social classes that have been traditionally disadvantaged in educational attainment have enjoyed considerable progress in the course of educational expansion. Across birth cohorts, children from the working and lower middle classes have disproportionally increased propensities to enrol in *Gymnasium* after primary school, to attain the *Abitur*, and finally to finish their university training successfully, in comparison with the middle and upper service classes. As the latter classes were traditionally already quite successful in getting their children into higher education, their additional rates of enrolment in higher education were more moderate in the course of

Table 2. Direct cohort and period effects of societal change on educational attainment in (West) Germany

Models	Abitur			University degree[a]			General VET[b]		
	1	2	3	4	5	6	7	8	9
Gender (Ref.: female)									
Male	−0.058	−0.061	−0.066	−0.189	−0.190	−0.185	−0.225	−0.222	−0.220
	(0.037)	(0.037)	(0.037)	(0.051)***	(0.051)***	(0.050)***	(0.017)***	(0.018)***	(0.018)***
Social origin (Ref.: working class)									
Lower middle class	0.101	0.104	0.126	−0.026	−0.026	0.390	−0.042	−0.048	0.010
	(0.062)	(0.064)	(0.161)	(0.094)	(0.095)	(0.254)	(0.048)	(0.046)	(0.034)
Middle class	0.232	0.201	0.745	0.430	0.426	1.194	−0.121	−0.118	−0.094
	(0.060)***	(0.061)***	(0.142)***	(0.098)***	(0.097)***	(0.227)***	(0.063)	(0.055)*	(0.081)
Upper service class	0.304	0.283	1.110	0.627	0.622	1.709	−0.193	−0.199	−0.069
	(0.059)***	(0.060)***	(0.138)***	(0.086)***	(0.086)***	(0.218)***	(0.035)***	(0.037)***	(0.041)
Time dimensions									
Age: Experience	0.600	0.573	0.573	0.291	0.275	0.290	0.258	0.254	0.268
	(0.013)***	(0.013)***	(0.013)***	(0.023)***	(0.024)***	(0.024)***	(0.032)***	(0.033)***	(0.033)***
Cohort: Level of modernization	0.465			0.319			0.018		
	(0.029)***			(0.053)***			(0.029)		
Cohort: Labour market situation	0.365			0.182			0.120		
	(0.033)***			(0.073)*			(0.050)*		
Period: Level of modernization		0.639	1.076		0.331	1.097		0.054	0.157
		(0.032)***	(0.099)***		(0.049)***	(0.145)***		(0.055)	(0.025)***
Period: Labour market situation		0.432	0.855		0.178	0.651		0.077	0.118
		(0.030)***	(0.120)***		(0.047)***	(0.198)**		(0.036)*	(0.023)***
Interaction: Modernization and . . .									
Lower middle class			0.004			−0.277			0.069
			(0.122)			(0.184)			(0.063)
Middle class			−0.498			−0.871			−0.313
			(0.108)***			(0.169)***			(0.127)*

(continued)

Table 2. (Continued)

Models	Abitur			University degree[a]			General VET[b]		
	1	2	3	4	5	6	7	8	9
Upper service class			−0.740			−1.172			−0.296
			(0.107)***			(0.172)***			(0.046)***
Labour market situation and ...									
Lower middle class			−0.051			−0.456			−0.123
			(0.149)			(0.233)			(0.057)*
Middle class			−0.491			−0.489			0.039
			(0.132)***			(0.220)*			(0.068)
Upper service class			−0.750			−0.627			−0.127
			(0.128)***			(0.210)**			(0.043)**
Intercept	−7.016	−7.022	−7.488	−4.507	−4.507	−5.259	−2.036	−2.004	−2.061
	(0.100)***	(0.096)***	(0.149)***	(0.106)***	(0.091)***	(0.216)***	(0.064)***	(0.061)***	(0.057)***
log likelihood L_0	−6657.312	−6657.312	−6657.312	−5781.647	−5781.647	−5781.647	−9939.724	−9939.724	−9939.724
log likelihood L_1	−2456.505	−2345.272	−2293.874	−4313.978	−4311.235	−4227.542	−8311.075	−8324.962	−8259.189
LR chi^2 (d.f.)	3806.08 (7)	4167.56 (7)	4485.95 (13)	451.43 (7)	429.47 (7)	620.47 (13)	466.40 (7)	439.00 (7)	861.73 (13)
Number of sub-episodes	86 287	86 287	86 287	59 287	59 287	59 287	37 857	37 857	37 857
Number of events	2844	2844	2844	2162	2162	2162	6882	6882	6882

*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; hazard rates estimated by exponential model (including episode splitting).

[a]Academic university degree or degree of university of applied sciences.

[b]Without individuals eligible for university training.

Source: GLHS and ALWA—authors' calculations.

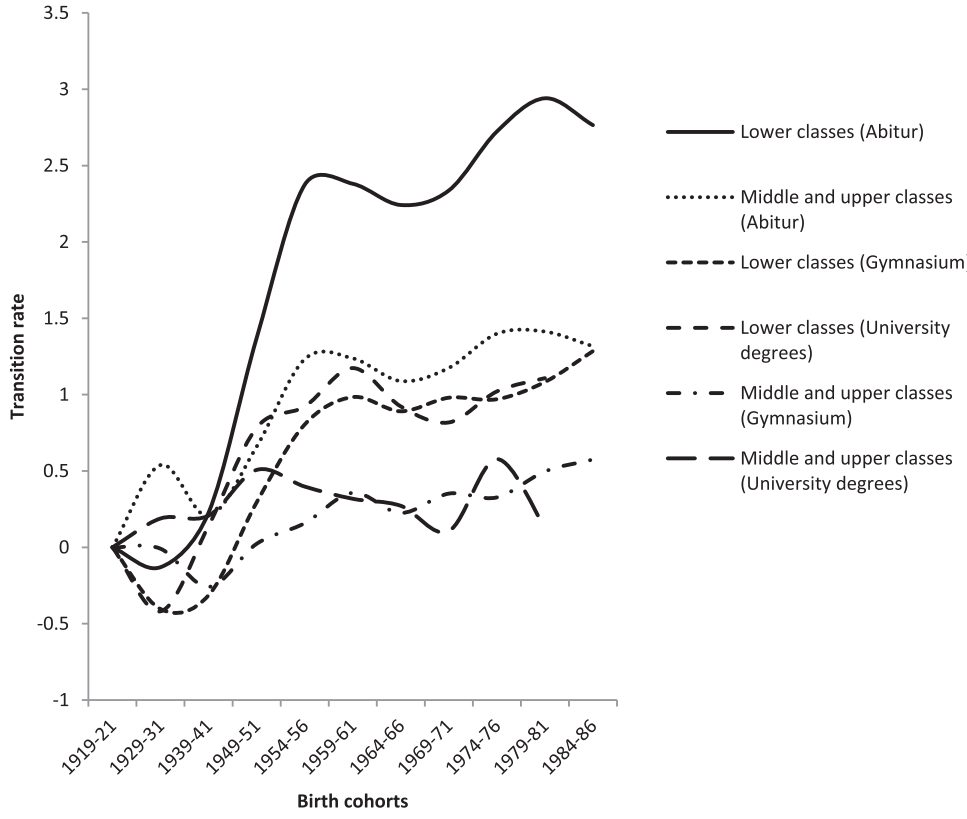

Figure 4. Educational career patterns and attainment across birth cohorts*
Note: * Estimates in Table A2 in OSA
Source: GLHS and ALWA study—authors' calculation

educational expansion. However, it should be noted that this does not imply that all middle-class children went to university before sizeable groups of working-class children were able to do so. Rather, more and more able working-class children successfully competed with those from the middle classes. Compared with the 1919–1921 cohorts, the cohorts born around 1930 and 1940 were disadvantaged. These historical disadvantages were especially salient for the offspring from lower social classes.

The attainment of the *Abitur* plateaued for the middle and upper classes after the cohorts born around 1955 and increased only very moderately. Attainment of academic degrees peaked for the middle and upper classes with the cohorts born around 1950 and even declined somewhat in the two decades afterwards. Thus, even in periods of extraordinary educational expansion, the middle and upper classes did not extend their attainment much further. If the main effects of social origin and modernization, as well as the interaction terms of class origin and modernization across periods, are taken into account, it can be concluded at the aggregate level that—with the exception of very few cohorts—social disparities in educational trajectory have decreased monotonically in favour of lower classes. At the macro level, however, the impact of modernization differs for social classes in both a level effect (increases in educational enrolment and attainment in tertiary education) and a structural effect (decreasing but persistent inequalities in the educational system).

This conclusion is confirmed by the impact of social origin and its interaction with modernization on the VET degree (Table 2). In particular, the higher social classes were not interested in their children attaining this certificate, something particularly true in periods of rapid societal growth and educational expansion. As mentioned earlier, this situation has most likely

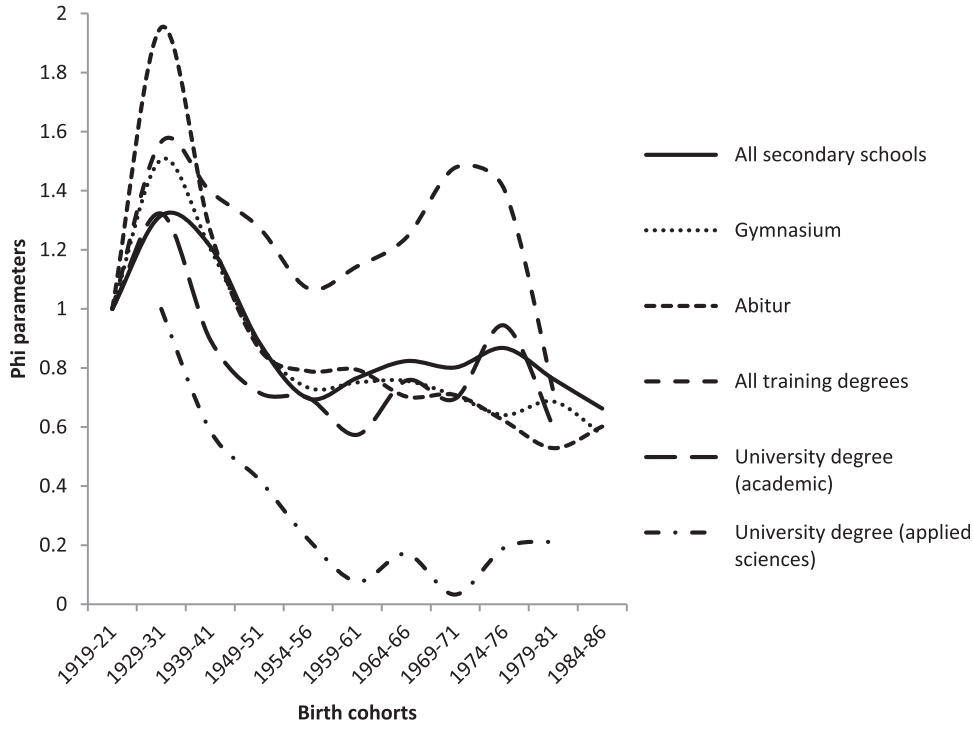

Figure 5. UNIDIFF layer scores (Phi parameters) for the effect of social origin on educational trajectories across birth cohorts
Source: GLHS and ALWA study—authors' calculation

contributed to more social disparities in VET. Overall, there are strong indications for (West) Germany that long-term modernization has contributed to both educational expansion across cohorts and social classes, as well as to a decrease in social disparities in educational attainment.

However, Breen (2005) has demonstrated that—compared with the upper classes—higher investments by lower social classes in their children's better schooling and higher education do not inevitably result in lower IEO. Only when the upper classes have 'saturated' their demand for higher education may we observe in the long run a reduction in inequality of opportunity across cohorts, given continuous demand for higher qualifications. We examine this claim and analyse the development of social inheritance in education by estimating UNIDIFF layer scores (Xie, 1992). These parameters, estimated by log-multiplicative layer-effect models, summarize changes in all the odds ratios between social origin and children's education across cohorts. Focusing on access to and attainment of higher academic education, it is evident that the social disparities in regard to enrolment in *Gymnasium*, high school diploma (*Abitur*), and university degrees (or other training degrees) initially increased for the cohorts born around 1930, and partially around 1940, in comparison with those born around 1920 (Figure 5). In the course of substantial educational expansion, the social disparities in enrolment in *Gymnasium* (or in other secondary schools after primary school) or educational attainment, such as *Abitur*, decreased remarkably for cohorts born around 1940 and thereafter, especially for those born around 1950 and 1955. For the more recent cohorts, the decline in the association between origin and education stagnated or was even temporarily reversed (university degree).

Moreover, we observe different patterns for schooling and for vocational and tertiary training after schooling. While secondary schools became universal and were less subject to social disparities across classes, the social disparities in academic university degrees show a cyclical pattern across cohorts, indicating stagnating disparities in the post-war period covered. An exception is the temporary increase in social disparities among those

attaining a VET degree in the course of educational expansion for cohorts born after 1955, until around 1980, due to increased social homogeneity in VET. However, as already shown by Blossfeld, Blossfeld and Blossfeld (2015), there has been a remarkably strong decrease in class inequality in regard to attainment of a degree at a university of applied sciences for cohorts born up to around 1960, and a flatter cyclical development afterwards. Overall, at the macro level, there is—except for cohorts born between roughly 1945 and 1955—no unidirectional trend of a reduction in class-related educational inequalities for each of the transitions, enrolments and attainments, but rather there are cohort-specific features.

Indirect Effects of Modernization

Finally, we examine whether there are any *indirect effects of modernization* (indicated by the extension of the educational system and the increased opportunities for transition to higher education) as well as *recursive effects of modernization* (indicated by the educational behaviour of other social classes and previous cohorts) on educational trajectories as well as the effects created by the increased enrolment in educational institutions (see Figures A1 and A2 in *Section A in OSA*). On the one hand, it is interesting to analyse whether the expansion of the educational system driven by modernization and its correlates (see time-series analysis in *Section D in OSA*), such as educational policy and reforms of the educational system, has resulted in growing enrolment across life courses and increased stability of educational trajectories. On the other hand, it is interesting if there is still a direct effect of modernization on educational trajectories' net of educational expansion. Only the period effects of modernization will be considered because—as already demonstrated—they dominate the cohort effects.

First of all, after controlling for gender and social origin, the likelihood of being enrolled in *Gymnasium* decreases—due to institutionalized latency in general schooling and the individuals' intention to attain the certificate—as duration of enrolment in school increases (Table 3). Second, as predicted by *Hypothesis 5*—that the extension of educational opportunities results in increased educational participation—the increasing number of academic high schools has a significant positive effect on children's transition to the highest track at lower secondary school level at the end of primary school, and on continuous enrolment in *Gymnasium*. In respect to this educational track, the direct effect of modernization was completely mediated via the expansion of the school system. Similar results are also valid for the transition to, and enrolment in, tertiary education.

Third, taking the period-specific number of academic high schools or universities and its interaction with social origin into account, our previous findings are replicated. Children from lower social classes are less likely to enter and stay enrolled in *Gymnasium* or tertiary education. However, their educational opportunities were improved by the increasing number of academic high schools and institutions of tertiary education. Working and lower middle classes were able to extend their children's enrolment in higher education, while for children from the upper middle and service class, significant ceiling effects became obvious in the course of educational expansion.

Fourth, in line with *Hypothesis 6*—that increased rates of enrolment in continued schooling or in tertiary education on the macro level result in increasing participation rates on the individual level in the following periods—the impact of previous period-specific aggregated rates of enrolment at age 13 on individuals' enrolment in *Gymnasium*, or of previous rates of enrolment in university training on individuals' enrolment in university training, is evident. In this case, the direct (period) effect of the modernization trend remains significant, indicating that educational policy driven by modernization has an important impact on the historical patterns of educational trajectories and disparities across cohorts.

Overall, the ongoing educational expansion has had significantly positive effects on individuals' educational careers. The estimation of interaction effects of others' educational behaviour with individuals' social origin empirically supports *Hypothesis 7*'s assumption that expanded general enrolment in upper and higher education creates an incentive for families in lower classes to invest in their children's higher education. Successful models in their social contexts help lower social classes to make similar educational decisions in favour of continued schooling in *Gymnasium* or of enrolment in tertiary education. Processes of contagious diffusion in favour of lower social classes are important mechanisms for explaining the social dynamics in educational expansion as well as the decrease in IEO and social disparities in educational attainment across cohorts. However, once again, the main effects of social origin remain large and indicate social disparities in the (West) German educational system in spite of the educational expansion that has taken place in the past 90 years.

Summary and Conclusions

Taking up an open issue raised by the work of Breen *et al.* (2009), we sought to unravel empirically the direct

Table 3. Indirect effects of modernization on education in (West) Germany—processes of opportunity, contagious diffusion, and decreasing uncertainty

Models	Transition and enrolment in *Gymnasium* (after primary school)				Transition and enrolment in tertiary education (after schooling)			
	1	2	3	4	5	6	7	8
Gender								
Male	−0.052	−0.051	−0.052	−0.050	0.220	0.218	0.223	0.222
	(0.033)	(0.033)	(0.033)	(0.033)	(0.028)***	(0.028)***	(0.028)***	(0.028)***
Social origin								
Working class	−1.443	−3.144	−1.443	−2.532	−1.099	−2.386	−1.101	−2.038
	(0.062)***	(0.312)***	(0.063)***	(0.217)***	(0.052)***	(0.171)***	(0.052)***	(0.120)***
Lower middle class	−1.275	−2.866	−1.273	−2.364	−0.988	−2.119	−0.994	−1.873
	(0.052)***	(0.261)***	(0.052)***	(0.185)***	(0.044)***	(0.143)***	(0.044)***	(0.103)***
Middle class	−0.539	−1.092	−0.530	−0.913	−0.422	−0.901	−0.423	−0.833
	(0.037)***	(0.211)***	(0.037)***	(0.147)***	(0.031)***	(0.109)***	(0.032)***	(0.082)***
Upper service class	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Time dimension								
Age effect	−1.747	−1.745	−1.747	−1.745	−1.812	−1.691	−1.635	−1.691
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Modernization								
Period effect	−0.073	−0.051	0.096	0.122	0.032	0.056	0.180	0.185
	(0.054)	(0.054)	(0.055)†	(0.055)*	(0.053)	(0.053)	(0.052)***	(0.053)***
Number: Gymnasia / universities								
Period effect	1.010	0.711			0.523	0.315		
	(0.094)***	(0.105)***			(0.054)***	(0.056)***		
Enrolment: Gymnasium / university								
Period effect			0.045	0.023			0.034	0.016
			(0.006)***	(0.007)***			(0.005)***	(0.005)***
Interaction effects: number/enrolment and . . .								
Period effect: Working		0.742		0.050		0.505		0.043
class		(0.131)***		(0.009)***		(0.060)***		(0.005)***

(continued)

Table 3. (Continued)

Models	Transition and enrolment in *Gymnasium* (after primary school)				Transition and enrolment in tertiary education (after schooling)			
	1	2	3	4	5	6	7	8
Period effect: Lower middle class		0.695 (0.110)***		0.050 (0.008)***		0.448 (0.052)***		0.040 (0.004)***
Period effect: Middle class		0.238 (0.088)**		0.017 (0.006)**		0.182 (0.038)***		0.018 (0.003)***
Period effect: Upper service class		Reference		Reference		Reference		Reference
Intercept	−3.535 (0.226)***	−2.839 (0.249)***	−2.182 (0.152)***	−1.706 (0.165)***	−2.409 (0.108)***	−1.877 (0.115)***	−1.930 (0.074)***	−1.528 (0.082)***
log likelihood L_0	−13 611.649	−13 611.649	−13 611.649	−13 611.649	−13 100.015	−13 100.015	−13 100.015	−13 100.015
log likelihood L_1	−8107.414	−8088.576	−8127.399	−8106.388	−8493.365	−8447.421	−8512.651	−8465.297
LR chi^2 (d.f.)	2 243 846 (7)	2 219 866 (10)	2 240 685 (7)	2 211 494 (10)	3 695 541 (7)	3 163 031 (10)	3 038 682 (7)	3 188 215 (10)
Number of sub-episodes	104 714	104 714	104 714	104 714	47 363	47 363	47 363	47 363
Number of events	2987	2987	2987	2987	3687	3687	3687	3687

*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; †$P \leq 0.1$; hazard rates estimated by exponential model (including episode splitting).

Source: GLHS and ALWA—authors' calculations.

and indirect impacts of long-term societal change on micro-level educational outcomes: transitions and enrolment in educational trajectories, and educational attainment, and the social disparities within them. Up to now it was more a postulate than a corroborated fact whether trends of modernization and more cyclical labour market conditions indeed have significant impacts on educational expansion and IEO, as stressed by modernization theories (Zapf, 1994; Treiman, 1970). We looked at societal change in (West) Germany over a period of about 80 years (1925–2008), focusing on three aspects: (1) a rather monotonic trend captured by 19 yearly time series on economic growth, government activities, and living conditions, which we label 'modernization', and cyclical 'labour market conditions' attached to economic business cycles; (2) the succession of birth cohorts as the carriers of social processes; and (3) cohort- and period-specific developments in the educational system and labour markets. Besides the time series for aggregate developments, the investigation was based on individual-level event-history data for 11 cohorts born between 1919 and 1986 from the GLHS and the NEPS studies. We were able to reveal age effects of enrolment in the educational system as well as period and cohort effects of modernization on educational trajectories. By a combination of micro- and macro-level analysis, we realized a multilevel dynamic analysis, as processes at the macro level are of particular interest for understanding the effects of societal changes on social action in life courses (Blossfeld, 1996; Hernes, 1976: p. 544).

Descriptively, our results document the long-term trend of educational expansion (enrolment and attainment), the decline of social disparities in educational attainment, and the persisting intergenerational status reproduction of the upper service class. However, we also observe dramatic reversals of these processes (especially due to the Second World War and its aftermath) as well as stagnation and more cyclical developments in the 1970s and 1980s. In our dynamic multivariate analysis, we found strong cohort and period effects of societal change, which varied markedly between social classes. In particular, modernization—as measured in this study—proved to be a significant 'motor' of educational expansion in terms of the extension of educational system, as well as the increasing enrolment in continued schooling and attainment of degrees in tertiary education. And we witness decreasing social disparities in educational attainment as one of the consequences of modernization and its correlates. Finally, we reveal that the extension of the educational system—the increase of educational opportunities in higher education—has significantly mediated the effect of modernization on educational trajectories and outcomes. Moreover, we found that recursive effects of educational expansion in terms of transition to and enrolment in higher education driven by modernization (including social mechanisms such as social diffusion of educational aspiration and behaviour) can contribute to the explanation of the persistent dynamic of educational expansion.

In the case of (West) Germany, at least, we have provided strong evidence that the expansion of education was a consequence of modernization. Structural mobility in the course of modernization, the upgrading of occupational structures, and the resulting increased qualificational requirements for intergenerational status maintenance form a very plausible linkage to a corresponding adaptation in educational aspirations and decisions (Becker, 2003). Against the background of ongoing trends of modernization and labour market conditions (and its persistent consequences for the class structure and for younger generations' demand for upper and higher education), it could be assumed that the 'race between education and technology' (Goldin and Katz, 2009) will still fuel educational expansion across younger cohorts and the IEO among social classes.

Finally, we point to some limitations of our study. The first is the missing information on the respondents' and their parents' educational aspirations and on their decision-making processes at branching points in the educational system. It would be interesting to control for social class to investigate whether and how individuals perceive and evaluate societal change, as well as how they adapt their aspirations to the trend for modernization, development of labour market conditions, and other significant historical circumstances. The second limitation is the exclusion of foreigners and immigrants from the analysis due to the low number of cases in different birth cohorts. The third limitation is the exclusion of educational trajectories in the former German Democratic Republic (GDR) (Solga, 1997), because the official statistics were incomplete for the periods before 1949, and were incompatible with the data for the western part of Germany. However, a comparison between West and East Germany would tell a different story from the analysis presented in this study (Mayer and Solga, 1994). The fourth limitation concerns the incomplete distinction between modernization and the expansion of the capacities of the educational system as a cause and a consequence. From the perspective of an extended modernization theory, it seems to be clear that modernization and its correlates pushed the dynamics of educational expansion but that education

and science were also pivotal factors reinforcing the process of modernization (Zapf, 1994).

Notes

1 Overall endogenous societal change—embracing different dimensions of cultural, political, and economic development, as well as social and psychological mobilization—has often been viewed as a complex secular process, labelled *modernization*, that propels traditional societies towards becoming 'modern' and 'postmodern' societies (Lerner, 1968; Weber, 1978). Modernization implies interactive structural changes in different societal areas: nation building, democratization, and social security and redistribution through a welfare state (in the political sphere); industrialization, self-sustaining economic growth, and transformation to a service economy (tertiarization), i.e. expansion of services and their inclusion in mass consumption (in the economic sphere); urbanization, mass education, and mass communication (in the social arena); secularization, rationalism, and universalism, including progress in science and technology (in the cultural arena); and individualization and orientation towards achievement in the personal sphere (Zapf, 1994). These authors stress that modernization has had a causal impact on changes in different societal areas and markets such as the educational system, class structure, and labour markets. However, they also assume that there are recursive effects on the trend for modernization based on social actors' reaction to societal change (Hernes, 1976).

2 For both data sets, analysis is restricted to West German citizens due to special characteristics of the political and economic system in the former GDR, which would make separate analysis necessary. Solga (1995, 1997) provides interesting details on IEO in the former GDR. This is also true for East Germany (Diewald, Goedicke and Mayer, 2006). Foreigners and immigrants have been excluded because they have not been sampled in all of the GLHS cohorts.

3 The *Abitur* also includes the advanced technical certificate (*Fachhochschulreife*) that enables study at a university of applied sciences. *VET* comprises dual training in vocational schools and firms simultaneously after (compulsory) school, or education and training in a full-time vocational school. Further training (e.g. to become a technician, foreman, or master craftsman) is not considered. Under *university training*, we subsume the enrolment in a state, technical, or private university (including art college [*Kunsthochschule*], university of applied sciences [*Fachhochschule*], teacher training college [*Pädagogische Hochschule*]) and the *university degrees* are attained at these universities (Mayer, Müllter and Pollak, 2007).

4 The time series used 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 (Statistisches Bundesamt, 1972). Historical time series published by Rahlf (2015, 2016), Bolt and van Zanden (2014), Diebolt (1997), Franzmann (2006), Herrlitz, Titze and Müller-Benedict (1995), Metz (2005), Sensch (2007, 2008), and Titze *et al.* (1987) have been used. Economic data have also been found in the Picketty–Zucman Wealth-Income Data Set (Piketty and Zucman, 2014) and in the Angus Maddison Project (http://www.ggdc.net/maddison/maddison-project/home.htm).

5 Furthermore, we are dealing with the problem of unobserved heterogeneity because educational aspirations are not directly measured. In this way, the impact of societal change on unmeasured parental aspirations for their children's education is at least indirectly taken into account.

6 It has to be emphasized that, particularly after 1949, there was a shift in enrolment from the *Volks-* or *Hauptschule* [lower secondary school] to the *Realschule* [intermediate secondary school] and to the *Gymnasium* [upper secondary school] across the cohorts. In the course of educational expansion, the *Volks-* or *Hauptschule* lost their dominant position as the main school for the populace (Becker, 2003: p. 2).

7 Although gender differences are not the subject of our study, it is interesting to report that gender gaps for the attainment of the higher education entrance qualification (*Abitur*), as well as vocational and university training certificates, cannot be explained completely by reference to different reactions to societal change. There is a need to investigate gender differences in detail in future research.

Supplementary Data

Supplementary data are available at *ESR* online.

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