Links between education, demographic behavior and inter-generational social reproduction
Germany in the 20th century

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Abstract
This paper proposes an analysis of historical developments in inter-generational educational mobility in West Germany during the second half of the 20th century. In contrast to conventional approaches, a special intention is to model the micro-level process of inter-generational mobility in such a way that partial processes of social selectivity can be distinguished: union formation, fertility, and children’s educational attainment. In doing so, the paper combines a traditional concept of social mobility with a demographic research perspective. The results indicate a rather stable mobility pattern at least with regard to attainment of higher education in the late 20th century, but they also illuminate the important role of the various partial processes in the overall process of inter-generational social reproduction.
1. Introduction: inter-generational educational mobility

This paper focuses on inter-generational educational mobility and has three major aims: First, it introduces a conceptualization of the micro-level process of inter-generational educational reproduction that distinguishes between partial processes, thereby linking the research areas of social mobility research and demographic research. Second, it describes selected historical developments concerning inter-generational mobility and their links to institutions in (West) Germany during the mid- and late 20th century. Using these trends as examples, the paper gives, third, a (counter-factual) account of how important the specified partial processes have been during that period. The paper begins with some general remarks concerning social mobility research and conventional forms of conceptualizing inter-generational educational mobility.

Questions of social mobility and social reproduction are central to sociological research. Social mobility is defined as the movement of individuals (or social units) among social positions within a society, which form a structure of social inequality. Hence, social mobility can be regarded to be an indicator of the individual- or group-level persistence of social advantage and disadvantage. An underlying assumption is that the permanence or transience of attachment to certain social positions and the rates and patterns of movement are likely to affect characteristics like identity and interests. In this sense, social mobility is seen as a mediating process between social structure and individual action. In addition to changes in individual life conditions, social mobility may also have important implications for social integration. From a liberal perspective, mobility helps to stabilize the social order. It may legitimate prevailing inequalities of social class and status, especially if it can be related to meritocratic principles. It also may reduce class identification and the potential for collective action of a class-based kind. In the face of promises of (upward) mobility, attempts of collective action tend to be abandoned in favor of individual solutions (Blau & Duncan 1967; Erikson & Goldthorpe 1992). This is the reason why from a class-oriented perspective, mobility has often been viewed more critically, the argument being that individual mobility may weaken the collective position of (lower) classes as especially their ‘elite’ gets regularly absorbed by higher classes.

Also when looking at it more technically, it is obvious that individual mobility by definition may always change the composition of both the groups that the individuals are moving out of and of the groups they are moving into. As a result, the social significance of the very categories among which individuals move may change, so that the study of social mobility often needs to be complemented by external assessments of the significance and the consequences of these categories.

Along with such more theoretical considerations, there has been a large strand of primarily descriptive research which has been interested in the actual levels and patterns of mobility. Studies of this kind have looked at both intra-generational mobility, i.e. social mobility within individual life courses, and inter-generational mobility, i.e. social mobility between various generations and (normally) within families. In most cases, this has meant that socio-economic positions of parents and their children have been compared. Due to the temporal distance between generations, inter-generational mobility is necessarily associated with a longer-term perspective. It has been analyzed with regard to historical trends as well as in the form of international comparisons (e.g., Featherman & Hauser 1978; Erikson & Goldthorpe 1992; Breen 2004).
A further important conceptual distinction is between absolute and relative mobility. Absolute mobility rates may be heavily influenced by structural change as it is expressed in the ‘marginal’ distributions of positions at any given point in time, in particular the collective upgrading of occupational positions. Due to that, often the majority of people have been mobile. Relative mobility rates – often also termed social fluidity – describe the relative chances of people coming from particular origin positions to attain particular destination positions. In this sense, they represent the degree of social ‘openness’ within a society when comparing various groups.

In large-scale social mobility research, structural change – concerning occupational positions and other structural elements – is often regarded as exogenous to the mobility process, which is at least in part an adaptation to it. In this sense, social reproduction is often used as a mere description of close empirical associations between the social positions of various generations. However, inter-generational reproduction of social inequality can also be regarded as an active process performed by social actors, which is to a major degree being brought about within and through families and which necessarily bases upon natural reproduction.

Another aspect concerns the mechanisms of how patterns of stability and fluidity of social positions between generations come about. In modern societies, formal education has probably become the most important mechanism of status transmission between the generations as well as a central dimension of inequality in itself. Hence, inter-generational educational mobility as such has become a relevant topic. Again, there have been historical and international comparisons (e.g., Shavit & Blossfeld 1993). There is, however, a close connection between analyses of the access to and the consequences of education in the labor market and elsewhere. It is especially the unequal returns that define unequal access to education as a social problem. These may vary both inter-nationally and over time.

2. Conceptual considerations

In spite of a long-established research tradition in sociology, social differences in educational attainment have received special public attention in recent years (especially in the debates following comparative school achievement studies like PISA 2000). In conceptual terms, however, research on educational inequalities has been focused on very specific aspects. Studies have normally been set up as comparisons between children’s education and their social origin, i.e. the parents’ situation (e.g., education or other socio-economic characteristics), analyzing relative chances of education among children from different social backgrounds. Most studies have shown considerable differences in children’s educational attainment by their educational background, but it has also been shown that both father’s and mother’s education have an important impact on the children’s educational attainment. In conceptual terms, the analyses start from the children’s generation and they are conditional on both the formation of the origin context and existence of the children.

This perspective is well compatible with references to individual life chances and rights of education (and possible means of intervention). If one is interested in the more ‘analytical

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1 Here, as well as in this paper, the term ‘chances’ is used descriptively to describe relative frequencies of actual educational attainment while not necessarily implying assumptions about individual motives, activities or alternative possibilities.
questions of inter-generational social reproduction or social mobility, however, the situation is different and an immediate interpretation of these results is often misleading. In these cases, one looks at inter-generational links from the perspective of the parents’ generation and asks about the consequences for the following generation(s). This includes questions of how the origin context is formed, whether there are any children at all and when they were born as well as the aspect of these children’s relative chances of education. As a particular generation of children may have parents from a wide range of birth cohorts, an analysis from the perspective of the parents’ generation would normally start with a particular cohort of individuals and look at their social relations to individuals of following generations. Hence, a reference to the (natural) population process may help to overcome the conceptual limitations of conventional research.

The basic unit in the following representation of the population process is the individual life course as it is defined by the events of birth and death (cf. Figure 1). In a demographic perspective, natural reproduction can be conceptualized as two individuals of particular birth cohorts (in this example t₁ and t₂) finding together and having (first) offspring at a particular point in time t₃ (fertility event). In this model, this is represented by the new existence of (normally) one other life course of the birth cohort t₃, which may itself later on contribute to reproduction.

The sociological perspective, on the other hand, starts from the basic assumption that social contexts have a decisive influence on individual behavior. In particular, differences in behavior may be the results of the exposure to particular forms of education during the individuals’ life time. Moreover, the likelihood of attending these forms of education tends to be transmitted across generations by mechanisms like unequally distributed resources and educational decisions made by the parents. In the context of this paper, it is important that educational differences may also affect demographic behavior like union formation and fertility.
In order to adequately reconstruct the pathway of educational transmission from one generation to another, one has therefore to distinguish between at least three partial processes in the overall micro-level process of inter-generational reproduction and mobility:

(1) Socially selective union formation, i.e. the process by which particular individuals are matched with particular other individuals (if any),

(2) Socially selective fertility, i.e. the process by which parents of this generation may have a certain number of children (conditional on (1)), and

(3) Socially selective educational attainment, i.e. the process by which children from a particular family background tend to attain particular levels of education (conditional on (1) and (2))

In reality, the process of the inter-general transmission of education may be more complex, but these three steps form the simplest model that connects individuals of two successive generations, thereby describing one ‘complete cycle’ of inter-generational educational reproduction.

This specification may be useful not only for the issues analyzed in this paper, but for any research that includes inter-generational relations, like the transmission of social (dis)advantage among various ethnic groups. Also in this case, processes of inner-ethnic and inter-ethnic union formation may be a central mechanism for the final outcomes. Note that the model resembles a ‘statistical de-composition’, which allows specifying more adequate explananda, rather than a causal model of explanation.

Previous work on the U.S. has indicated that, for example, particular effects of differential fertility on educational mobility have been relatively small (cf. Mare 1997), while there has been a larger impact in rapidly changing developing countries (Mare & Maralani 2004). In general, the impact that partial processes have on the overall process of status transmission in a particular society always depends on how large social differences in behavior are, how fast historical changes occur and how closely the partial processes are connected.

This paper intends to sort out the relative importance of these partial processes in the overall process of inter-generational educational mobility in Germany. It also looks at their combined effects and gives an account of the historical changes in these processes. Being mainly concerned with describing these trends, it is rather brief with regard to explaining these changes. In fact, many factors are likely to influence these processes, not least particular institutions. However, the major systematic point to recognize is that, in principle, any of the partial processes may be influenced by a particular institution. This may be illustrated in the following two sections. Probably the most important single set of institutions is the educational system, which is therefore described in more detail in the following section. Not least because of the necessity to have long-term comparable historical data, the analyses in this paper are confined to West Germany and the period between World War II and the end of the 20th century.
3. The German educational system and participation in education

There is no such thing as a monolithic educational system. Rather, different parts of the education and training systems may show very different genetic origins and/or different forms of organization in the present. Also in a very stylized description, at least three parts of the German educational system should be distinguished: the general school system, the vocational training system, and the higher education system (for further information on the German educational system, see Cortina et al. 2003).

**General school system:** Schools in Germany are regulated mainly on the Länder level (to some extent in a coordinated way), which leads to heterogeneity among the various school systems. However, a characteristic that is nowadays common to most systems is the relatively early (around age 10) selection of students into hierarchical tracks of secondary schooling. The German schools are predominantly public.

**Vocational training system:** Vocational training is provided mainly in the form of the dual system of apprenticeship training, a combination of firm-based training and school-based teaching. Apprenticeships, which normally take 2 to 3 years, are based on an individual contract with an employer, which means that their selection criteria are highly important, even if there are no formal minimum school qualifications to enter apprenticeships. Unlike general education, apprenticeship training is nation-wide standardized and regulated by intermediary institutions and federal law. The dual system has been praised for its capacity to provide up-to-date work-related practical skills. However, being predominantly employer-based, it is also bound to economic cycles more closely than other parts of the educational system. In addition to the dual system there is also another pillar of school-based vocational training (particularly in social services and the health sector).

**Higher education system:** There has been no clear hierarchy among German universities, but traditional universities were supplemented by newly founded universities in the 1960s and 1970s. University courses have tended to have a relatively long duration (5 to 6 years until the first degree, meaning around 18-19 total years of education). An important step for the development of a hierarchically stratified higher education system was introduction of a lower tier of higher education in the form of Fachhochschulen (polytechnics) in the 1970s.

As most other industrial countries, Germany has experienced a marked educational expansion regarding average attainment since the 1950s. Often attributed to the public debate about a ‘Bildungsnotstand’ and various institutional reforms in the 1960s, expansion had in fact begun already before. By the early 1980s, however, this expansion had slowed down considerably, and in comparative terms, especially the expansion of higher education remained limited.

In general, educational expansion was more marked with regard to young women than with regard to young men. This was associated with a change in attitudes towards female education, not least on the side of parents (and not only due to the fact that, with smaller family sizes, fewer families actually had sons). In general, parents’ attitudes and their educational decisions for their sons as well as daughters became more ‘individualized’ rather than dependent on the (male) siblings’ situation.
While being visible in all parts of the educational system, the expansion of female educational attainment applies especially to vocational training. Immediately after the war, only a minority of women entered vocational training, but this applied to a majority at the end of the century. Co-education in schools became almost universal by the 1970s (Faulstich-Wieland 1991), but there has remained a relatively high degree of gender segregation among training occupations.

The development of educational expansion was also subject to demographic conditions like the impact of cohort sizes fluctuations, which had consequences especially in competitive segments of the educational system. But abstracting from such short-term, what is the likely impact that institutional structures of the educational system and their changes have had on each of the partial processes?

4. Partial processes of educational reproduction

4.1 Marriage and assortative mating

Union formation and education are linked. These links concern both the likelihood of forming unions or marriages and the phenomenon of assortative mating, which means the patterns in which particular types of individuals get together as partners and spouses. There has always been a tendency of social homogamy within a society, i.e. that unions and marriages have been formed by partners with similar sociological characteristics. However, these links have changed over time with education becoming a more relevant element of social homogamy.

What has clearly lost importance is a direct link or motive for (female) education, namely to enter a ‘proper marriage’. This is again an aspect of an increasing ‘individualization’ of education. On the other hand, the indirect consequences of changing ‘opportunity structures’ that make particular educational constellations within unions more likely have become more important. These opportunity structures show up as both macro and micro level effects. On the macro level, opportunity structures are defined by the aggregate (‘marginal’) educational distributions of men and women as potential partners. Even if partners were assigned randomly to each other, these distributions would determine some combinations to be more likely than others. With an increasing equalization of male and female educational attainment, the likelihood of education-related homogamy has (statistically) increased.

On the micro-level, educational institutions may influence union formation as a means of bringing particular individuals into contact with each other (moderated by factors like gender segregation in educational tracks) but also by shaping individual preferences. Empirically, homogamy tends to increase for potential partners with longer duration within the educational system, as this population becomes increasingly homogenous (cf. Blossfeld & Timm 2003). Given the close connections between education and cultural preferences or styles of life, an early selection into different educational tracks is likely to increase the degree of educational homogamy.

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2 Often the assumption of such independence is made in order to derive some reference value for comparisons with the empirical degree of social homogamy within a society.
Social homogamy has been associated with social differences in marriage rates. Particularly high ‘risks’ of remaining unmarried are found among the groups of low skilled men and highly qualified women (cf. Blossfeld & Timm 2003). In an economic perspective, this has been interpreted as a non-clearing marriage market in a situation where there is a continuing preference for a hierarchy between spouses concerning educational status while at the same time the marginal distributions of male and female education equalize. However, this explanation seems to be more adequate for the low-skilled men than for the high-skilled women where changing preferences have probably had a greater impact.

There has also been a declining trend in overall marriage rates since the 1960s. Again, there have been demographic influences of varying cohort sizes which may have led to ‘marriage squeezes’ even in the absence of historical events like wars and gender-specific migration.

4.2 Differential fertility patterns

In spite of the ‘baby boom’ in absolute numbers of the 1960s (which was more a structural result of large parental cohorts), there has been a long-term decline in relative fertility rates. Educational groups also differ with regard to their fertility patterns, and there are differences in both the level and the timing of fertility.

The simplest way to describe the level effect is that higher educated women have, on average, fewer children, although there are ongoing debates in sociological research concerning adequate explanations. There is probably an influence of educational institutions, but this is rather indirect. More direct factors are labor market demands for individual flexibility before the backgrounds of increasing labor market attachment and a continuing gender division of labor within households as well within society, but also changing preferences among the higher educated. For the analyses in this paper, the level of fertility matters only for analyses that are concerned with absolute group sizes.

On the other hand, there is a clear timing effect: especially graduates of higher education tend to have children relatively late. In general, people normally have not had children as long as they were in education and training, and that the long duration of academic courses in Germany as well as preceding stages of education, military service, waiting times, etc. have resulted in relatively high leaving ages, leading to a postponement of family formation.

For (children’s) educational attainment, this timing effect is important because of possible interactions with historical (period) change. This becomes obvious especially in times of rapid educational expansion. If, in a given birth cohort of parents, particular groups have their children relatively late, then these children will have (on average and ceteris paribus) higher educational attainment than children of parents who had their children earlier, just because the overall chances have increased over this period.

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7 For example, given a rather stable age difference of 2 to 3 years between spouses, the steadily growing birth cohorts until mid-1960s meant a relative ‘over-supply’ of women, while the rapid decline in cohort size after that meant an ‘over-supply’ of men in these cohorts
4.3 Differences in (conditional) educational transmission

There is a long literature on social selectivity in education in general and differences in educational attainment by social background in particular. In most countries educational inequalities with regard to social background (parents’ socio-economic status and education) have been much more persistent than differences with regard to gender, religion or region. In theory, social selectivity in education has been explained, in particular, by selective rational decisions by parents (Boudon 1974, Breen & Goldthorpe 1997) and class-specific socialization and discriminatory standards set by dominant classes (following e.g., Bourdieu & Passeron 1971).

With its early selection into hierarchical tracks, the German school system is prone to a comparatively high degree of social selectivity (Müller & Karle 1993). Later transitions in the life course do normally not compensate for this (Hillmert & Jacob 2005a,b). Since the 1960s, there have been a number of developments in favor of declining social selectivity, at least in parts of the German educational system. Among them are (Müller & Haun 1994): the lowering of direct costs of education (abolishing of schooling fees, generally increasing affluence) and also of opportunity costs (extension of the duration of lower-level secondary education, thereby closing the gap towards higher tracks); a lowering of the threshold for entering higher education by introducing a lower tier of higher education; and a more comprehensive regional supply of upper secondary and higher education. Most studies have found a long-term decline in social background effects on educational attainment (Henz & Maas 1995, Schimpl-Neimanns 2000), but often only until the late 1970s. The broad system of vocational education and training has clearly helped to integrate young people from lower educational backgrounds, but there are also indicators that it has distracted them from entering higher education (Shavit & Müller 2000; Hillmert & Jacob 2003). Again, chances of access have also been affected by rather short term-macro-level demographic and also by macro-economic influences, especially in sectors of the educational system that follow economic cycles more closely and that are subject to competition.

To sum up, all three partial processes of inter-generational reproduction are prominently (though not exclusively) influenced by the institutional structures and the development of the educational system. Without being able to go into detail, the following sections provide an aggregate empirical description of the interaction between these partial processes.

5. Data, estimation and an integrative process model

5.1 Data sources and estimations

As there is no comprehensive data source that contains all the information needed to analyze our research questions, the analysis follows a multi-stage procedure:
(1) In a first step, the partial processes are estimated separately using different data sources.
(2) In a second step, these results are combined using a simulation technique in order to get an estimate of the overall process.
(3) In a third step, this combination is modified using counter-factual assumptions to assess the relative importance of the partial processes.
The 1930 birth cohort is the oldest cohort for which comprehensive data is available. Together, the data sources cover the years 1930 to 2000 and they allow conducting historical comparisons through the second half of the 20th century. However, the analyses need to concentrate on West Germany.

The data sources are listed in Table 1. In particular, they consist of the records of registered births from official statistics (Statistisches Bundesamt 1999; various years) and individual-level data from the West German Life History Study (GLHS) (Mayer & Brückner 1989; Brückner & Mayer 1995; Hillmert et al. 2004). The GLHS is a series of representative, retrospective surveys of selected birth cohorts.

To get a condensed representation of empirical developments, the variables that represent the partial processes are linked to a set of covariates:

(For women:) Marital status = fct (cohort, education)
(For women:) Homogamy (partner’s educ.) = fct (cohort, education)
(For women:) Fertility rate = fct (age, cohort, marital status, education)
Educational attainment = fct (cohort, gender, mother’s marital status, mother’s education, father’s education)

If possible, actual figures were used for each year. However, in most instances trends had to be estimated, i.e. interpolated and in some cases also extrapolated\(^4\). Depending on the data and the complexity necessary to represent the empirical trends, different estimation models were used (see Table 2).

\(^4\) In order to get more precise parameter estimates, it is intended to replace part of the data step-by-step with additional, more comprehensive data sources.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Source</th>
<th>Data type</th>
<th>Birth cohorts</th>
<th>Year of data collection</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age-specific fertility rates</td>
<td>Official records (Statistisches Bundesamt)</td>
<td>Register data</td>
<td>1930-1985</td>
<td>1945-2000</td>
<td>Total population of women</td>
</tr>
<tr>
<td>Educational homogamy</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Educational attainment</td>
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<tr>
<td>Marriage probabilities</td>
<td></td>
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</tbody>
</table>
Table 2: Empirical distributions and parameter estimations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimation model</th>
<th>Covariates</th>
<th>no. of parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average fertility rates</td>
<td>-- (Reported figures)</td>
<td>Cohort, age (women only)</td>
<td>1.271 single values</td>
</tr>
<tr>
<td>Group-specific fertility rates</td>
<td>Discrete-time (piecewise-constant) transition rate model</td>
<td>Cohort, age, education, marital status (women only) and simple interactions</td>
<td>27 model parameters</td>
</tr>
<tr>
<td>Marriage probabilities (until age 35)</td>
<td>Binary probit</td>
<td>Cohort, education (women only)</td>
<td>5 model parameters</td>
</tr>
<tr>
<td>Spouses’ educational attainment</td>
<td>Ordinal probit (3 categories)</td>
<td>Cohort, education (women only)</td>
<td>5 model parameters</td>
</tr>
<tr>
<td>Group-specific educational attainment</td>
<td>Ordinal probit (3 categories)</td>
<td>Cohort, sex, mother’s education, mother’s marital status, father’s education and simple interactions</td>
<td>18 model parameters</td>
</tr>
</tbody>
</table>

In order to keep the analyses relatively simple, only three (ordered) categories of educational attainment are distinguished in all of them:

- **Low** education, i.e. having attained neither vocational training nor an upper secondary school degree
- **Medium** education, i.e. having attained either vocational training or an upper secondary school degree or both
- **High** education, i.e. having attained a higher education degree (from universities or polytechnics)

Note that these variables refer to the level of the finally (highest) attained level of education, not to the transitions on the way to get there. If, for example, attainment of higher education turns out to be socially selective, this does not necessarily mean that the institutions of higher education as such are socially selective. It may also be that the main source of this selectivity is the selectivity of the secondary school tracks that lead to higher education.

5.2 Combination of the partial processes

A statistical combination of the estimated partial processes is achieved by using a Monte-Carlo type micro simulation approach. This means that the individual life events and (yearly) values for particular variables are assigned at random to a given population on the basis of the group-specific probabilities defined by the empirically estimated parameters.

The basic algorithm starts with initial populations of women (of various educational levels) of the 1930+ birth cohorts; it assigns to the individuals the most likely marital status, educational level of their partners, number, years of birth, gender and educational attainment of their children (if any), and finally, does the same for these children and further generations.
Note that the process of natural reproduction works in this model only through the population of women. The reason is that reliable data on fertility is normally only available for women. Men do, however, show up as spouses of the women and hence as (married) fathers. While there are single mothers in the model, the only aspect that is not represented by the model is the existence of single fathers.

Beyond that, there are a number of assumptions:

- The partial processes are independent, given the common parameters, i.e., there are no unmeasured common background factors influencing them, and they only connect two generations. For example, the grandparents’ (educational) situation does not affect their grandchildren’s situation, except through the parents’ situation.
- Fertility distributions are homogeneous among the members of the (female) population. Having a child is not affected by already having a child. However, the maximum number of children is limited to five.
- There is no selective mortality until the end of the reproductive phase, which is limited to the ages 15 to 45.
- There are only heterosexual unions and no adoptions.
- There are no systematic effects of partner changes.

The aspect of inter-national migration as another major demographic process requires also some special attention. The simulation looks at the offspring of starting populations which may well include immigrants of the second generation, but migration is not explicitly modeled. Still there is the assumption that immigrants, once they lived in the country and when controlling for the specified characteristics (cohort, education, marital status), did not differ from native Germans. The reason is that some of the data sources do not distinguish between migrants and natives. Moreover, some of the data is retrospective, so that only the ‘survivors’ of out-migration are in the sample.

The starting populations born in 1930+ are stratified in the sense that in any of these populations there are three educational groups (of women) of equal size. Hence, together they do not form a ‘representative’ population, and this applies also to their joint population of descendants. In the following, analyses will therefore be confined to developments within or comparisons between cohorts or educational groups. The following calculations are based on a population size of n=10,000 per starting cohort. This number is, in principle, set arbitrarily (or better, as a compromise between sufficient distributional representation and convenient computing time). It does not affect the results when proportions or ratios are analyzed, but the information may allow to making sense of absolute numbers as far as they are displayed in the following diagrams.

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5 In order to be able to combine aggregate fertility data with individual-level data, the registered natality figures (no. of births by women of a certain age / population of women of that age; they are all well below 1) are interpreted as birth rates (probabilities).
6 If adequate data are available, in most instances a more complex model could be set up to include a finer group differentiation. In fact, already in the present model most of the mentioned groups are not completely missing, but there are not distinguished. The simulation model uses the same parameter structures as the empirical estimations, which are based on data from heterogeneous populations. Here, these groups are normally part of other groups, and together they are represented by ‘weighted average’ effects. Given constant group composition, these effects are reproduced in the simulation.
6. Results

6.1 Long-term developments within the population of descendants of a single cohort

Figure 1 displays the (simulated) distribution of the number of persons who are descendants of women of the 1930 birth cohort (= ‘1st generation’). The descendants are distinguished by their own year of birth and the respective generation. One can see that there are overlaps between the generations. In other words: At times (around 1970) when some women of the 1930 cohort were becoming (late) mothers, others were becoming already grandmothers, and at times (after around 1990) when some of them were becoming grandmothers, others were already becoming grand-grandmothers, if they were still alive at that time.

Fig. 1: Descendants of the women of the 1930 birth cohort (= 1st generation), by year of birth and generation

Figure 2 displays the cumulated number of descendants of the 1930 birth cohort, irrespective of their generation, for any year between 1945 and 2000 (giving also a smoothened image of the birth distribution).
In Figure 3, this distribution has been calculated separately for all families with a particular educational level of ‘generation 1’, i.e. of the women of the 1930 birth cohort. One can clearly see differences in fertility which affect both the timing (e.g., women with higher education tended to have their children later) and the level of fertility (e.g., they tended to have fewer children). These differences accumulate and become larger over the generations.
For the questions analyzed in this paper, most important is the educational attainment of these descendants. In Figure 4, the cumulated numbers of descendants are distinguished by the level of education these descendants finally attained. There are three panels that again discriminate with regard to the descendants’ ‘educational origin’, i.e. the educational level of the women of the 1930 birth cohort, the first generation.

When comparing the panels, it is obvious that there have been significant differences among these distributions. Children with low education can mainly be found among the descendants of a low-educated first generation. The descendants of the women with medium education had, on average, higher levels of educational attainment, and among the descendants of the highly educated women, the majority attained higher education themselves.

*Development of educational inequality:* There are various possibilities for contrasting groups in order to assess the level of inequality in these figures. As an example, the following comparisons are confined to the question of attaining higher education. Simple measures of inequality are the ratios of either the proportions or the absolute numbers of children attaining higher education.

Attainment among children can be compared by calculating ratios as in the following (hypothetical) example:

If 5,000 out of 10,000 children from higher social background attained higher education (= 0.5) and 3,000 out of 15,000 children from lower social background attained higher education (= 0.2),

then the ratio of proportions would be: 0.5/0.2 = 2.5
and the ratio of absolute numbers would be: 5,000/3,000 = 1.7

Such ratios can be calculated for any of the cohorts.

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7 Their proportion may still seem rather low. One reason may be an under-estimation of the proportion of low-educated in the survey data (as in most surveys). More important, however, is that in the 1930 cohort most women had only low education, so most of them were actually not part of particularly disadvantaged families.
8 These measures are chosen to allow for a simple comparability of relative and absolute numbers, but in many instances, conventional measures like odds ratios could also be used.
Fig. 4: Cumulated no. of descendants of the 1930 birth cohort, by cohort, educational attainment and origin

First generation: Women with low education

First generation: Women with medium education

First generation: Women with higher education
Figure 5 displays relative differences in the attainment of higher education by educational background. Calculated has been the ratio between the proportion of (cumulated) descendants who attained higher education among those coming from a higher education background and the proportion among those who descended from a lower or a medium educational background respectively (solid lines). While there has obviously been a decline in the relative inequality between higher and lower background, the relative difference between persons from higher and from medium educational background has been rather stable.

**Fig. 5: Ratios of proportions (solid lines) or absolute number (dotted lines) of children with higher education among the descendants of the 1930 birth cohort, by year of birth and educational origin**

If not the proportions, but the absolute number of descendants who attained higher education (dotted lines in Figure 5) are compared, the picture is rather different. The trends in the inequality of attainment by educational background are non-monotonic and their levels are lower. Differences in fertility between the educational origin groups are now of major importance for the level of inequality among the three origin groups.

### 6.2 Historical trends in educational reproduction

Developments within a population of people who are the descendants of a particular birth cohort are only one aspect of historical trends. Probably more important is in what way various cohorts of parents have differed with regard to the transmission of their educational status to their descendants. The following analyses compare a whole number of birth cohorts in this regard.

However, the process of inter-generational reproduction extends considerably through time, in that sense linking various historical periods. For example, parents born around 1930 married normally not before the 1950s, their fertility patterns represent the conditions of the 1950s/60s, and most of their children left education not before the 1970s.
As a result of that, the observation window for historical comparisons becomes rather small, even when long-term data – in this case, for the period between 1930 and 2000 – is available. For the same reason, the following analyses link only two generations, i.e. parents (mothers) and their children with regard to educational attainment.

Figure 6 shows trends in the inequality regarding the attainment of higher education, comparing among the children of the (parental) birth cohorts 1930 to 1950. With regard to proportions (solid lines), the levels of inequality have remained rather stable. The proportion of children attaining higher education among those from higher educational backgrounds was around five times the proportion among those from lower educational background and around three times the proportion among those from medium-level educational background.

As the origin groups differed in the number of children they had, differences in the absolute numbers of children who attained higher education (dotted lines) were considerably lower and they showed a downward trend⁹.

There are also important gender differences. As the model attaches fertility to women only, fathers can be identified only as (married) partners of women (and they also need to be attached to their spouse’s birth cohort). Given these qualifications, Figure 7 shows that the relative differences (of proportions) among the origin groups were larger when comparing the effect of educational background on the basis of (married) fathers’ education than when comparing it on

⁹ For the same reason, the differences would be higher if absolute numbers rather than proportions with regard to children attaining low levels of education were compared.
the basis of mothers’ education. This difference is the combined effect of two sources: differences in the impact of mother’s and father’s education on children’s educational attainment and gender differences in homogamy (with women’s education also in each of these families having consequences for fertility and the children’s educational attainment).

Fig. 7: Ratios of relative chances of attaining higher education, by mother’s and father’s education and by (mother’s) birth cohort

![Graph showing ratios of relative chances of attaining higher education](image)

6.3 Relative importance of partial processes: Counterfactual analyses

Following these empirical results, this section presents some results from counterfactual analyses. On the basis of the ratios between the proportions of children attaining higher education, they assess the importance of the various partial processes by calculating the results when imposing certain constraints on the form of these processes\(^\text{10}\).

Of course, in order to interpret the results as counterfactuals, the general assumption is that everything else would remain constant. In particular, this means that category-specific effects remain constant, independently of how many people these categories consist of. In some cases, this seems to be easily justifiable, as these conditions entail relatively minor changes in the overall distributions, in other cases this assumption seems to be rather strong.

\(^{10}\) This actually means to lift some of the (social) constraints that are observed in the empirical data.
a) No selective marriages and homogamy

In the model represented in Figure 8 (dotted lines), the partial process of partner choice and marriage is constrained to be equal among all women of the particular cohort. Hence, marriage chances and the level of partner’s education vary only by the common cohort trend. In other words, in each cohort partners are found at random – or at least irrespectively of their education. As a reference, the solid lines represent the empirical trends. When comparing empirical and counterfactual trends one can see that about half of the observed inequality has obviously been due to selective union formation.

Fig. 8: Empirical and counterfactual trends: marriage at random

The other possible extreme case would be a situation of strict homogamy (Figure 9, dotted lines), i.e. that every woman is matched to a partner with exactly the same level of education as this woman herself – assuming that this is not constrained by the men’s educational distribution. Of course, this means an even greater concentration of advantage and disadvantage among couples than it is empirically observed. In this scenario, inequality in inter-generational educational mobility would even be much higher. These figures can also be interpreted as the relative educational chances in relation to particular types of couples or households rather than in relation to individual parents.
b) No selective fertility

In the model represented in Figure 10, the partial process of selective fertility is constrained to be equal among all women of the particular cohort. Timing and level of fertility vary only in accordance with the common cohort-specific fertility distribution.

In this case, the counterfactual trends differ only slightly from the empirical trends. However, one would also not expect too much deviation. Since the measure of inequality is a comparison of relative proportions, the number of children has no influence. The differences would be larger (and inequality would be higher), if one compared the origin groups on the basis of the absolute number of children who attain higher education. The deviations one can see in the figure are due to the timing effect of differential fertility, i.e. the phenomenon that children from different origin groups tend to grow up (on average) under different historical circumstances.
Fig. 10: Empirical and counterfactual trends: equal fertility

![Graph showing empirical and counterfactual trends for equal fertility across different educational origins.]

**c) Both no selective marriage/homogamy and fertility**

Finally, in the model represented in Figure 11, the partial processes of both partner choice/marriage and fertility are constrained to be equal among all women of the particular cohort. Again, this would result in lower levels of inequality, mainly due to the lack of education-related homogamy, while the trend among cohorts would be rather similar or even increasing.

Fig. 11: Empirical and counterfactual trends: no homogamy, equal marriage chances and equal fertility

![Graph showing empirical and counterfactual trends for no homogamy and equal marriage chances and equal fertility across different educational origins.]

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The remaining level of inequality essentially represents the impact of different levels of mother’s education on children’s educational attainment.

The trend stability in spite of various attempts to open the educational system has probably various reasons: Historically, the educational careers of most of the children in this analysis fell into period when most of the institutional reforms and educational expansion had already come to an end. There is also the possibility of counter-acting selectivity. As a consequence of educational expansion, having a low educated mother has increasingly become an indicator of disadvantage. In this sense, constant educational chances for this category would in fact indicate a (net effect of) growing openness in educational attainment.

7. Conclusions

The analyses of this paper indicate a relatively high degree of historical stability in inter-generational educational reproduction in West Germany towards the end of the 20th century. Such social differences in access to different levels of education have remained important particularly since their respective consequences have remained distinctive. For example, in spite of a marked educational expansion during the 20th century, returns to education (relative chances of entering higher-level occupational positions, relative wages) have remained relatively stable (Müller 1998).

Note that the analyses of this paper have looked at higher education as a particular level of educational attainment and (in most cases) only at women’s inter-generational educational reproduction. It has also become obvious that this kind of analysis poses high demands on data scope, differentiation and quality, and in practice, one may often face problems in finding adequate data sources. Moreover, given the considerable age variation with regard to education and parenthood, the process of inter-generational reproduction extends across time, so that even with long-term historical data, the actual observation window for making trend comparisons may be rather small.

Still, there are a number of systematic conclusions that may be drawn from these results.

While background-specific chances of access to certain levels of education have been major determinants of the level of inter-generational educational reproduction, there have been important contributions also of other partial processes to the final outcomes of inter-generational educational reproduction. In some of our examples, about half of the observed inequality is due to educational homogamy. Hence, the results underline the necessity to specify partial processes when looking at long-term social reproduction from the perspective of an origin generation. This also means that the analysis of inter-generational transmission has to be careful about distinctions like individual and (household) union-related perspectives; gender-differences in the odds of social transmission; relative proportions and absolute quantities; and comparisons of two generations versus multi-generation comparisons.

There is also a more general conclusion regarding the construction of explanations, which is to think more carefully about possible relationships between institutions and a potentially wide range of social mechanisms. This seems to be in line with a recent trend in (comparative) sociological research, and also fields like political economy, namely an increasing awareness that
there are no exclusive relationships between particular institutions and related social mechanisms (like: the educational system has a direct impact on educational behavior and only on that). Rather, it is their indirect connections and unintended consequences that are often not just more interesting, but also most relevant.

References


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