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Economic Gains from Publicly Provided Education in Germany

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ABSTRACT

Economic Gains from Publicly Provided Education in Germany*

The aim of this paper is to estimate income advantages arising from publicly provided education and to analyse their impact on the income distribution in Germany. Using representative micro-data from the SOEP and considering regional and education-specific variation, from a cross-sectional perspective the overall result is the expected levelling effect. When estimating the effects of accumulated educational transfers over the life course within a regression framework, however, and controlling for selectivity of households with children as potential beneficiaries of educational transfers, we find evidence that social inequalities are increasing from an intergenerational perspective, reinforced in particular by public transfers for *non*-compulsory education, thus negating any social equalisation effects achieved within the compulsory education framework.

JEL Classification: I38, I22, D31, I32

Keywords: education, public transfers, income distribution, economic wellbeing, SOEP

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1 Introduction

The German government is widely criticized for its comparatively low investments in the educational system as compared to other OECD countries. In 2002, total public expenditures for education amounted to 4.4% of GDP, placing Germany at 20th out of 28 OECD countries. Furthermore, decomposing public expenditures on education by educational level shows that Germany spends particularly little on pre-primary, primary and secondary schools, revealing a lower value assigned to the early stages of educational development. This situation, together with generally poor performance of students in early education and wide social inequalities among secondary schools identified by PISA and other international school studies, has triggered the demand for increased public spending on education in general and especially the early stages. The federal state of Berlin, for example, has announced plans to exempt pre-primary education from parental fees. At the same time, sweeping reforms of the German university system designed to improve German universities' rankings among international higher educational institutions have involved the introduction of tuition fees for public universities, which had previously been free of charge. These are only two examples of broader redistribution efforts underway in the allocation of public budgets across different levels of the educational system.

Public spending on education is a key concern not only for educational policy but also for social policy. Although in contrast to other European countries, Germany has historically separated educational from social policy, both institutionally and conceptually, in recent years educational policy has gradually come to be seen as one component of overall social policy (Allmendinger 1999). On the one hand, education often operates as the key factor defining later life chances, with specific educational diplomas acting to either restrict or enlarge young people's labour market opportunities and their potentials to develop particular life skills.[1] On the other hand, however, public spending on education acts as a mode of economic redistribution, with publicly provided education offering a specific kind of income advantage or non-cash income component to recipient households, that is, to households with members attending public schools. As such, this type of income advantage should be understood not only as qualitative support for educational processes and careers but also as an important form of quantitative economic support. These advantages pay off in particular for low-income house-

[1] See e.g. Müller and Shavit (1998) on the relevance of such institutional arrangements and the potential stratification effects emerging from a cross-national comparative perspective.

holds with many children, ensuring their participation in educational institutions and potentially even keeping them out of poverty and economic hardship.[2]

To date, however, the distributional impact of publicly provided education has only been debated in any depth in relation to *higher education subsidies*. It was Milton Friedman (1962: 105) who started this debate in the early 1960s by asserting that public subsidies to higher education produce a "perverse distribution of income" from low-income to high-income families. This position has "become part of the conventional wisdom in the economics of education" (Barbaro 2003: 458), although the actual evidence is ambiguous if not contradictory (Janeba/Kemnitz/Ehrhart 2007; Borgloh et al. 2007). Compared to previous research on the distributional impact of publicly provided higher (university) education (see e.g. Grüske 1994, Lemelin 1992, Blaug 1982, Crean 1975), the present study attempts to broaden the focus by considering the impact not only of tertiary education but also of public pre-primary, primary and secondary schools. We believe that the overall impact of public education on the income distribution can be addressed adequately only by taking these lower educational levels into account as well. This idea is supported by empirical evidence that distributional effects differ among the various education levels (Antoninis/Tsakloglou 2001). By starting from this assumption, we also emphasize the relevance of differentiating compulsory from *non*-compulsory education.

In order to provide a solid baseline for discussing the re-distributional effects of public educational expenditures, in this paper we address the general incidence of public educational transfers, varying across type of education and region, as well as its impact on income distribution and poverty in Germany in the year 2002. As such, this analysis may serve as a starting point for further analyses and simulation studies of the distributional impacts of educational reforms in Germany.

This approach entails several restrictions that should be kept in mind from the outset regarding potential conclusions about educational financing reforms and their long-term consequences. *First*, although the analysis at hand focuses on the distributional effects of (total) public expenditures on education, we do not explicitly take into account taxes paid by the

[2] In welfare states the redistribution of income and economic wellbeing generally takes place not only through the tax system and cash transfers but to also a large extent through public services in areas such as health and education. However, these re-distributional effects are frequently not taken fully into account in theoretical analyses of welfare states, and even less so in comparative empirical analyses of income distributions—particularly for OECD countries. For developing countries, there exists a larger body of literature dealing with the effect of public spending on the distribution of economic wellbeing (see van de Walle and Nead 1995; Fields 1975). Moreover, empirical studies on inequality usually rely on distributions of disposable monetary income, disregarding non-cash incomes arising from private sources or from the public provision of services. Thus,

households. Instead, we look strictly at the destinations of public transfers: where the money ends up and not where it comes from.[3]

Second, we do not provide any analysis of the distributional effects of public educational transfers across the life course. This would require time-series data of estimates of public expenditures per student, which could then be linked with longitudinal data on the educational careers of a given cohort, but such data are not readily available. We should keep in mind, however, that benefits from publicly provided educational services accumulate over the life course, and as such, the sum of transfers enjoyed (at a given point in time) may also vary considerably across individuals.

Third, although our analysis intends to depict redistribution effects of public education, the effects of changes in the financing of the educational system cannot be estimated without making broad assumptions within the static simulation procedures since educational decisions are likely to be sensitive to opportunity costs.

Keeping these restrictions in mind, the following analysis depicts the impact of public educational transfers on income distribution and poverty in Germany. This allows us to examine who benefits most from public education at each level of the educational system in the year 2002. Moreover, it allows us to address the three main factors driving these results. First, a given household's total benefits from public education will depend on the number of household members (i.e., children) attending school, which may be expected to vary with income. Second, it will depend on the participation rates at the various levels of the educational system. Since participation at the higher, non-compulsory levels may be strongly associated with social and educational background, this will lead to higher benefits for higher income groups or social classes. Third, the resulting effect of these two conflicting factors will be moderated by the structure of public expenditures across the different levels of the educational system.

The paper is organized into four sections. In the following Section 2, we give a description of the educational system in Germany. In the third section, we present the data on aggregated public spending for education per student and describe how this data was merged with the

the picture of the income distribution may be significantly altered once non-cash income components are taken into account (see Smeeding et al. 1993).

[3] An analysis of the net effects of taxes paid and educational transfers received may require a more comprehensive microsimulation of taxes and transfers along the lines of the proportionality approach (see e.g., Grüske 1994, Barbaro 2003, Borgloh et al. 2007). However, this approach is based on a well-defined link between taxes (government revenues) and specific public transfers. Alternatively, one may argue against this proportionality assumption by assuming the tax system to be rather exogenous instead. Along these lines, it should be noted that the proportionality approach contradicts the progressivity built into the redistributive function of taxation as such.

micro-dataset of the German Socio-Economic Panel Study (SOEP) providing a representative picture of the population living in private households in Germany from 2002 on. The fourth section contains the empirical analysis of the impact of educational benefits on the income distribution and poverty rates from both a cross-sectional and a "life course" perspective. Section five concludes.

2 The Educational System in Germany

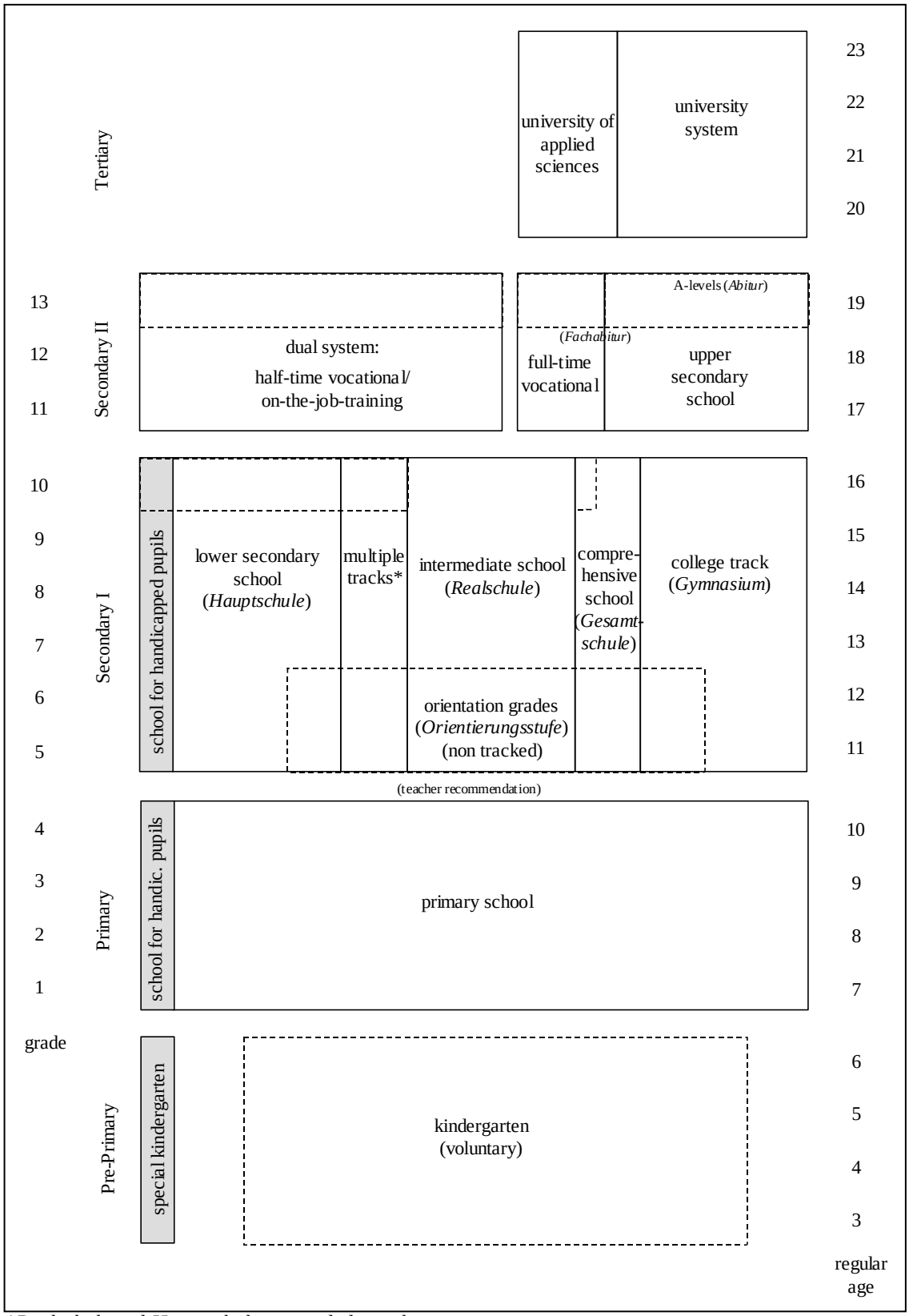
The educational system in the Federal Republic of Germany is organised into four stages: pre-school, primary school, secondary school, and tertiary education (see Figure 1). Starting with the secondary level, it is subdivided further into different tracks based on individual ability. Given that education is mainly under the authority of the federal states (*Bundesländer*), Germany's educational system is regionally fragmented. However, there are similarities in structure. Most children have to decide after either grade four or grade six whether they will attend lower secondary school (*Hauptschule*), intermediate secondary school (*Realschule*), or college-track secondary school (*Gymnasium*). This early choice often predetermines the young person's school career and subsequent labour market opportunities (see also Blossfeld 1993, Müller et al. 1998, Müller and Shavit 1998).

In Germany, the educational system has traditionally been public and free of charge in large part, at least until recently. Thus in 2002, only about 6% of all young people went to private schools (StaBu 2002: 16) and less than 2% were enrolled in private universities (StaBu 2005a: 10). All public schools and public universities are almost free of charge, and only pre-school (Kindergarten) is subject to a fee.

2.1 (Pre-)Primary Education

Children regularly enter the educational system at the age of three or four upon entering pre-primary education (known in Germany as *Kindergarten*). Attendance either full-time or part-time is voluntary, but all children are entitled by law to receive a Kindergarten slot from the age of three on. In 2002, only 10.9% of children aged 4 to 6 did not attend Kindergarten in Germany (KMK 2006: 77). Pre-schools operated by churches and social organisations run Kindergartens for about 60% of Germany's children, for which they receive government funding (DJI 2005: 140).

Figure 1: The German Educational System



**Realschule* and *Hauptschule* are pooled together.

Subject to having attained a sufficient level of development, children enter primary school at the age of six. In primary school (*Grundschule*), students attend heterogeneous classes that do not separate young people according to their individual abilities through the fourth grade (sixth grade for the federal states of Berlin and Brandenburg). Following primary school, at the age of about ten, the German school system separates children of differing abilities into different educational tracks. The transition from primary school to one of the secondary school tracks, where young people remain at least until completion of full-time compulsory education (ninth grade), is dealt with differently depending on the state's legislation. The decision on which track the student will enter is made partly by the school, which makes a recommendation based on criteria such as academic achievement, potential, and personality characteristics, which can also be influenced by in-depth consultations with the parents. The final decision is left up to the parents in most federal states, and in the others to schools or school authorities. Also, in some states the selection process is delayed for an additional two years for further "orientation" (grades five and six). This is the case for about one quarter of all pupils.

2.2 Secondary Education

2.2.1 Secondary General School

The secondary general school system is divided into various educational tracks, with their respective certificates of graduation and differing qualifications. Also, the same certificate may be attained from different school types.

The traditional track is lower secondary school (*Hauptschule*), which provides a basic general education as a basis for practical vocational training. In 2002, about 24% of the children leaving primary school after either grade four (or after "orientation" grades five and six) went into this kind of educational institution.[4] Grades five to nine are compulsory, and grade ten is usually voluntary. Over one-third of secondary general school students in grade nine stay on for a tenth year. In 2002, about 70.4% of all students leaving the secondary school level from a *Hauptschule* did so with a *Hauptschule* certificate, 16.0% left with a *Realschule* certificate (only after completing grade ten) and 13.6% dropped out without graduating.

[4] If not otherwise stated, the numbers reported in the text are calculated from StaBu 2002: 32-35.

Alternatively to *Hauptschule*, young people can also attend intermediate school (*Realschule*). These schools reach from grade five (or seven) to grade ten. Graduation from *Realschule* generally provides the basis for higher training in all mid-level occupations. In 2002, 23.7% of all children leaving primary school entered *Realschule.* 92.5% of *Realschule* students graduate with a *Realschule* certificate, and 5.3% graduate with a *Hauptschule* certificate. The *Realschule* drop-out rate is 2.2%, i.e., considerably lower than in case of *Hauptschule*. Particularly in some of the East German federal states, *Realschule* and *Hauptschule* are pooled together into what is known as "multi-track secondary school" (*Schule mit mehreren Bildungsgängen*). About 9% of each age cohort attend this combined school form.

The third path in the German school system is the academic track (*Gymnasium*), which has become the most popular of the three: 33.9% of all young people attend this school type after completing primary school. *Gymnasium* usually lasts eight or nine years (grades five to twelve or thirteen) or, as the case may be, seven years (grades seven to thirteen).[5] Graduation from college-track secondary school (the *Abitur*, functionally equivalent to British A-levels) qualifies young people to apply for all institutions of higher education. In 2002, 85.7% of all students leaving college-track secondary school graduated with the *Abitur*, while 12.3% left with a *Realschule* certificate. The very small share of 1.4% of Gymnasium students left school with a *Hauptschule* graduation certificate, and less than 1% dropped out without any certificate.

An alternative to the traditional tripartite school system are comprehensive schools (*Gesamtschulen*). They combine the different types of secondary schools in various organizational and curricular forms. There are integrated comprehensive schools (joint classes for all students) as well as additive and cooperative comprehensive schools (where the various types of secondary schools exist side by side on the same premises). These schools are not found in all the German states. The *Gesamtschule* arose out of a social movement in the 1960s promoting the idea of a more egalitarian educational system. Most of the *Gesamtschulen* are located in states traditionally governed by the Social Democratic Party. 9.9% of all students who graduated in 2002 received their certificate from a *Gesamtschule*.

Finally, about 4% of each age group attends a special school for handicapped persons, where they can attain a special degree for people with learning difficulties.

[5] In 2002 only schools in Saxony and Thuringia (recent also in the federal state of Berlin) finished after twelve years instead of the usual thirteen. There are also college-track secondary schools covering only grades eleven to thirteen, which are open to young people who have already completed intermediate-track secondary school.

2.2.2 Secondary Vocational School

One unique element of the German vocational education is the dual system. It is based on the close connection between vocational part-time school and on-the-job-training in a firm. This entire system depends on the willingness of companies in the particular industry – especially medium-sized businesses – to provide adequate apprenticeships. The dual system has been successful in designing specialized vocational education programmes to fit the occupational structures of the labour market (Gangl/Müller 2003). But the system is now in crisis due to its increasing inability to provide enough vocational training positions for the number of applicants. This has been caused by the weak German economy and by an increasing number of *Abitur*-holders who choose the dual system over university because it takes less time to attain a degree and may offer more secure prospects of getting a job. Today, many companies only award the more prestigious, better-paid apprenticeships to *Gymnasium* or at least *Realschule* graduates. This creates an incentive to avoid attending lower secondary school (*Hauptschule*). Another problem with the German educational system is that people with low education have very low chances of getting a job if they have not completed the dual system or another vocational school.

Besides vocational schools in the dual system, there are a range of full-time vocational schools for special occupational fields, such as schools for health-related occupations (*Schule für Gesundheitswesen*), schools preparing for public services (*Beamtenschulen*) or other topic related schools (*Fachschulen*). Usually, these vocational schools are open to *Abitur*-holders, but may impose additional requirements.[6]

2.3 Tertiary Education

Universities are the traditional form of higher education in Germany providing courses on a broad range of subjects. Universities combine teaching with research, and have the right to award doctoral degrees. The university system in Germany is publicly financed and has been largely free of charge up to the present. Depending on the parents' income, students can also receive financial support (according to the *Bundesausbildungsförderungs-Gesetz* BAföG) to cover their living expenses. There is no well-developed scholarship system in Germany. The

[6] The distinction between secondary general and vocational schools that we will use subsequently in this report contrasts against the international classification of lower, upper and (non-tertiary) post-secondary schools, at least in some cases. The vocational schools outside the dual system thus belong to either upper secondary or post-secondary schools, and the various types of secondary general schools may include the upper secondary as well as the lower secondary level (see Hetmeier 2004: 2).

average duration of study for students who obtained a university degree in 2002 was 6.8 years (Heublein/Schwarzenberger 2005: 1).

The number of university graduates has traditionally been very low in Germany in comparison to other OECD countries (OECD 2006). Because of this as well as the Bologna Declaration of 1999 and other EU agreements, the German university system has been undergoing sweeping reform in recent years.[7] Bachelor's and master's degrees have been established to reduce the length of university studies and to make the system more comprehensible and effective.

Universities of applied science (*Fachhochschulen*) and colleges of public administration were established to provide practical training in occupations requiring scientific knowledge and methods or creative and artistic skills. These schools offer courses of study mainly in the fields of engineering, economics, social sciences, agriculture, and design. These schools have been successful because of their more flexible orientation towards the changing situation on the labour market. The average duration of study for students who graduated from a *Fachhochschule* in 2002 was 5.4 years, thus about 1.4 years less than for university students (Heublein/Schwarzenberger 2005: 1). About three-quarters of all students attending tertiary education in Germany choose the university and about one-quarter choose universities of applied sciences.

2.4 Regional Differences

The Federal Republic of Germany is made up of 16 federal states, each of them with its own government, its own ministry of education and a distinctive set of political, religious, and cultural traditions. Educational legislation and the administration of the educational system are primarily within the jurisdiction of the states, although specific policies and practices are being gradually aligned by the "Standing Conference of the Ministers of Education and Cultural Affairs" (*Kultusministerkonferenz* KMK). The Federal Government is responsible for vocational training within the dual system as described above and for the promotion of scientific research.

It is important to note that significant regional differences exist in Germany's education system. The Christian parties that hold parliamentary power mainly in the southern federal states strongly identify with the tripartite system and the fostering of an academic elite, while the

[7] See http://www.bologna-berlin2003.de/ [accessed March 1, 2007].

Social Democrats have encouraged school reform as a means of increasing equality of educational opportunities. As a result, many aspects of schooling in the states of central and northern Germany differ from those in the southern German states, despite the fact that all states have basically the same educational structure and core curriculum (e.g., an *Abitur* obtained in a given federal state is accepted for university access in any other federal state).

2.5 Social Inequalities

The German educational system is characterized by comparatively high social inequalities in educational attainment (Shavit/Blossfeld 1993; Baumert/Schümer 2001). This is due to low investments in compensatory education in the early stages of schooling and child development, since primary education is only part-time and starts relatively late in the life course. On this ground, the very early and rigid selection that takes place at the transition from primary to secondary education is the main cause for the strong dependency of educational attainment on the social and educational origins (Schimpl-Neimanns 2000; Becker/Schubert 2006). The importance of the early selection process is reinforced by the fact that the educational system – and thus the quality of a person's education and training – strongly determines his or her individual chances of finding a job on the labour market, resulting in high stability of educational inequalities from both, intra-generational as well as intergenerational perspective (Gangl/Müller 2003).[8]

Whereas the structure of educational attendance has changed dramatically in the past five decades, with the proportion of children obtaining only a *Hauptschule* graduation certificate declining from about 80% in the 1950s to almost 20%, the odds of obtaining an *Abitur* for children of different social and/or educational backgrounds has remained remarkably constant (Schimpl-Neimanns 2000). At the same time, graduation from a track higher than the *Hauptschule* level has basically become a precondition for better-paid jobs, not to mention individual chances on the marriage market. Thus the rapidly declining number of children graduating with lower certificates results in an ever more accentuated discrimination against these individuals on the labour market and in society as a whole (Solga 2002). This paradoxical effect of educational expansion leads to a structural convergence between educational inequalities and increased social divisions within German society overall.

[8] There is a large body of literature on the effects of social origin, income poverty and parental educational background on the educational attainment of children based in large part on data from the German SOEP (see e.g. Büchel and Duncan 1998, Büchel et al 2001, Kreyenfeld et al. 2003). It seems most useful to also include pre-primary education in such analysis (see

3 Public Expenditures on Education

In the following we focus exclusively on *public* expenditures for education to derive the monetary value of publicly provided education services. We assume public expenditures on education to operate as an income advantage or transfer, which adds to the net household income of the household where the pupil or student is living.[9] Therefore, we first have to estimate the average amount of public expenditures per student, which is calculated as total public expenditures on a certain kind of school divided by the total number of students attending this type of school. We use national statistics provided by the Federal Statistical Office of Germany (StaBu) to estimate these figures and link them to the micro-dataset of the German Socio-Economic Panel (SOEP).

Taking into account the regional differences and institutional diversity of the education system in Germany, we seek to capture as much variance of educational transfers as possible.[10] The official statistics on educational expenditures allow us to distinguish 14 educational categories ranging from pre-primary to higher tertiary institutions, at the level of the 16 federal states. Nevertheless, not every cell within the resulting matrix (14 school types times 16 federal states) is valid, because not all of the different types of secondary schools actually exist in every one of the German states. There are some special types of educational institutions for which we derived educational expenditures separately, but we were not able to identify them in the SOEP micro-data. This is especially the case for schools for handicapped children, who show by far the highest expenditures per student, but only about 4% of students attend this school type. On the other hand, some types of educational institutions can be distinguished in SOEP, but there are no figures on their educational expenditures. This is the case for different vocational schools outside the dual system. In fact, our matrix of public educational expenditures per student leaves us with 187 valid combinations of "school type" and "federal state" that could be linked with respondents in SOEP, providing us with sufficient variance among student benefits (see Table 3 at the end of this chapter).

e.g. Spiess et al 2003 and Büchel et al. 1997). For previous analysis on the distributional impact of *higher* education subsidies, see Barbaro 2003 and Borgloh et al 2007.

[9] This builds on the counterfactual consideration that in a totally private educational system, the household would have to pay for all educational services consumed by its members. Thus, adjustments of household income to household needs via equivalence scales are performed *after* adding the educational benefits of each student to net household income.

[10] See Wolf (2007) for a detailed analysis of regional disparities in educational expenditures in Germany.

3.1 Pre-Primary Education

As mentioned above, primary schooling starts rather late in the life course of children in Germany. To account for improved international comparability, we include public expenditures for pre-primary education in our analysis, but only for children aged four and above. As can be seen from column (1) of Table 1, about 88% of all pre-school children aged 4 to 7 attend Kindergarten. Within this group, the share of children attending Kindergarten full-time varies across German states, with much higher shares in the East and in Berlin. However, the sample size is too small to allow for substantive interpretation on the state level.

Table 1: Pre-Primary Education

	(1) children attending Kindergarten aged 4-7	(2) in % of all pre-school children aged 4-7	(3) % attending full-time (vs. part-time)	(4) annual gross public benefits per child, full-time	(5) net public benefits per child (mean)*	(6) un-weighted observations (SOEP)
Schleswig-Holstein	55.349	68,5	16,5	5000	1584	27
Lower Saxony	239.931	80,1	7,5	6100	2434	94
North Rhine-Westphalia	596.280	85,6	18,7	5500	2356	213
Hesse	290.334	95,5	23,2	5300	2383	106
Rhineland-Palatinate	188.212	79,5	32,1	4700	2419	69
Baden-Württemberg	421.986	96,4	28,7	4600	2203	173
Bavaria	342.288	83,9	17,8	4500	1903	167
Saarland	37.916	100,0	13,5	4900	2145	17
Hamburg	33.879	86,3	52,5	6100	3384	14
Bremen	12.026	87,8	14,9	6000	2463	6
Berlin	87.788	92,8	74,1	6200	4580	29
Mecklenburg-Western Pomerania	32.962	95,4	67,3	2900	1572	18
Brandenburg	27.738	89,8	53,4	3900	2311	22
Saxony-Anhalt	33.213	91,0	47,2	4600	2555	20
Thuringia	47.034	92,4	54,4	3700	1884	29
Saxony	94.301	94,0	62,7	3400	2064	55
Germany	2.541.237	87,6	26,6	5000	2328	1059

* Based on all children, after deduction of private fees and adjusted for time actually spent in the institution as well as possible costs for lunch.
Source: SOEP 2002, Schilling (2006)

The data on pre-school public benefits used in this study is not readily available from official statistics and has been provided by Matthias Schilling from the *Dortmunder Arbeitsstelle Kinder- und Jugendhilfestatistik*. For Thuringia and Hamburg, the calculated costs are not plausible according to Schilling (2006), so the weighted average of the eastern states has been assigned to Thuringia, and the weighted average of the city-states of Bremen and Berlin has been assigned to Hamburg. Since the data provided by Schilling are for 2003, we deflated these costs by the factor 1.0245 to obtain prices for 2001, assuming no substantial differences in public expenditures for pre-primary education between 2001 and 2003.[11] Column (4) of Table 1 gives gross public expenditures per child attending Kindergarten fulltime. For children attending Kindergarten part-time, we simply assign half of the cost of a full-time slot. For children who attend part-time but still have lunch at Kindergarten, an additional 5% of a

regular full-time slot is added (see Schilling 2006). As can be seen, households in the eastern states receive far less (gross) education transfers at the pre-primary level than those in the Western German states.

As described above, Kindergarten is the only public educational institution in Germany that imposes fees on parents depending on household income and needs. Thus, private fees have to be subtracted from public expenditures in order to obtain net public benefits for pre-primary education. The corresponding information on tuition fees for child care is available in SOEP.[12] Column (5) of Table 1 gives the mean values of net public transfers per child regardless of whether they attend full-time or part-time. Due to the higher percentage of full-time attendees and lower fees in eastern Germany, the difference between East and West in gross public expenditures (for a full-time slot) declines to almost zero, whereas the city states, and especially Berlin, now show remarkably high net public transfers.

3.2 Primary and Secondary Schools

The data on public expenditures on education per student for primary and secondary schools are taken from calculations by the Federal Statistical Office.[13] In principle, these data can be linked directly with the SOEP without further modification.[14] The costs per student include current investment costs, school administration costs, and pension funds for teachers.[15]

3.3 Tertiary Education

Public expenditures per student for tertiary education are calculated separately for universities and for universities of applied sciences (*Fachhochschulen*). The Federal Statistical Office provides detailed statistics on aggregated income levels and expenditures on different institutions of tertiary education. This allows calculating different types of expenditures separately. Table 2 shows personnel costs, other ongoing costs and investment costs per student. These

[11] We deflated to 2001 values, the income year used in the following.

[12] In cases of missing values due to item-non-response (n=48), fees have been imputed by means of OLS-regression-based imputation (with R^2=0.23, based on valid n=934).

[13] These calculations are provided regularly by the Statistical Office from 2002 on. Source: http://www.destatis.de/themen/d/thm_bildung6.php.

[14] There is only one exception: the costs of vocational schools outside the dual system had to be calculated from the (weighted) difference of total costs for all vocational schools and costs for vocational schools in the dual system.

[15] Costs of pension funds for teachers account for the old-age pensions that teachers receive from special state funds for civil servants.

add up to total expenditures per student (not shown in Table 2). However, two important adjustments have to be made to obtain adequate figures:

First of all, public expenditures on tertiary education include expenditures for medical institutions such as university-run hospitals. The expenditures of university medical institutions account for nearly half (46%) of the total expenditures of tertiary education institutions (including universities of applied sciences). However, this includes all costs for medical attendance and administration which should not be considered as public subsidization of the educational system. Thus, these expenditures, together with the number of medical students in the denominator, have been excluded from calculations of third-level education costs per student.

Second, within the remaining total expenditures per student (sum of rows 1-3), costs for research and development (R&D) are included. Based on the fundamental idea guiding the German university system since Humboldt that research and teaching be unified, costs for research and development are not provided separately in university accounting data and thus can only be roughly estimated. The Federal Statistical Office performs such estimations based on a complex set of assumptions (StaBu 2004). The shaded row of Table 2 gives the figures on R&D spent per student. R&D costs make up approximately 40% of total expenditures on tertiary education. To calculate public expenditures on tertiary education we aggregated personnel costs, investment costs, and other ongoing costs, and deducted costs for research and development.[16] The resulting figures are given in row (5) of Table 2 for universities and *Fachhochschulen* (universities of applied sciences) separately.

Here we see that once R&D is excluded, public expenditures per student no longer differ between universities and universities of applied sciences. A striking result is that costs per student are far higher in the eastern states. This is mainly due to higher recent investment costs incurred by the expansion of tertiary education in the East after the fall of the Berlin wall in late 1989.[17]

[16] Personnel costs in the national statistics do not include pension funds for professors (which are included in costs for primary and secondary education), although they are included in the calculations passed to the OECD. Administrative fees (*Studiengebühren*) need not to be subtracted, because they are not included in the expenditure figures used.

[17] Calculating running averages for the investment costs of the last ten years would probably even increase these differences further.

Table 2: Public Expenditures for Tertiary Education per student in euro

	Germany	Western States	City States	Eastern States
University				
(1) personnel costs	6.659	6.547	6.608	7.381
(2) other ongoing costs	2.446	2.519	2.396	2.066
(3) investment costs	980	815	634	2.320
(4) R&D included in (1)-(3)	4.757	4.770	4.248	5.211
(5) Total Costs w/o R&D	**5.329**	**5.111**	**5.390**	**6.558**
Applied Sciences				
(1) personnel costs	3.846	3.714	3.614	4.688
(2) other ongoing costs	1.264	1.272	1.168	1.287
(3) investment costs	836	691	676	1.689
(4) R&D included in (1)-(3)	596	594	665	557
(5) Total Costs w/o R&D	**5.350**	**5.084**	**4.792**	**7.107**

Unweighted means.
Public expenditures for the medical institutions of universities are excluded.
Source: StaBu 2004.

3.4 Synopsis

In Tables 3 and 4 we present the resulting matrix of educational expenditures per student and the projected distribution of students in our sample compared with national statistics.

Annual costs per student are quite low at pre-primary level (€2,300, see Table 3). At primary schools, public transfers per student are €3,900 p.a. on average, ranging between €3,200 in Brandenburg to as much as €5,300 in Thuringia. Secondary education receives somewhat higher subsidies than primary education. The German average ranges from €2,100 for vocational education in the "dual system" to more than €5,000 for upper secondary schools and as much as €11,500 for special schools for handicapped people, which cannot be identified in SOEP. Comparing the benefits across various types of secondary schools, intermediate schools (€4,400), orientation grades five and six (€4,600) and schools with multiple tracks (€4,700) have the lowest costs per student, whereas the costs for lower secondary schools (€5,200), college-track schools (€5,300) and comprehensive schools (€5,600) are higher. Vocational schools outside the dual system show slightly higher costs per students (€5,700), whereas vocational schools within the dual system are much "cheaper" (€2,100) due to being only part-time. Furthermore, public expenditures per student for universities (€5,300) and universities of applied sciences (€5,400) are again very similar after deducting costs for research and development. Thus, there seems to be no clear relation between the hierarchy of the school system and public spending overall.

Table 3: Public Expenditures for Education in Germany 2002, by Federal State and Educational Institution (in 2002 euros per student)

		Pre-Primary (net)*	**Primary**	**Secondary General Schools**							**Vocational**		**Tertiary**	
				orientation	lower	middle	multiple tracks	compre-hensive	college	special	dual system	other	applied sciences	university
West Germany	Schleswig-Holstein	1600	3600		4700	4400			5500	10800	2400	5900	4800	4000
	Lower Saxony	2400	3900	4500	5200	4500			5600	11400	2000	5600	5600	6600
	North Rhine-Westphalia	2400	3700		5000	4000		5600	5200	11700	2100	5600	4900	4200
	Hesse	2400	3600	4700	5500	4900		5000	4800	12200	2400	5500	4200	4700
	Rhineland-Palatinate	2400	3800		5000	4000	4600		5300	9900	1900	5600	5100	4800
	Baden-Württemberg	2200	3800		5100	4400			5800	13600	2300	6200	5800	6600
	Bavaria	1900	4100		5500	5000			6100	9300	2200	6400	5000	5800
	Saarland	2100	3600				4100	4500	4800	11600	2200	5200	5400	5200
City States	Bremen	2500	4200	4900	5300	4300		5400	5500	15200	2300	5800	5000	6900
	Hamburg	3400	5800		6300			7100	6100	14900	2800	6900	4500	6100
	Berlin	4600	4500	5500		4700		6600	5500	13500	2200	5300	4900	4800
East Germany	Mecklenburg-Western Pomerania	1600	3800		5200	3900	4400		4100	9200	1700	3900	7500	6100
	Brandenburg	2300	3200	4300		3600		4800	4100	10900	2000	3100	7200	5700
	Saxony-Anhalt	2600	4500	4300			5000		4700	10500	1800	4800	7600	8800
	Thuringia	1900	5300				5300		5300	10900	2100	5100	7200	7200
	Saxony	2100	4400				4300		4800	11300	1800	4100	6500	5900
Germany		**2300**	**3900**	**4600**	**5200**	**4400**	**4700**	**5600**	**5300**	**11500**	**2100**	**5700**	**5400**	**5300**

* Figures for pre-primary are rounded means of net individual transfers for childcare after deduction of parental fees actually paid for childcare.
Sources: Schilling (2006) and SOEP 2002 (pre-primary, own calculations), StaBu 2005b (primary, secondary and vocational), StaBu 2004 (tertiary, own calculations).

Having a closer look at the regional variation, there emerges a clear picture about city-states with higher expenditures per student for all school forms. For pre-primary and primary education, there seems to be no general difference between eastern and western states. But starting from intermediate secondary schools, a regional hierarchy appears, with eastern states showing the lowest public expenditures per student, city-states the highest, and western states expenditures ranging in between. This ranking is reverted again for tertiary education, where now the eastern states have the highest costs per students due to the higher investment costs.

In Table 4 we compare the projected number of students per educational level calculated in SOEP with the corresponding figures from the national statistics. For pre-primary education, we present numbers of childcare slots in Germany at the end of year 2002, which exactly fits the projected number of children attending Kindergarten in our database. For children in primary school, the SOEP sample closely resembles the population figures in the national statistics. Looking at the total rows, the deviations between SOEP and national statistics on secondary and vocational students are still in the acceptable range of +/- 7%.

Table 4: Population of Students (SOEP vs. National Statistics)

		SOEP in private HH	StaBu	Deviation SOEP-StaBu abs	Deviation SOEP-StaBu in %	SOEP non-private HH
Pre-Primary	fulltime	675,648	--			0
	part-time plus lunch	671,716	--			0
	part-time	1,193,873	--			0
	Total Pre-Primary	2,541,237	2,550,399	-9,162	-0.4	0
Primary		3,135,663	3,211,486	-75,823	-2.4	1,851
Secondary	orientation grades (five and six)	256,554	387,365	-130,811	-33.8	
	lower secondary	1,163,593	1,113,954	49,639	4.5	5,745
	intermediate secondary	1,368,873	1,277,739	91,134	7.1	1,192
	schools with multiple tracks	482,799	440,512	42,287	9.6	2,247
	comprehensive schools	689,086	531,151	157,935	29.7	1,851
	college track	2,593,871	2,284,326	309,545	13.6	1,771
	other / not assignable	506,611	561,084	-54,473	-9.7	5,782
	Total Secondary	7,061,387	6,596,131	465,256	7.1	18,588
Vocational	dual system	1,595,370	1,784,368	-188,998	-10.6	8,096
	other vocational schools	906,977	909,807	-2,830	-0.3	1,355
	not assignable	29,460		29,460		
	Total Vocational	2,531,807	2,694,175	-162,368	-6.0	9,451
Tertiary	university	1,353,897	1,328,941	24,956	1.9	36,500
	university of applied sciences	474,092	513,885	-39,793	-7.7	16,319
	not assignable	2,800		2,800		
	Total Tertiary	1,830,789	1,842,826	-12,037	-0.7	52,819
Total		17,100,883	16,895,017	205,866	1.2	82,709
Sample size	*(SOEP)*	*7,255*				*48*

Source: SOEP 2002, DJI 2005 (pre-primary), StaBu 2002 (primary and secondary), StaBu 2004 (tertiary).

However, there are some fairly large deviations at the level of the various secondary schools. The SOEP sample overestimates the number of students at comprehensive schools and college-track schools, and underestimates the number of students in the “orientation” grades five

and six. Partly, this can be explained by differences in the underlying timing of these measures. The student population refers to the beginning of the school year 2001/2002, which was August 2001. The educational participation of SOEP respondents refers to the time of interview, which started in January 2002 with about 70% of the interviews conducted by March and more than 90% by May. Thus, the SOEP population figures refer to a point in time six or more months into the school year, in contrast to the national statistics. This might explain some of the failure to cover students in the "orientation" grades and also some deviations at secondary school levels, but it cannot explain the general overestimation of secondary students.

At the tertiary education level, the SOEP population of students in tertiary education again perfectly matches official statistics. In the last column, we report projected figures of students in non-private households, who by definition were excluded from our analysis. With this sample restriction we exclude students living in student accommodations (dormitories, student residences, etc.), who are only partly covered by the survey frame of the SOEP due to the concept of following up on all respondents even when they move to institutional accommodation and thus drop out of the basic population of private households. As can be seen, there are only a few students excluded from our sample. In Germany, the share of students in tertiary education living in student accommodations was about 12% in 2003 (HIS 2004: 340), compared to 3% in SOEP 2002. Students living in non-private households have to be excluded from the analysis at hand because no sufficiently reliable information on "household income" is available for them. Of course, a similar problem arises with students who live on their own in individual households because their incomes are usually low and, more important, often much lower than the actual financial resources at their disposal, which in most cases will include part of their parents' incomes (who may be paying their rent, for example). This is why sensitivity analyses have been performed by including and excluding students not living with their parents (altogether with their fellow household members).[18]

[18] According to the SOEP about 40% of all students co-reside in parental households, whereas this share is about 22% according to the HIS-survey (based on over 20,000 interviewed students, see HIS 2004: 340).

4 Empirical Results

4.1 Data and Methods

The aggregated figures on public transfers for education as described in the previous section have been linked with micro-data of the German Socio-Economic Panel (SOEP) for the survey year 2002. The SOEP is a wide-ranging representative longitudinal study of private households that provides yearly information on all household members, consisting of Germans living in the old and new German federal states, foreigners, and recent immigrants to Germany. The panel was started in 1984, and in 2002, there were over 12,000 households with more than 30,000 persons sampled (see Haisken-DeNew and Frick 2005; SOEP-Group 2001).

The principle underlying the following analyses is to compare the situation of a baseline model using monetary annual equivalent post-government household income with the income situation after adding equivalent educational transfers. The modified OECD equivalence scale is applied (1; 0.5; 0.3). Based on the differentiated matrix of public transfers per student by educational institution and federal state, the impact of public education benefits on the overall income distribution will be analysed at a more aggregated level, in order to show possible differences by educational level. Thus, results presented throughout all tables differentiate between primary education (including pre-primary education benefits), secondary education (including all kinds of general secondary schools and vocational schools) and tertiary education (including universities and universities of applied sciences).

Separate estimates of the impact of public education benefits on household incomes and the income distribution as a whole will be presented, taking only benefits for compulsory education into account. Compulsory education is here defined as primary (excluding pre-primary) and secondary general education up to the age of 15, the age by which the lowest possible secondary degree (*Hauptschule* degree) can be obtained.

As mentioned above, students in tertiary education not living with their parents are excluded from the following analyses. Since these students are likely to be found at the bottom of the income distribution (although their parents may have higher incomes) adding public benefits for tertiary education to these students' income might result in extreme changes in their relative income position. In other words, the available information on those persons` monetary income will most likely provide a biased picture of their true economic position. In order to provide empirical evidence of the underlying selectivity we also mention results from sensi-

tivity analysis including these students, however, without presenting empirical results in tabulated form[19].

4.2 The Impact of Educational Transfers on Income Distribution and Poverty

4.2.1 Population Shares of Beneficiaries

Table A1 shows the share of the entire population receiving any kind of public benefits for education, at least for one member of the household. This is the case for nearly half of the population (44.6%, column D1). At least 30% of the population receives benefits for household members in secondary education, and 21% for children attending (pre-)primary school. Only 3.1% of the population benefit from public transfers to tertiary education, either directly or via other household members (see columns A-C). Including the population living in households of students no longer living with their parents increases this figure to 4.8%. Thus, about 1.5 million people are affected by this exclusion (as mentioned above, this figure includes co-residents of these students).

If only expenditures for compulsory education are taken into account, the overall number of beneficiaries is reduced from 44.6% to 27.7% (column D2). In other words, a substantial number of persons profit only from transfers related to non-compulsory education. On the other hand, there are also households that do not receive any kind of education benefit, although at least some of their members could be attending (non-compulsory) schooling institutions. About 16.8% of all persons (i.e., 100%-83.2%, column H1) live in such potential (but not actual) beneficiary households.[20] There are only few people in the respective age brackets that do not attend primary or secondary school (including pre-primary education and vocational school), but nearly 80% in potential tertiary education households do not attend universities (see columns E-G).[21]

Accounting for differences across the income distribution, it can be seen from column D1 that almost half of the population of the first three income quintiles does benefit from public ex-

[19] These complete results can be found in Frick et al (2006).

[20] Potential recipient households are defined here as those with persons in specific age brackets that would allow them to attend specific schools. Children aged 4 to 15 are seen as potentially attending (pre-)primary and lower secondary school, young persons aged 16 to 21 are defined as potentially attending upper secondary school (including vocational schools) and persons aged 22 to 28 are defined as potentially in tertiary education, all of them independent of their qualification. These age brackets are derived from the de facto age distribution across educational institutions.

[21] Note that "potential" beneficiaries are defined by means of age only, i.e., we do not control for the individual's qualification to enter an institution of higher education.

penditures on education, whereas in the higher income quintiles, this share declines to 42.6% (fourth quintile) and only 34.7% (top quintile). This pattern is similar for primary and secondary education and simply reflects the fact that households in the higher income ranges comprise fewer children attending primary and secondary school. This is the case even though the educational participation rates (measured here as the share of those realising potential benefits) are slightly higher in the higher income quintiles (see columns E and F).

With respect to tertiary education, there are much higher shares of beneficiaries in the higher income quintiles. Also, participation rates at third level education are, as expected, much higher among higher incomes, ranging from 38% in the top quintile to only 6% in the bottom quintile (see column C in Table A1). Including students not living with their parents for sensitivity reasons alters this linear relation between income position and participation in tertiary education into a U-shaped curve. In this case, due to the low income position of university students living on their own, we find higher shares of beneficiaries as well as higher participation rates also at the bottom quintile.

4.2.2 Income Advantages from Public Educational Transfers

Adding public educational transfers to the baseline income yields an overall increase in disposable income of 7.7% (see Table A2, column F1). In line with the distribution of beneficiaries, the increase in disposable income is highest for secondary education (4.9%), followed by primary education (2.3%) and finally, tertiary education (0.5%, and 0.9% respectively, if students no longer living with their parents are included). By restricting the analysis to public transfers for compulsory education only, the overall increase in income declines from 7.7% to 4.4% (column F2 of Table A2). This picture is about the same across the entire income distribution, where in all quintiles the corresponding income share is cut nearly in half if only compulsory education is taken into account.

As expected, educational benefits have the greatest impact on low-income households, making up as much as 21.7% of total adjusted household income in the lowest quintile.[22] They are least relevant for the top quintile, accounting for only 3.0% of disposable income after adding education transfers (column F1 of Table A2). This difference across income quintiles is similar for primary and secondary education as well as for compulsory and non-compulsory education. Again, transfers to tertiary education behave somewhat differently, since increase in

[22] It should be noted that in the baseline measure of our disposable household income direct cash transfers like student grants are already included.

disposable incomes is rather small and identical across the income distribution. Only when including students who are no longer living with their parents there appears to be an appreciable increase in disposable incomes of 3% for the bottom quintile.

Of course, the percentage increase of disposable income not only depends on the magnitude of educational transfers received – which by the very nature of the system are the same for any individual attending the same school in the same federal state – but also from the baseline monetary income to which these transfers are added. Obviously, the relative impact of the public education transfer *ceteris paribus* decreases with income. But furthermore, the amount of education transfers should be higher in the lower income groups due to the larger numbers of children and thus actual beneficiaries. This is in fact the case, as can be seen from columns G to J of Table A2 ("mean transfer per capita"). It is most pronounced for secondary education, with persons in the lowest quintile receiving about €690 compared to €360 in the top quintile. Again, in the case of tertiary education, the picture is different and even reversed. However, transfers for tertiary education are on a lower level than for secondary and even primary education, and thus the different distribution across income groups does not change the overall pattern for secondary and primary education transfers.

There might be at least two other reasons why low-income households in Germany appear to benefit more from public expenditures to education than high-income households in such cross-sectional perspective. First, transfers for primary education include transfers for pre-primary education for children aged 4 and above, and these are means-tested (i.e., we only assign *net* transfers after deducting parental fees). In consequence, high-income households receive less (net) public transfers than low-income households. Second, public transfers for universities are significantly higher in Eastern Germany due to the recent increase in investment costs. Since low-income households are more likely to be found in eastern Germany, they will *ceteris paribus* receive higher transfers for tertiary education. It is most important to note that both of these additional issues relate to *non*-compulsory education.

4.2.3 Impact on Income Distribution and Poverty

As can be expected from the analysis so far, the overall impact of educational transfers on the distribution of incomes is a decrease in inequality for the total population. This is examined

using a range of well-established inequality indicators such as Gini, Atkinson, Deciles-Ratios and poverty measures taken from the FGT-family[23] (see Table A3).

The decline in inequality is strongest comparing figures for the total population before (column A) and after (table B1) adding all educational transfers to the monetary income (see column F1). Including students not living with their parents yields a marginally less equal baseline distribution, while adding public transfers to students in tertiary education does reduce inequality somewhat further. Again, transfers to secondary education show the strongest impact on all applied measures of inequality (see columns C-E). Interestingly, the effect of transfers for compulsory education is about the same as the effect of transfers for non-compulsory education (columns F1-F3).

While there appears to be no systematic difference according to the Atkinson measure using e=0.5 and e=1.5 respectively, the inspection of the decile ratios show a somewhat stronger reduction of inequality within the upper half of the income distribution. Furthermore, the degree of poverty reduction is higher for the normalized poverty gap (FGT1) than for poverty risk rate (FGT0), and increases further with increasing sensitivity of the parameter α, i.e., the strongest poverty reduction effect is found for α=2, where overall poverty is reduced by as much as 16.5% (see column F1 of Table A3).

With respect to socio-demographic structures, the social groups benefiting most from public education subsidies are, of course, households with younger children and younger persons themselves.[24] The particular household group benefiting most in absolute and relative terms are single-parent households, which form a rather small group. For example, the poverty rate for single-parent households declines from about 42% to 20%. On the other hand, households with elderly members experience an increase in relative poverty, since by recalculating the poverty line after adding education transfers, their relative income position deteriorates significantly. Thus, there is a strong decline in economic inequality between different household

[23] This index as described by Foster, Greer and Thorbecke (1984) is defined as $FGT(\alpha) = P_\alpha(y,z) = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^\alpha$

where *n* describes the number of persons observed, *q* represents the number of poor, *y* is the equivalent income of the poor individuals, *z* describes the poverty threshold and α is the weighting parameter for the individual poverty gap. Setting the parameter α equal to zero yields the widely used head-count ratio or poverty incidence (FGT0). FGT(1) is the average normalised poverty gap, and FGT(2) is the average squared normalised poverty gap. The larger α is, the greater the degree of "poverty aversion", i.e., the sensitivity to large poverty gaps. Note that the poverty threshold applied to the baseline distribution is recalculated after adding educational transfers.

[24] For the following exemplary interpretations see Table A4 for analyses focussing on inequality and inequality decomposition (based on MLD), as well as Table A5 for poverty-related analyses, respectively.

types and across the age structure, although the level of between-group inequality is already rather low for the baseline distribution.

With respect to the socioeconomic structure as measured by employment status and educational level of the household head, the picture is just the opposite. Income inequalities between different groups of socioeconomic position and educational levels are comparatively high in the baseline distribution, and the decrease in inequality due to educational transfers is rather small. Persons living in households with a head who is either a blue-collar worker or who is unemployed experience a rise in their relative income position, whereas for the position of white-collar households remains unchanged, and households of self-employed and pensioners loose in this implicit redistribution process. Also, relative poverty is substantially reduced among blue-collar workers and the very heterogeneous group of “other” households, as well as for self-employed households. Thus, there appears to be a rather small levelling effect of economic inequalities across the socioeconomic groups as defined here.

Indeed, in the case of education levels this effect is close to zero. Whereas the relative income position of persons whose household’s head finished tertiary education falls slightly from 138% of mean income to 136% of mean income, the income position of those whose household’s head completed no more than general elementary education changes marginally from 77% to 78%. Also, the decline in poverty rates and the closing of poverty gaps is smallest for households with low educational level and highest for persons living in households with heads who finished upper secondary education.

Regarding the change in income inequalities between social groups, there is no significant impact of including or excluding students not living with their parents.

4.3 Who Profits Most from Public Education? – A Regression Analysis of Educational Transfers on Family Background

From our previous cross-sectional analyses, we can conclude that the overall effect of educational transfers on the income distribution is a reduction of income inequalities and poverty, mainly through a redistribution of fictitious income from childless households to those with children. However, we have also seen that income inequalities between social classes and educational groups are at best slightly reduced or even remain unchanged. The most important limitation stems from the fact that the cross-sectional approach chosen here essentially ignores effects arising from the accumulation of educational transfers over the life course that are impossible to observe at a single given point in time. Assuming an average annual public

education transfer worth the equivalent of €3,000 per beneficiary, the magnitude of this issue can be exemplified by comparing an individual who attended the standard nine years of compulsory schooling (€27,000 total lifetime transfers) with an otherwise identical person who attended both pre-primary and tertiary education as well (approximately €57,000 total transfers accumulated over a period of 19 years in various educational institutions).[25]

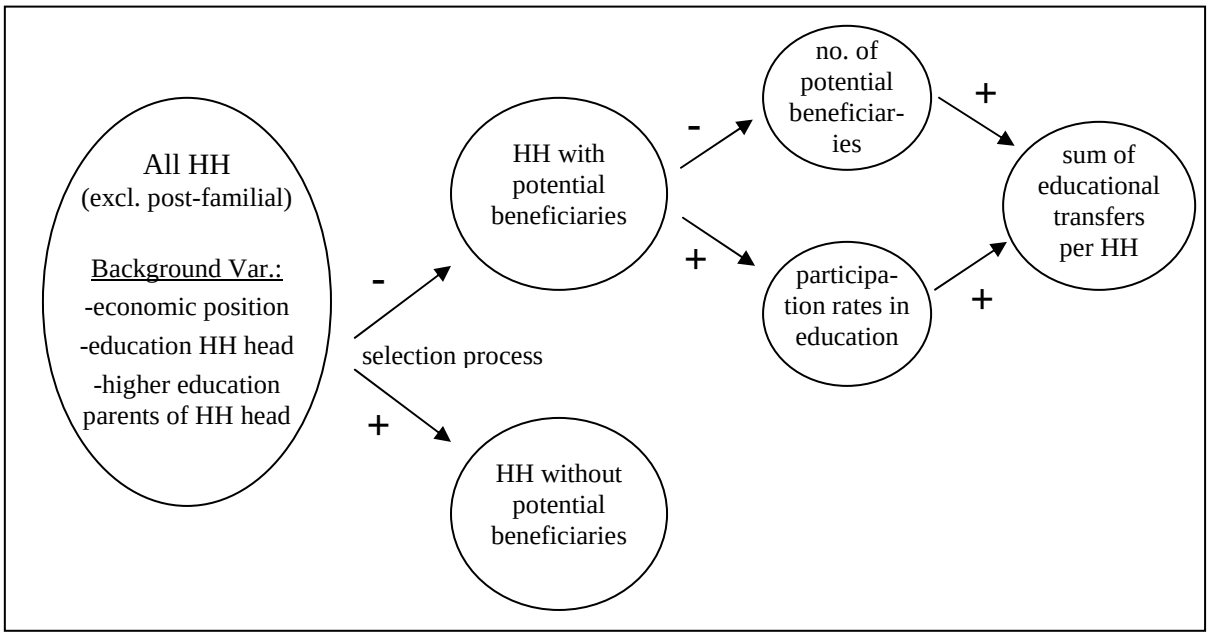
As such, one might argue that over the life course, social inequalities in accumulated public educational transfers arise from different durations of participation in non-compulsory pre-primary, upper secondary, and tertiary education. From a cross-sectional perspective, these differing durations of educational careers for individuals from different social backgrounds will result in differential levels of participation in non-compulsory education. On the other hand, the total amount of public educational transfers accumulated across the life course by households from different economic and educational backgrounds will also depend heavily on whether they have children or potential beneficiaries within the household and how many they have. On these grounds, we try to investigate the income effects potentially arising from a longer duration of participation in the educational system in a multivariate setting, controlling for the presence and number of potential beneficiaries within the household and other significant factors. In other words, we use a rather simple cross-sectional regression framework as an approximation of the otherwise unobservable life course perspective, given that (representative) panel data over such a long period does not (yet) exist.

The dependent variable is the total amount of educational transfers in kind received by a household in a given year. The most important control variables include the baseline economic position and the educational background. The first is based on a combined measure of relative income and wealth positions, while the latter also considers information about the educational level of the household head's parents in order to measure the family's long-term income potential arising from higher education. These variables together indicate the baseline (social and income) inequalities among the parental generation. Our main hypothesis is that the system of public educational transfers not only leads to the well-established intergenerational homogeneity of the educational system but also reinforces social inequality, especially through the funding of non-compulsory education.

[25] This is similar in spirit to Grüske (1994) who links lifetime labour income and the advantages of publicly provided education taking into account individual tax contributions. Borgloh et al (2007) also stress the need for longitudinal analyses, but their focus is on tertiary education only.

There are at least three intervening forces driving the relationship between a household's social background and its educational transfers received that need to be adequately controlled for in this set-up (see Figure 2):

Figure 2: Setting for regression analyses of educational transfers



First, the number of potential beneficiaries from public education can be expected to be highest among low incomes as well as among the least educated groups. For the overall population, this is supported by the finding of the highest income quintile comprising the smallest number of children (see column D1 in Table A1).[26] However, given our interest in inequalities within the population of families, we exclude all post-familial ("empty nest") households from the analyses including those elderly people who never had any children. By restricting our sample population to households in an early or middle stage of the family cycle, we take on the prospective perspective of the intergenerational transmission and accumulation of human capital.[27] For the remaining households, we control for the overall existence of children, i.e., potential beneficiaries, in the household by means of a Heckman selection model (Heckman 1979). Furthermore, in the regression part of the Heckman model, we also control for the number of potential beneficiaries within the household. By doing so, we ensure that

[26] Of course, this correlation between welfare position and number of children is affected by the income measure used in the descriptive analysis in the previous section, since post-government incomes comprise child-related transfers and tax relief for children. Therefore, in the following regression analysis we employ a measure of total income given by the sum of market incomes and social transfers deducting direct child allowances. However, we still equalise our measures of income and wealth by means of the modified OECD scale, since the interesting effect of economic wellbeing on educational participation decisions requires adequate control of the within-household distribution of economic resources.

[27] To identify the stage of a given household in the family cycle, we exploit the available longitudinal and retrospective biographical information available on all individuals in SOEP (Frick/Schmitt 2006). It should be noted that households in the post-familial stage of the family cycle that still include members enrolled at educational institutions are retained in our analysis sample.

the effects of income position and educational transfers indicate educational participation behaviour instead of the probability of having (many) children.

Second, and most interesting, we assume the actual educational participation of these potential beneficiaries to vary by economic position and educational background, with higher participation being more prominent among the economically strongest and the best-educated groups. Moreover, these differences are likely to be more immanent at the *non*-compulsory stages of education. This is why we additionally perform separate regression models focussing only on compulsory and on non-compulsory educational transfers, respectively. Our main hypothesis is that within the compulsory stages of education, there should be *no* systematic differences between different social groups in terms of the total amount of transfers received from public education net of the effect of number of children, whereas for non-compulsory education, participation rates and choices of school types are expected to be significantly different and to be driving the results for the overall sample.

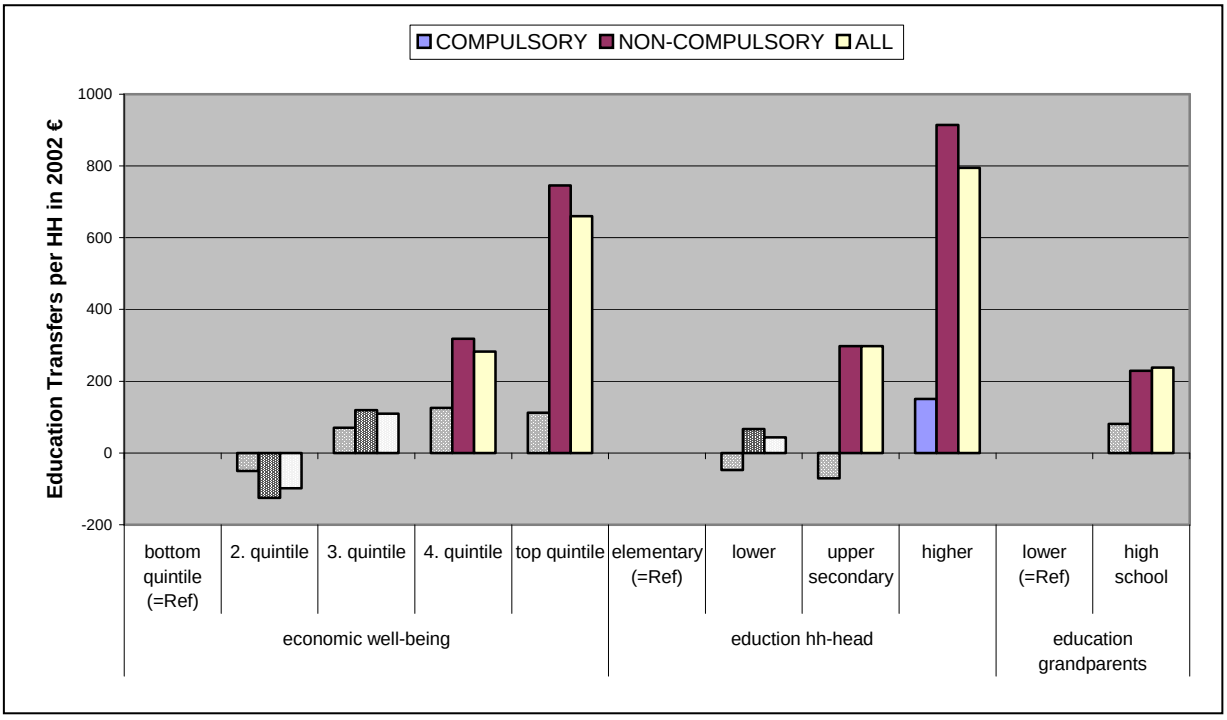
Third, the overall amount of public transfers for the various educational tracks could have been expected to rise with educational level, with higher transfers going to pupils at more privileged institutions. However, as we have seen in detail in section 3, there is no systematic variation of public transfers per student across different educational tracks. For example, in terms of (net) public subsidies received, children attending lowest secondary school do not benefit more than children at college-track schools, and students at universities do not receive significantly higher subsidies than students at universities of applied sciences after controlling for R&D-related costs. The only exception here is the very low transfer per student for vocational education within the dual system, compared to any other kind of non-compulsory education[28]. Effects that arise from the choice between vocational education and higher secondary vocational education (e.g., attending *Gymnasium*) or tertiary education will be captured within the overall effects of household backgrounds. In addition, there is considerable variation in educational transfers across federal states, especially between city-states, western and eastern states, which suggests the need for controlling these regional effects by means of a set of state-specific dummy variables.

Empirical results of the three selection models are documented in detail in Table A6. It should be noted that the definition of the dependent variable as well as the definition of the selection

28 However, this group generally also receives some type of compensation from the employer, which increases with duration of apprenticeship.

population differ across these models.[29] In model 1, the dependent variable is defined as total amount of public educational transfers received by the household, and the sample selection controls for the existence of at least one household member being aged four to 28, i.e., being a potential beneficiary of any type of educational transfer. Models 2 and 3 restrict the respective dependent variable to educational transfers for either compulsory education (model 2) or non-compulsory education (model 3), with an accordingly specified sample selection of households comprising potential beneficiaries from either compulsory or non-compulsory education.

Figure 3: Regression Coefficients from Heckman Selection Models



SOEP 2002. Grey bars indicate non significant effects at 10% level. See Table A6 for detailed information.

The most important regression results are given in Figure 3; complete results and information on statistical significance can be obtained from Table A6. All results are net of the number of children (in various age brackets) within the household and the federal state in which the household lives.[30] Effects of family background are close to zero and statistically not significant—except for a rather small effect for higher educated household heads—for the model of compulsory education, and thus the effects for the overall model are almost entirely driven by

[29] The additional variables identifying the selection process within the framework of the respective selection model are dummy variables for "home ownership" and "household head is civil servant" in all three models.

[30] As can be expected, in model 2 (compulsory education) we find high effects of the number of children at the age of compulsory education (8 to 15), whereas the effects are low for the number of children aged 4 to 7 as well as for the number of household members aged 16 to 21. In model 3 (non-compulsory education), this picture is completely reversed. Effects for lone parents` households are insignificant in both models, i.e., there is no independent effect of lone parenthood net of all other controls.

the effects of non-compulsory education. We find strong and highly significant effects especially for the highest economic and educational levels. Controlling for the number of children in various age brackets, these households *ceteris paribus* receive educational transfers worth €600 more per year than the poorest and €900 more than the least educated. We also find significant additional effects for higher education of the household head's parents (i.e., the grandparent generation), confirming our expectation of a reproduction of the status quo, maintaining educational elites across the generations.

In short, these results clearly support the thesis of an intergenerational transmission of educational achievement, which has been shown by a number of other research projects previously (see, e.g., Schimpl-Neimanns 2000; Fuchs/Sixt 2007). More importantly, however, with respect to the impact of public educational transfers on the distribution of a most relevant proxy for economic wellbeing, namely income and wealth, these results support a different interpretation of our rather simple cross-sectional results presented in section 4.2. Obviously, from the cross-section perspective, the impact of adding a fixed amount of public transfers to a low baseline income yields a higher relative gain from those transfers for the poor than it does for the rich. Moreover, not only in relative but also in absolute terms, low-income households receive higher amounts of in-kind transfers from education (see column J1 in Table A2). However, this is mainly driven by higher numbers of children in these households currently in the educational system. The multivariate setting allows us to control for this and to proxy the long-run (life-time) effects of these transfers via socioeconomic status. Here it appears that the total amounts of educational transfers from compulsory education do not vary across income quintiles and educational levels of the household head once the number of children at the age of compulsory education is controlled for. In contrast, we find quite large effects for non-compulsory education. It appears that the main driving force behind this process lies in the (self-)selection of children from high-income and high-education households into institutions of non-compulsory education, reinforcing educational inequalities by public subsidies.

5 Conclusion

The aim of this paper was to estimate income advantages arising from public funding of the educational system and to analyse their impact on the income distribution and poverty in Germany. The structural distribution of education transfers shows no systematic variance of educational transfers across education levels or school types, neither privileging higher education nor compensating the underprivileged. Only transfers per child for pre-primary and pri-

mary education as well as for vocational education within the dual system are significantly lower than other transfers at the secondary and tertiary levels (excluding costs of research and development).

From a simple point-in-time perspective, the overall impact of public educational transfers on income distribution and poverty is a levelling effect. This process is mainly driven by a "re-distribution" of income from households without children to those with children, the latter being the main beneficiaries of these transfers by definition. Transfers to secondary general education have the greatest impact in terms of the amount transferred and thus also the increase in disposable income and redistribution effects. Whereas the main redistribution effects take place through demographic factors (particularly the number of children in the household), we find little to no decrease in income inequality across socioeconomic groups and in particular across households with different educational levels (based on the household head).[31]

To further investigate the impact of public educational transfers on economic inequality, we performed Heckman selection models in order to disentangle demographic influences from educational participation behaviour and to approximate the long-term accumulation effects of educational transfers in separate analyses for compulsory and non-compulsory education. Our results show that inequalities in educational attainment arising from the unequal participation in non-compulsory education play a crucial role. They are strong enough to cancel out the levelling effect that arises from the larger number of potential and current beneficiaries in lower-income families, and thus to reverse the picture that emerges from descriptive analyses taking a solely cross-sectional perspective. Thus, it is the (self-)selection of children from high-income and high-education households in institutions of higher education that tends to reinforce not only educational inequalities (which are not within the scope of this paper), but economic inequalities between families of different economic and educational background as well, thus contributing to long-run societal stratification. From a policy perspective, this finding may be relevant for the current discussions underway in Germany on raising tuition for higher education and on eliminating the private fees for pre-primary education.

[31] Sensitivity analyses show that including students not living with their parents yields a much greater reduction in income inequality due to transfers to tertiary education. Excluding these students yields the opposite result of no change or even a slight increase in income inequality. However, regarding the change in income inequality between social groups, there is no significant impact of including or excluding students not living with their parents.

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7 Tables

Table A1: Population Shares of Beneficiaries

Quintile	Population share of beneficiaries					% potential beneficiaries				
	A	B	C	D1	D2	E	F	G	H1	H2
	Primary	Secondary	Tertiary	All	All-Compuls.	Primary	Secondary	Tertiary	All	All-Compuls.
1 (bottom)	23.7	34.8	1.0	47.2	31.9	96.2	92.7	6.2	81.4	100.0
2	23.4	32.7	1.5	48.2	31.6	95.4	91.2	9.2	83.8	100.0
3	24.1	33.0	4.0	50.3	31.8	95.7	95.5	23.8	85.0	100.0
4	19.0	28.8	4.3	42.6	24.3	98.6	94.0	28.8	82.8	100.0
5 (top)	15.5	20.5	4.7	34.7	19.0	96.5	93.9	38.1	82.7	100.0
All	21.1	29.9	3.1	44.6	27.7	96.4	93.4	20.4	83.2	100.0
N in Mil.	80,196									
n	28,504									

Population: Individuals living in private households with Post-Govt.-Inc.>0
Column H1: Population aged 4-28 years old
Note: Primary education includes pre-primary education starting from age 4.
Source: SOEP 2002

Table A2: Income Advantages from Educational Transfers

Quintile	Income Share		% Increase in disposable income					Total transfers per capita (not equalised)				
	A Baseline	B plus transfers	C Primary	D Secondary	E Tertiary	F1 All	F2 All - Comp.	G Primary	H Secondary	I Tertiary	J1 All	J2 All - Comp.
1 (bottom)	8.4	9.0	6.7	14.6	0.4	21.7	13.1	273	692	19	984	556
2	13.7	14.2	3.8	8.0	0.3	12.2	7.0	237	574	25	836	466
3	17.5	17.9	3.0	6.1	0.6	9.7	5.8	253	559	62	874	501
4	22.4	22.4	1.9	3.9	0.6	6.3	3.5	200	454	70	724	380
5 (top)	38.0	36.5	0.8	1.8	0.3	3.0	1.6	156	363	77	597	304
All	100.0	100.0	2.3	4.9	0.5	7.7	4.4	224	527	51	802	440
N in Mil.	80,196											
n	28,504											

Population: Individuals living in private households with Post-Govt.-Inc.>0
Note: Primary education includes pre-primary education starting from age 4.
Source: SOEP 2002

Table A3: Inequality and Education-Related Transfers

Inequality indices	Value of the Index				Proportional change in %					
	A baseline	B1 plus transf.	B2 compulsory	B3 non-comp.	C Primary	D Secondary	E Tertiary	F1 (B1-A)/A	F2 (B2-A)/A	F3 (B3-A)/A
Gini	0.293	0.273	0.281	0.285	-2.4	-4.7	0.1	-6.8	-4.2	-2.8
Atkinson 0.5	0.075	0.066	0.069	0.071	-4.7	-8.7	0.1	-12.6	-8.0	-5.5
Atkinson 1.5	0.225	0.197	0.206	0.213	-5.6	-8.2	0.3	-12.7	-8.4	-5.4
MLD	0.157	0.136	0.151	0.148	-5.4	-9.3	0.2	-13.6	-4.1	-6.0
DR: 90/10	3.61	3.30	3.42	3.45	-3.6	-5.9	0.2	-8.4	-5.2	-4.4
DR: 90/50	1.88	1.76	1.81	1.83	-2.3	-4.4	-0.2	-6.0	-3.7	-2.6
DR: 50/10	1.92	1.87	1.89	1.89	-1.3	-1.7	0.4	-2.6	-1.5	-1.9
FGT0	14,78	13,41	14,07	14,07	-2.6	-7.8	0.5	-9.2	-4.8	-4.8
FGT1	4,24	3,76	3,90	3,99	-4.1	-8.2	1.1	-11.5	-8.0	-5.9
FGT2	2,02	1,68	1,77	1,85	-6.6	-11.3	1.1	-16.5	-12.1	-8.5

Population: Individuals living in private households with Post-Govt.-Inc.>0
Note: Primary education includes pre-primary education starting from age 4.
Source: SOEP 2002

Table A4: Inequality and Education-Related Transfers

Characteristic of household or household head	A	B	C	D	E	F	G	H	I
Household type									
Older single persons or couples (at least one 65+)	17.2	89	83	0,0	0,134	0,134	0,0	14,6	16,8
Younger single persons or couples (none 65+)	27.1	117	109	0,4	0,180	0,176	-2,5	31,0	35,0
Couple with children up to 18 (no other HH members)	37.3	96	103	16,1	0,136	0,100	-26,2	32,1	27,4
Single-parent household	4.3	62	76	31,1	0,119	0,090	-24,3	3,2	2,8
Other household types	14.2	103	102	6,7	0,147	0,132	-10,7	13,3	13,7
% Within-group inequality	./.	./.	./.	./.	0,148	0,130	-12,1	94,2	95,8
% Between-group inequality	./.	./.	./.	./.	0,009	0,006	-37,7	5,8	4,2
Socioeconomic group of HH head									
Blue-collar worker	19.5	82	86	13,1	0,064	0,046	-28,7	7,9	6,6
White-collar worker	34.0	119	119	8,0	0,106	0,090	-15,3	22,8	22,4
Self-employed	7.4	163	160	5,9	0,197	0,164	-16,4	9,2	8,9
Unemployed	6.8	66	70	14,4	0,152	0,129	-15,3	6,6	6,5
Pensioner	24.8	88	83	1,3	0,124	0,122	-1,2	19,5	22,3
Other	7.4	73	77	13,4	0,314	0,236	-24,9	14,9	12,9
% Within-group inequality	./.	./.	./.	./.	0,127	0,108	-15,1	81,0	79,6
% Between-group inequality	./.	./.	./.	./.	0,030	0,028	-7,2	19,0	20,5
Educational level of HH head									
Tertiary education	21.5	138	136	6,6	0,171	0,149	-12,8	23,5	23,7
Upper secondary education (higher vocational)	14.2	104	104	7,7	0,144	0,116	-19,7	13,0	12,1
Lower secondary education (middle vocational)	45.3	90	91	8,0	0,118	0,102	-13,6	33,8	33,8
General elementary education or less	18.9	77	78	8,8	0,139	0,118	-15,4	16,8	16,4
% Within-group inequality	./.	./.	./.	./.	0,137	0,117	-14,6	87,0	86,0
% Between-group inequality	./.	./.	./.	./.	0,020	0,019	-6,7	13,0	14,0
Age of HH member									
Below 25	26.2	89	97	17,1	0,157	0,117	-26,0	26,2	22,4
25-64	55.9	109	107	6,0	0,156	0,138	-11,7	55,5	56,8
Over 64	17.9	89	83	0,4	0,132	0,132	-0,1	15,1	17,4
% Within-group inequality	./.	./.	./.	./.	0,152	0,131	-13,7	96,7	96,6
% Between-group inequality	./.	./.	./.	./.	0,005	0,005	-10,1	3,3	3,4
ALL	100.0	100	100	7,7	0,1574	0,1360	-13,6	100,0	100,0

A: Population share
B and C: mean equivalent income relative to the national mean; distributions A and B
D: % increase in mean equiv. Income
E and F: mean log deviation (2nd Theil-Index); distributions A and B
G: % change in inequality
H and I: % contribution to aggregate inequality; distributions A and B

Table A5: Poverty and Education-Related Transfers

Characteristic of household or household head	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Household type																
Older single persons or couples (at least one 65+)	17.2	17.0	22.8	34.3	19.7	29.2	4.0	5.5	38.8	16.2	25.4	1.6	2.2	35.3	14.0	22.7
Younger single persons or couples (none 65+)	27.1	13.2	15.8	19.9	24.1	31.9	4.0	4.7	18.1	25.3	33.7	1.9	2.2	14.4	25.8	35.3
Couple with children up to 18 (no other HH members)	37.3	13.0	7.5	-42.2	32.9	20.9	3.9	2.2	-44.3	34.7	21.8	2.0	1.0	-49.8	36.9	22.2
Single-parent household	4.3	42.0	20.2	-52.0	12.1	6.4	11.3	5.4	-52.0	11.4	6.2	4.7	2.3	-52.1	10.0	5.7
Other household types	14.2	11.5	10.9	-5.3	11.1	11.6	3.7	3.4	-8.3	12.5	12.9	1.9	1.7	-11.6	13.3	14.1
Socioeconomic group of HH head																
Blue-collar worker	19.5	13.3	8.3	-37.4	17.6	12.1	2.8	1.9	-30.2	12.8	10.1	1.1	0.7	-38.4	10.2	7.5
White-collar worker	34.0	5.1	4.2	-18.2	11.7	10.5	1.3	1.1	-13.0	10.2	10.1	0.5	0.5	-13.8	9.2	9.5
Self-employed	7.4	6.0	4.0	-33.0	3.0	2.2	2.0	1.3	-31.6	3.4	2.6	1.1	0.7	-38.1	4.0	3.0
Unemployed	6.8	44.4	35.3	-20.5	20.5	18.0	13.0	10.1	-22.4	20.9	18.4	5.7	4.6	-20.0	19.5	18.7
Pensioner	24.8	15.6	20.4	30.3	26.3	37.7	3.8	5.0	31.6	22.5	33.4	1.6	2.1	28.9	20.0	30.8
Other	7.4	41.6	35.1	-15.7	21.0	19.5	17.2	12.9	-25.1	30.1	25.5	10.1	6.9	-31.4	37.2	30.5
Educational level of HH head																
Tertiary education	21.5	7.1	6.5	-8.4	10.3	10.4	2.0	1.7	-12.9	9.9	9.8	1.0	0.8	-21.5	10.8	10.1
Upper secondary education (higher vocational)	14.2	10.6	9.3	-11.7	10.2	9.9	3.9	3.0	-21.8	13.0	11.5	2.3	1.5	-32.8	16.0	12.9
Lower secondary education (middle vocational)	45.3	14.5	13.2	-9.0	44.4	44.5	3.8	3.4	-10.3	40.4	41.0	1.6	1.4	-12.0	36.8	38.8
General elementary education or less	18.9	27.4	24.9	-9.1	35.1	35.2	8.2	7.5	-8.7	36.6	37.7	3.9	3.4	-12.3	36.4	38.2
Age of HH member																
Below 25	26.2	19.4	12.2	-37.1	34.4	23.8	6.3	3.7	-40.4	38.6	26.0	3.1	1.7	-45.0	40.8	26.9
25-64	55.9	11.9	11.1	-7.0	45.0	46.1	3.3	3.2	-4.8	44.1	47.5	1.6	1.5	-7.1	43.8	48.7
Over 64	17.9	17.0	22.5	32.7	20.6	30.1	4.1	5.6	36.1	17.3	26.6	1.7	2.3	32.3	15.4	24.4
ALL	100.0	14.8	13.4	-9.2	100.0	100.0	4.2	3.8	-11.5	100.0	100.0	2.0	1.7	-16.5	100.0	100.0

A: Population share

B and C: Poverty index FGT0 (poverty rate); distributions A and B

D: % change in poverty index FGT0

E and F: % contribution to aggregate poverty (FGT0); distributions A and B

G and H: Poverty index FGT1 (norm. poverty gap); distributions A and B

I: % change in poverty index FGT1

J and K: % contribution to aggregate poverty (FGT1); distributions A and B

L and M: Poverty index FGT2; distributions A and B

N:% change in poverty index FGT2

O and P: % contribution to aggregate poverty (FGT2); distributions A and B

Table A6: Regression of Educational Transfers per Household on Family Background (Heckman Selection)

		Model 1: ALL		Model 2: COMPULSORY		Model 3: NON-COMPULSORY	
		Regression	Selection	Regression	Selection	Regression	Selection
Economic Position (averaged relative income and wealth position)	Bottom Quintile = Ref.						
	2. Quintile	-98	-0.49***	-50	-0,32***	-125	-0,40***
	3. Quintile	110	-0.89***	71	-0,66***	120	-0,66***
	4. Quintile	283**	-1.22***	126	-0,79***	318**	-0,95***
	Top Quintile	660***	-1.48***	113	-1,07***	745***	-1,03***
Educational Level of Household Head	Low = Ref.						
	Medium	43	0,05	-47	-0,03	67	0,09*
	Higher Vocational	298**	-0,02	-70	-0,06	298**	0,06
	Highest	795***	0,00	151*	0,10*	914***	0,03
Parents of HH Head: Higher Education	yes	239**	0.13**	82	0.05	230*	0,16***
Migration Background	yes	-75	0,04	-28	0,19***	-6	-0,03
No. of Persons aged ... in Household	... 4-7	1924***	--	881***	--	1309***	--
	... 8-15	4585***	--	4255***	--	162**	--
	... 16-21	2831***	--	214***	--	2434***	--
	... 22-28	594***	--	-86	--	321***	--
Federal States (dummy)	controlled for	yes	yes	yes	yes	yes	yes
Identifying Sample Selection	no. of adults	--	1.38***	--	0.04**	--	1.65***
	age	--	-0.10***	--	0.33***	--	-0.23***
	age^2	--	0.001***	--	-0.004***	--	0.002***
	Home Owner	--	0.56***	--	0.75***	--	0.21***
	HH-Head is Civil Servant	--	0.23***	--	-0.01	--	0.21***
Constant		840***	1.32***	940***	-6.98***	997***	3.06***
R-Squared		0.71		0.84		0.33	
rho		-0.64		0.03		-0.49	
LR-Test (rho=0): Chi-Squared (p-value)		167 (p=0.000)		-17 (p=1.000)		57 (p=0.000)	
Observations	censored / uncensored obs.	2555	5494	5590	2459	3762	4287
	total observations	8049					

* significant at 10%; ** significant at 5%; *** significant at 1%

Model	Dependent Variable	Selection Variable
1 ALL	Total educational transfers per household	HH with potential beneficiaries (aged 4-28)
2 COMPULSORY	Sum of educational transfers for compulsory education only, per HH	HH with potential beneficiaries of compulsory education (aged 8-15)
3 NON-COMPULSORY	Sum of educational transfers for non-compulsory education only, per HH	HH with potential beneficiaries of non-compulsory education (aged 4-7 and 16-28)

In all models, households in the post-familial stage of the family cycle and without potential beneficiaries are excluded.