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The Distributional Impact of
Subsidies to Higher Education –
Empirical Evidence from Germany

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Content

1. Introduction

It has become part of the conventional wisdom in the economics of education that subsidies to higher education have a regressive distributional effect. Given that wealthier families enroll more children in higher education, many economists assume an unwanted distributional impact of these subsidies to higher education. Roughly speaking: *the nurse is being taxed to support the higher education of the dentist's son.*

This reproach concerning the fiscal activity in higher education is – at least in Germany - as old as the claim to subsidize tuition fees. In 1875, the German Social-democratic Party (SPD) for the first time expressed in their *Gotha Program* the claim for a "free instruction". Karl Marx and Friedrich Engels were the first to question this in their *Critique of the Gotha Program*: Free instruction "only means in fact defraying the cost of education of the upper classes from the general tax receipts." (Marx/Engels 1875:30; own translation)

In the following more than hundred years, the critique did not only come from the Marxists' side. The most popular economist who expressed the thesis noted above was Milton Friedman. He assumed public higher education to produce a "perverse distribution of income" (Friedman 1962:105). Due to Friedman's expression, this thesis was named the *Friedman-thesis*. As mentioned above, the intuition of the Friedman-thesis is concerned with the processes of selection and allocation of students to the higher education system. Given that children from upper-income families are more likely to attend higher education than children from lower-income households, many economists assume that wealthier households gain the most from subsidies. In their book "Free to choose" Milton and Rose Friedman express their opinion as follows: "We know of no government program that seems to us so inequitable in its effects, so clear an example of Director's Law, as the financing of higher education. In this area those of us who are in the middle- and upper-income classes have conned the poor into subsidizing us on the grand scale – yet we not only have no decent shame, we boast to the treetops of our selflessness and public-spiritedness" (Friedman/Friedman 1979:183).

In fact, many textbook writers still refer to this Friedman-thesis, even if empirical work on this issue is at least ambiguous.

The first empirical research on the distributional impact was carried out by Hansen and Weisbrod in 1969. In their article they showed that in California worse-off households gain less from higher education subsidies than better-off households even after allowing

for the fact that they also contribute less in taxes to support public colleges and universities. Therefore, they reasoned that the Californian system of subsidizing higher education out of public funds redistributes income from the poor to the rich. Although they confirm a widespread thesis, they provoked a large debate on the distributional impact, called the "Hansen-Weisbrod-Pechman" debate (Conslik 1977), which lasted nearly ten years.

Pechman (1970) was the first to oppose Hansen and Weisbrod's thesis. He argued, "at no point do Hansen and Weisbrod compare the benefits and costs of public higher education at different levels, as they seem to suggest. Their comparison is between benefits and taxes paid on the average by families with and without children enrolled in the California system." (Pechman 1970:361). Pechman shows that Hansen and Weisbrod's data can be reworked to turn their results upside down, and the distributional impact would then be clearly progressive. A similar procedure, based on Hansen and Weisbrod's data (updated to 1971-72), was used by McGuire (1976). Additionally, he argued that the family group with the head of the family being between 35 and 60 years of age is the most appropriate universe with which to compare the income of student's parents, and that student financial aid must be added to tuition subsidies to obtain the total subsidy given to students in California public higher education. Taking into account these adjustments, McGuire concluded that the subsidy granted to students in each segment of public higher education in California was, both on the average and in the aggregate, larger for students from below-average-income families than that granted to students from families with above-average incomes.

Machlis (1973) for New York, Fields (1974) for Kenya, Crean (1975) for Canada, Merz (1981) for Switzerland, James/Benjamin (1987) for Japan, Lemelin (1992) for Quebec and Grüske (1994) for Germany provided more empirical results. All of them used a net-transfer calculation. Except for Fields and Merz, all authors found that the distributional impact is progressive. Merz concluded with a proportional incidence, and Fields determined the middle-income groups as the net wealthier. Inadequate data might be the reason why none of these authors considered equivalence scales to define in a common way, which household is wealthy and which is poor.

More recent studies use equivalence scales. Tsakloglou/Antoninis (1999) used the equivalence consumption expenditure for each household as an indicator for the household's welfare level. To judge whether inequality has reduced through public education on various levels or not, they used some inequality indices. Unfortunately, they did not consider the incidence of the tax burden to finance the subsidization and statistical inference is neglected. Irrespective of these methodological problems, they ascertained an unambiguous result. The first research using equivalence incomes and a net-transfer cal-

culation was done by Sturn/Wohlfahrt (1999). They conclude that public subsidization in Austria for 1994 had a clearly progressive impact.

Regardless of the fact that empirical evidence is at least inconclusive, international research and most textbooks often refer to the thesis of a regressive distributional impact and many models take it as granted. Blaug (1982) was certainly right to ask in surprise: "how is it possible that so many commentators keep repeating the Hansen-Weisbrod results as if they were gospel truths?"

1.1 Cross section view or long run effects?

It is interesting to note that almost all empirical studies are cross-sectional analysis. Since such a cross-sectional analysis provide snapshots of the incidence at particular points of time, they can be criticized due to the fact that they ignore the longitudinal dimension of the point at issue. This critique also applies to the distributional effect of higher education subsidies. While analyzing the distributional impact we have to distinguish between an analysis of children from various household types and an analysis of educated and non-educated individuals in their life cycle. The first is only possible by using the cross section examination, for the latter a long run analysis might be appreciated. One of the possible questions related to longitudinal analysis is, whether graduated pay back their received benefits from public subsidization within their lifetime (for example: Grüske 1994). Another related question is how public higher education affects the income inequality in subsequent years.

The non-empirical literature often ignores this distinctive feature and deals with a conglomeration of both views. Basically, a long-run analysis does not provide a distributional effect among rich and poor individuals (cf. Grüske 1994, Barbaro 2001). The relation to such a socioeconomic variable is possible only if an underrepresentation of students from socio-economically disadvantaged backgrounds in higher education could be ascertained. Than, one can argued that students from higher-income families benefit the most from the subsidies and those fortunate to get their higher education subsidized would receive all the returns from the human capital investment whereas the costs would be borne by all taxpayers, including the poorer ones.

The present paper deals among other things with the distribution of children from various income brackets in German higher education institutions. Hence, cross-section analysis also makes a contribution to this view, even if there are not concerned with the long run effects directly. For instance, suppose the most of the students are descended from poor families. How can the thesis noted above be supported?

Anyway, an empirical analysis concerning the long run effects would be very interesting and useful, but would also exceed the usual size of a discussion paper.

1.2 Organization of the paper

The present paper deals with the net-transfer calculation and the data (section II), presents empirical evidence for the distribution of children from various income brackets in the German higher educations system (section III) and builds a net transfer calculation on this analysis in order to ascertain the net incidence which is presented in section IV. Section V provides further extensions including the distributional impact of a partial cut of the subsidies.

Additionally, it shall be investigated in section V how various kinds of benefits from public higher education affect the income distribution within households with children enrolled in higher education. To judge the statistical inference, *bias corrected and accelerated* confidence intervals (BC_a) via bootstrapping are used. The main goal of this procedure is to point out which kind of benefit significantly affects the income distribution within the subgroup that consists only of net-gainer.

The main goal of the present paper is to assess this argument critically for West-Germany, using cross section data for the year 1997.

2. Methodology and Data

Even if the Hansen-Weisbrod-Pechman debate does not provide a final result of the distributional impact, it is consensual that, with regard to methodology, the point at issue should still be measured by using a net transfer calculation (cf. Blaug 1982). The idea of such a calculation is to break down the population of households into income brackets and then to check whether each income class gains more or less in subsidy benefits than it pays in taxes in order to support higher education. The pattern of such net-transfers depends on a) the distribution of the benefits from public higher education along with b) the tax incidence effect. The tax incidence, resulting from both the comprehensive tax rate structure and the distribution of the tax base among income brackets, will determine the implicit share of the costs of higher education subsidies being imposed on each income class. The distribution of the benefits depends in particular on the student representation effect, that is, does each income bracket contribute a pro rata share of students to the higher education system. Furthermore, but to a smaller extent, the distribution of the

benefits depends on their structure, which is the incidence of the benefits within households with children enrolled in higher education.

If the benefits attributable to a particular income bracket, as determined by the share of students it contributes, differ from its implied share of the cost of subsidization, as determined by the tax incidence among income brackets, then a transfer among these income brackets has occurred.

2.1 Tax Incidence

How much an income bracket contributes to finance higher education subsidies depends on the tax system. By paying taxes, all households carry the costs of subsidization. If X % of the public budget is spent for subsidies, every household will therefore provide X % of his tax burden for (this) fiscal activity. Since the comprehensive tax burden should be considered (direct as well as indirect taxes) and there is no detailed data concerning the tax incidence, the assumption of a proportional tax incidence shall be made. This assumption implies that the regressivity of the indirect taxation offsets the progressivity of the direct taxation. Empirical work for Germany (Grüske 1978) and for the USA (Pechman 1986) shows that this assumption is an acceptable approximation of the incidence of the tax burden and it is also used in the distributional investigations of Sturn/Wohlfahrt (1999) and Grüske (1994). As a consequence, each income bracket contributes a portion of the whole tax revenue that is the exact the portion of gross income each income bracket receives.

2.2 The distribution of the benefits

The amount of benefits a population subgroup receives depends in particular on the *student representation effect* and on the structure of the benefits, as noted above. In Germany, households with students receive in-kind benefits from the higher education system (tuition fee subsidy). Additionally, they are granted child benefit or child allowances (the latter only if its relief exceeds their child benefit). If a household does not gain from income splitting (e.g. due to a divorce), it has the opportunity to demand an allowance called *Haushaltsfreibetrag*. Furthermore, every household with children enrolled in the education system can ask for an education allowance (*Ausbildungsfreibetrag*) as well as for other separate settlement in tax laws, which are not considered in the present investigation[1]. Students / households also receive cash benefits through the student finan-

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[1] In 1997, an amount of 220 DM per month (child benefit) was granted for the 1st and the 2nd child, 300 DM for the 3rd and 350 DM for the 4th, 5th and so on. Better-off households assert a child allowance of 288 DM (divorced par-

cial assistance scheme (*Bafög*). Since a large share of the public higher education funding consists of research and health expenditures, the amount of in-kind benefits every student/household receives cannot be measured exactly. According to a procedure developed by the Federal Statistical Office of Germany, the share of pure health expenditure on the entire expenditure for medicinal university-institutions are estimated by the formula: $\dfrac{AR}{CE - ES}$, where AR denotes the administrative revenues, CE denotes the current expenditure and ES denotes the revenues from external sources[2]. Using this procedure, the wanted share come to 75.6 %. Further, I define half of the rest (distributed to non-medicinal faculties) as public subsidization, according to a procedure proposed by the *Wissenschaftsrat*[3] (cf. Wissenschaftsrat 1997:32f). Thus, every student / household receives an amount of 532 DM per month as in-kind benefit from public funding in higher education.

Apart from the in-kind benefits and the student financial assistance scheme the, remaining cash benefits are part of the general family promotion and not higher education subsidies in the narrower sense. But the entitlement of these cash benefits would expire if the children were not enrolled in higher education. Therefore, it seems indispensable to take these benefits and the tax burden into consideration, whereby the tax burden is necessary to finance these kinds of indirect higher education subsidies.

The amount to which students receive cash benefit from Bafög depends primarily on the income of their parents. The basic intention of the Bafög is to enable children from worse-off households to get higher education and is only granted to this group. Therefore, the incidence of Bafög is unambiguously progressive. On the other hand, it is obvious that the relief from the various allowances (measured in absolute quantities) increases in income, due to income tax progression. The incidence of such an allowance is less clear-cut by measuring the relief in relative quantities.

The incidence of the tax burden is henceforth referred as *revenue incidence* (tax incidence, therefore revenue of the state) and the incidence of the benefits is henceforth referred as *expenditure incidence*, respectively. The difference is the result of the net transfer calculation and can be called the *net incidence* (cf. Grüske 1994).

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ents) and 576 DM (married parents). The *Haushaltsfreibetrag* was an allowance of monthly 468 DM, and the *Ausbildungsfreibetrag* accounts for 200 DM.

[2] I am grateful to Heinz-Werner Hetmeier from the German Federal Statistical Office, Wiesbaden for helpful advices concerning that issue.

[3] The *Wissenschaftsrat* is an advisory body to the Federal Government and the state (Länder) governments. Its function is to draw up recommendations on the development of higher education institutions, science and the research sector as regards content and structure, as well as on the construction of new universities.

If there are no subsidies, the net transfer for all income brackets will be close to zero. Therefore, the situation without public higher education funding is the one with which the observed situation will be compared. If an arbitrary income bracket obtains a positive net transfer, it will gain from public subsidization and vice versa.

2.3 Income Brackets

As noted above, the population of households shall be broken down into income brackets, namely income deciles based on equivalized disposable income. The equivalence elasticity is simply set to a half. This so-called *square-root-scale* is an application of the single parametric approximation to equivalence scales which encompassed a wide range of scales in use, first proposed by Buhmann et. al. (1988).

2.4 Data

The data are taken from the *15ᵗʰ social survey* (bmbf 1998). In this survey, the monthly net-incomes of student's parents have been listed. Additionally, the students specified the number of brothers and sisters living at the household of their parents and if their parents were living together in the same household or not. Using these numbers, the household size is taken into account using the just introduced equivalence scales to receive a weighted distribution of the net-income. The sample contains 11,509 households. Data for the income distribution of the whole population are taken from the German Socio-Economic Panel (GSOEP, for further contains the appendix at the end of the paper).

2.5 Statistical Inference

A major shortcoming to literature about income inequality is the lack of statistical inference; in most studies, no attempt has been made to determine the statistical significance of observed differences in the computed values of a particular measure. As Mills/Zandvakili (1997) pointed out, the need for statistical inference with small samples should be obvious, but even for large samples, it may be essential to report statistical measures of precision. Since confidence interval estimates available from asymptotic theory may not be accurate (see for details: Mills/Zandvakili (1997), Biewen 2002), an advisable method for computing confidence intervals is to bootstrap. These intervals have been

shown to be superior to asymptotic intervals, both theoretically and in a variety of applications[4].

In this paper, *bias-corrected and accelerated* confidence intervals (BC$_a$) are computed. The BC$_a$-method is an improved version of the percentile method and is second-order correct in a wide class of problems.

Let $\hat{\theta}$ be an estimator of a parameter, the percentile interval $\left(\hat{\theta}_{lb},\hat{\theta}_{ub}\right)$ of intended coverage 1-2α, is obtained directly from these percentiles, therefore, $\left(\hat{\theta}_{lb},\hat{\theta}_{ub}\right)=\left(\hat{\theta}^{*(\alpha)},\hat{\theta}^{*(1-\alpha)}\right)$, whereby $\hat{\theta}^{*(\alpha)}$ indicates the $100\cdot\alpha$th percentile of B bootstrap replications. Percentiles of the bootstrap distribution also give the BCa intervals endpoints, but they further depend on an *accelerator* (acc) and the *bias-correction* (z_0). The BC$_a$ interval of intended coverage 1-2α, is given by $\left(\hat{\theta}_{lb},\hat{\theta}_{ub}\right)=\left(\hat{\theta}^{*(\alpha_1)},\hat{\theta}^{*(\alpha_2)}\right)$, where

$$\alpha_1 = \Phi\left(\hat{z}_0 + \frac{\hat{z}_0 + z^{(\alpha)}}{1-acc(\hat{z}_0 + z^{(\alpha)})}\right)$$

$$\alpha_2 = \Phi\left(\hat{z}_0 + \frac{\hat{z}_0 + z^{(1-\alpha)}}{1-acc(\hat{z}_0 + z^{(1-\alpha)})}\right)$$

$\Phi(\bullet)$ is the standard normal cumulative distribution function and $z^{(\alpha)}$ is the 100αth percentile point of a standard normal distribution (for further details see Efron/Tibshirani 1993).

3. The Distribution of Children from various income brackets in German Higher Education System

As noted above, the distribution of the benefits among the income deciles depends in particular on the amount of children each income decile descends to the higher education system.

Figure 1 shows the distribution of children from various income brackets enrolled in higher education compared with the entire population.

The linear line indicates the entire population. Every income deciles consists of 10 percent of the whole population according to the definition of income deciles. The filled bars

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4   E. g., Burr (1994) studied bootstrap confidence intervals for three types of parameters in Cox's proportional hazards model, Mills/Zandvakili (1997) using the bootstrap percentile method proposed by Efron/Tibshirani (1993), Xu (2000) appealing inference using the iterated-bootstrap method proposed by Hall (1992).

indicate whether households with children enrolled in higher education are over- or underrepresented. The lines around the bars indicate the confidence intervals with 95 % confidence.
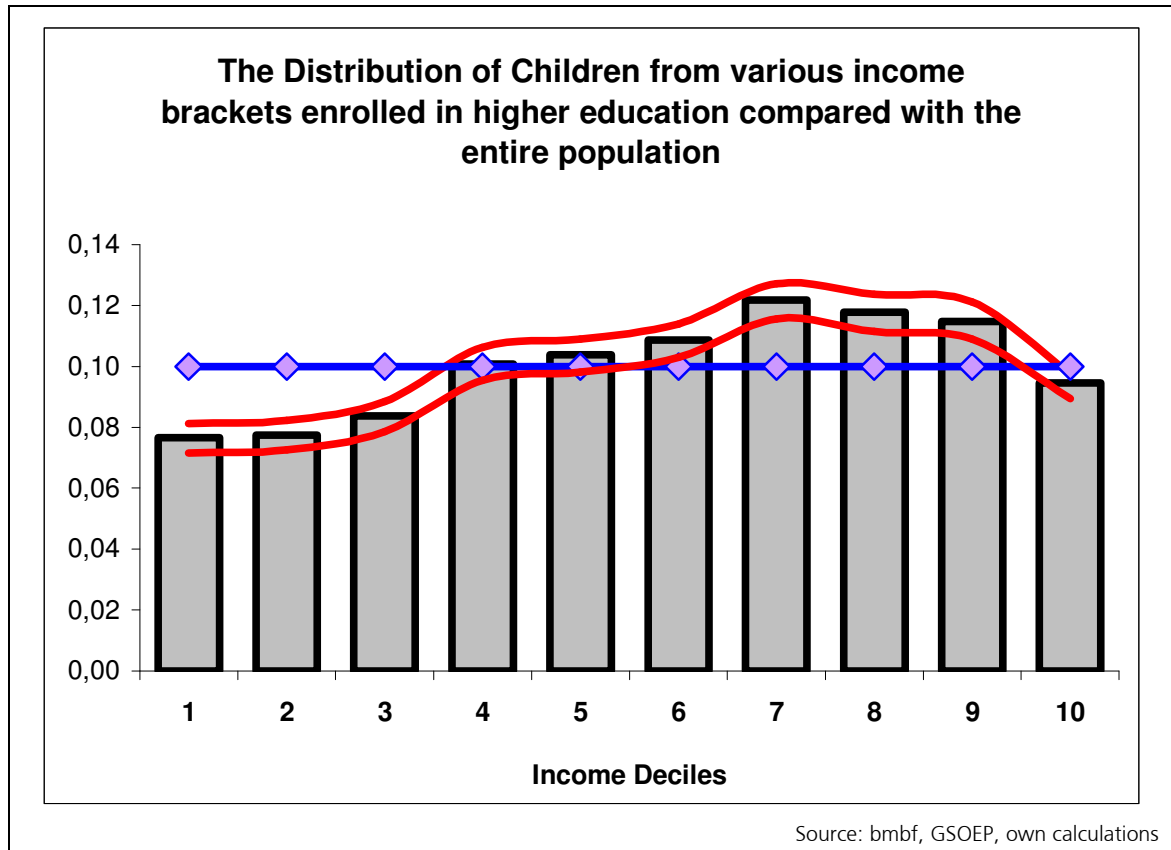
Figure 1.

For example, 10 percent of the entire population is part of the bottom decile, but 7.65 percent of all students descended from this decile and, hence, the bottom decile is significantly underrepresented in higher education. The same applies to the second and the third decile but also for the top one. While the 4th and 5th deciles are neither under- nor over represented in higher education (because the confidence intervals overlap the 10 %-line), an overrepresentation applies to the 6th to the 9th deciles. It is important to note that even if an uneven distribution could be ascertained, only a slight under representation of the lower and of the top decile and only a slightly overrepresentation of the upper deciles can be observed. Thus, it seems to be true that better-off households enroll more children in higher education, but this overrepresentation is not excessive.

4. Net Transfer Calculation

4.1 The Distribution of the Benefits (Expenditure Incidence)

The filled bars in figure 2 indicate the distribution of benefits among the income deciles. It is obvious that the benefits are more or less evenly distributed, regardless of the fact that the students are less evenly distributed.
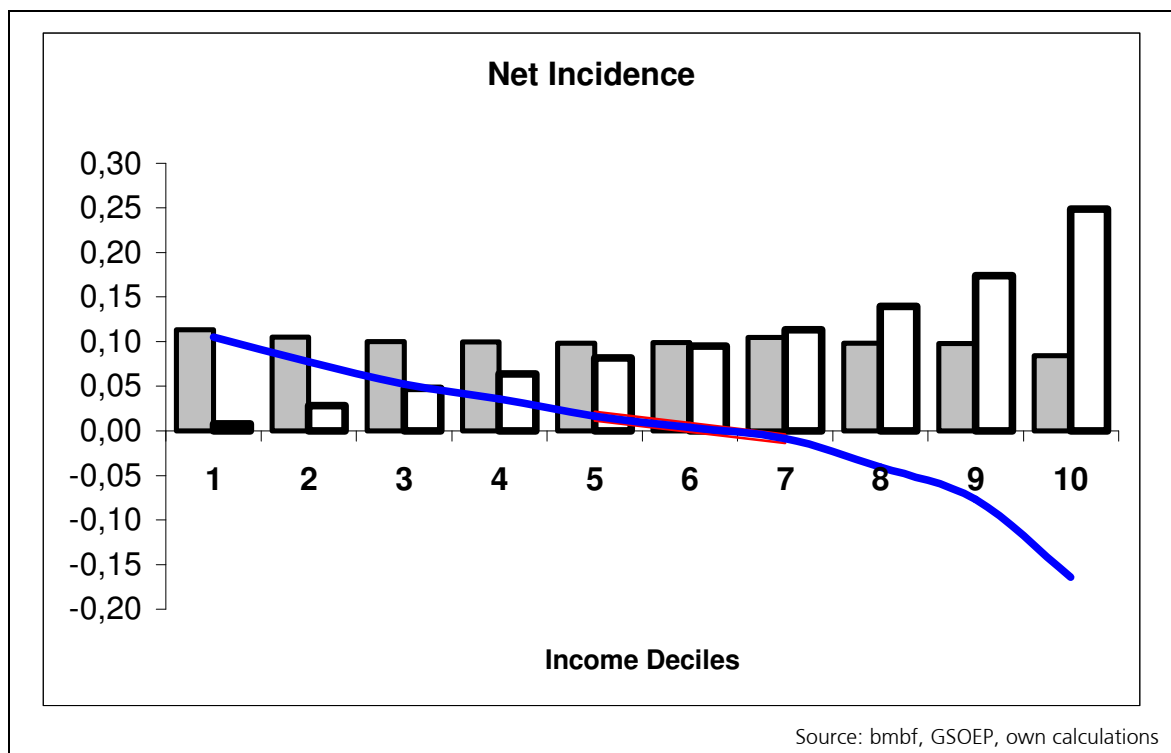
Figure 2:

The bottom to the 3rd decile receives a disproportionately high share of the whole benefits (e.g., 7.65 % of the students are enrolled from the bottom decile, but the same decile receives 11.31 % of the benefits), which is caused in particular by the student financial assistance scheme. The contrary applies to the other deciles. They receive a portion of the whole benefits that is below the share of the enrolled students. Only a small share of these subgroups benefits from Bafög, and the relief from the allowances is (compared to the upper deciles) small. The relation between received benefits and enrollment is only slightly disproportionate for the two upper deciles. They also do not profit from Bafög but they receive a relief from the allowances that is relative high, caused by income tax progression.

4.2 The Distribution of the Tax Burden (Revenue Incidence)

The unfilled bars in figure 2 indicate the tax incidence. According to the assumption made with regard to the comprehensive tax rate structure, the distribution of the tax burden is the same as the distribution of the gross income. Since the top decile receives 24.86 % of the whole gross income, the households being part of the top decile also contribute 24.86 % of the fiscal revenue and, therefore, they provide about a quarter of the whole revenue to support higher education subsidies.

4.3 Net Incidence

Figure 2 also shows the net incidence for each income decile. The bottom decile receives 11.3 % of the whole benefits, but contributes only 0.8 % of the taxes to support it. By subtracting the tax burden from the received benefit portion, the bottom decile gains with a net transfer of approximately 10.5 %. The lowest five deciles receive a significantly positive net transfer and the 7th to the top deciles a negative one. In the absence of public benefits, each income decile would pay exactly for what it receives and, therefore, no income bracket could gain from redistribution through fiscal activity in higher education. To sum up, the data show that the distributional impact is clearly progressive.

5. Interpretation

How can these findings be explained? The intuition of Friedman and others is based on the processes of selection and allocation of students (unequal opportunities), as mentioned before. The probability that a child from a poor household will be enrolled in higher education is lower than the probability that a child from a rich household experience the same. At no point I contradict this often observed fact (cf. Shea 2000, Blossfeld/Shavit 1993, McPherson/Shapiro 1991, Mare 1980), but focusing on this point alone might not suffice to conclude a distributional impact. The problem of unequal opportunities may be called a structural effect, and this structural effect might be overcompensated by a level effect, which is the general social stratification among and within the income deciles.

Figure 3 shows the distribution of households with and without children within the income deciles (also for 1997). According to our cross-section view, only children who are part of their parent's household are taken into account. The top decile consists of 83 % of households without children (DINKs, single households and elder married couples), and the portion of households with children in the 5th decile is about 2.5 times larger com-

pared to the top decile. The consequence of this result is that the probability to enroll a child in higher education should be about 2.5 times larger for members of the top decile compared to members of the 5th one to enroll the same amount of students. This is the consequence of the level effect.

Source: own calculations based on GSOEP. The filled bars indicate the households with children.
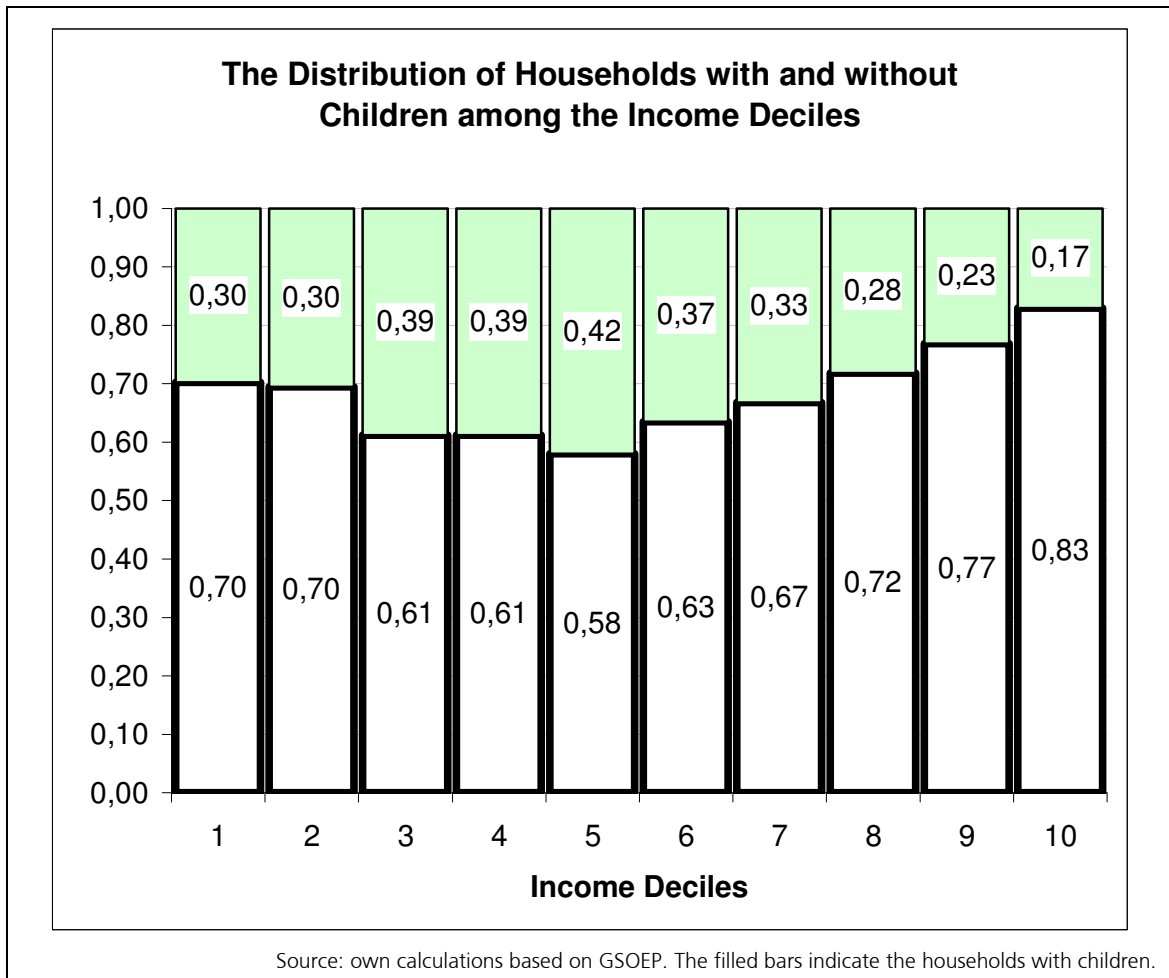
Figure 3.

Roughly speaking, there are not enough children in top decile-households who could descend to higher education even if a child from such a household were enrolled with a relatively high probability. Children are concentrated in the intermediate deciles whereas *Dinks*-households constitute the majority in the upper deciles (53 % of all households at the top decile are Dinks-households). The under representation of the bottom deciles could also be explained by the social stratification: pensioners and young single-parent households constitute the majority of the bottom decile. All of these households could not bring out students, at least in the cross-section view.

6. Extensions

6.1 A Change of the Net Price and its Effect on the Net Incidence

Analyzing the distributional effect of a changed net price (i. e., a abolition of the student aid or of a reduce of the tuition fee subsidy) is another interesting issue with regard to policy implications. We could not simply rework the net transfer figure by subtracting the benefits from the student aid, because a correlation between the grant of this cash benefit and the enrolment behavior seems to be likely.

Source: own calculations, η indicates the elasticity of enrollment with respect to the student aid.
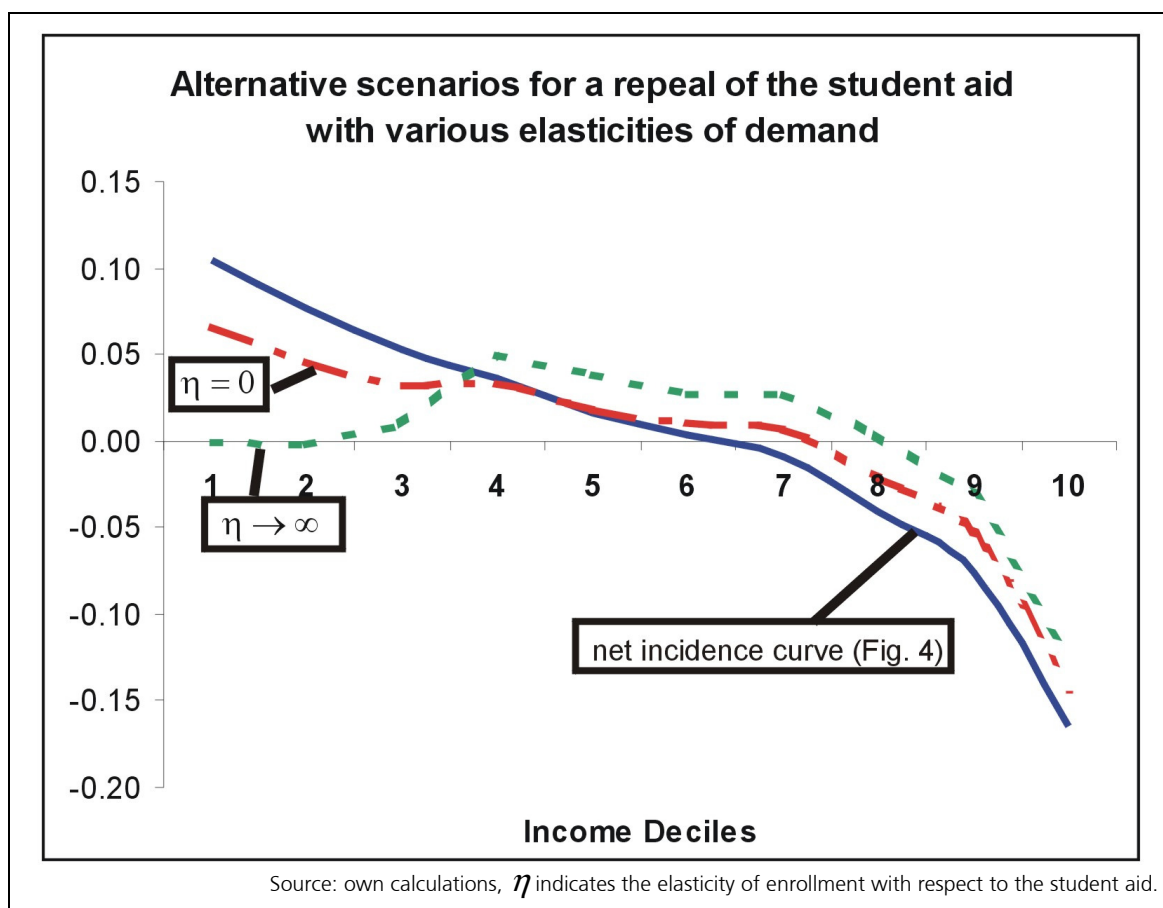
Figure 4:

McPherson/Shapiro (1991) investigated the overall schemes between student aid and enrollment. Their analysis indicates that changes in the net price (e.g., a decrease of the student aid) facing lower-income students have significant effects on their enrollment behavior. On the other hand, the elasticity of students from better-off households is supposed to be very small. Assume that all students from the bottom decile would not be enrolled if a repeal of the student aid occurred. In that case, the lower deciles would have a negative net-transfer because they would contribute in taxes in order to support the

remaining benefits, but would not gain from any of them. In other words: the isolated effect of a benefit can only be investigated precisely if we consider the enrollment elasticity with respect to the net price. Unfortunately, there is no data available about these elasticities for the various income brackets.

To achieve at least an approximation of the distributional impact caused by a abolition of the student aid, I constructed two scenarios. An elasticity equal to zero is assumed in the first scenario; thus, no student would change his or her enrollment behavior facing a change in the net price. In the second scenario, an infinitely large elasticity is assumed. In this case, the enrollment changes considerably.

The blue line in figure 4 is taken from figure 2. The red line indicates the net incidence resulting from the first scenario (elasticity $\eta = 0$) and the green line the net incidence resulting from the assumption of $\eta \to \infty$. It is obvious that the second case leads to a situation in which the lowest deciles become net-payers and the changes in the net price clearly favor the intermediate deciles. Further, even when enrollment behaviour remains unchanges (as in the first scenario), an abolition of the Bafög scheme is shown to cause substantive regressive effects.

This result is congruent with predictions from political economy literature. In their recent paper, Fernandez/Rogerson (1995) show in a political economy model that transfers of resources from lower income brackets to higher ones are possible if households vote over the extent to which they subsidize education. If education is only partially subsidized, poorer households who are credit constrained cannot afford to obtain a higher education and are thereby excluded from benefiting from the subsidies.

6.2   The Effect of the Equivalence Elasticity

As noted above, the equivalence elasticity is set to a half to compute equivalized income deciles. Recent studies use the so-called modified OECD scale. The modified OECD scale assigns a weight of one to the household head, a weight of 0.5 to each remaining adults (including children older than 15 years) and a weight of 0.3 for younger members of the household. Both equivalence scales produce similar results for most of the unweighted samples, e. g., a family with two adults and two young children is weighted with the factor 2.1 using the modified OECD scale (1+0.5+0.3+0.3) and weighted with the equivalence digit 2.0 (=$\sqrt{4}$) using the *square root scale*. But the equivalence digits differ significantly if children are aged over 15 years, which applies to enrolled students, because in contrast to the modified OECD scale the square root scale does not take into

account decreasing economies of scales with increasing age of children. Figure 5 compares the alternative use of the equivalence scales. It follows from these differences in the equivalence digits that, by comparing the entire population with the subgroup of households with children enrolled in higher education, the alternative use of the modified OECD scale brings out different results. Therefore, the portion of households with children enrolled in higher education would be higher in the lower deciles by using the modified OECD scale. While the net transfer calculation depends in particular on the student representation effect, the use of the square root scale is more conservative (i.e., brings out a less progressive distributional impact).

Net Income Distribution of households with children enrolled in higher education - equivalence scales compared

Source: bmbf, own calculations
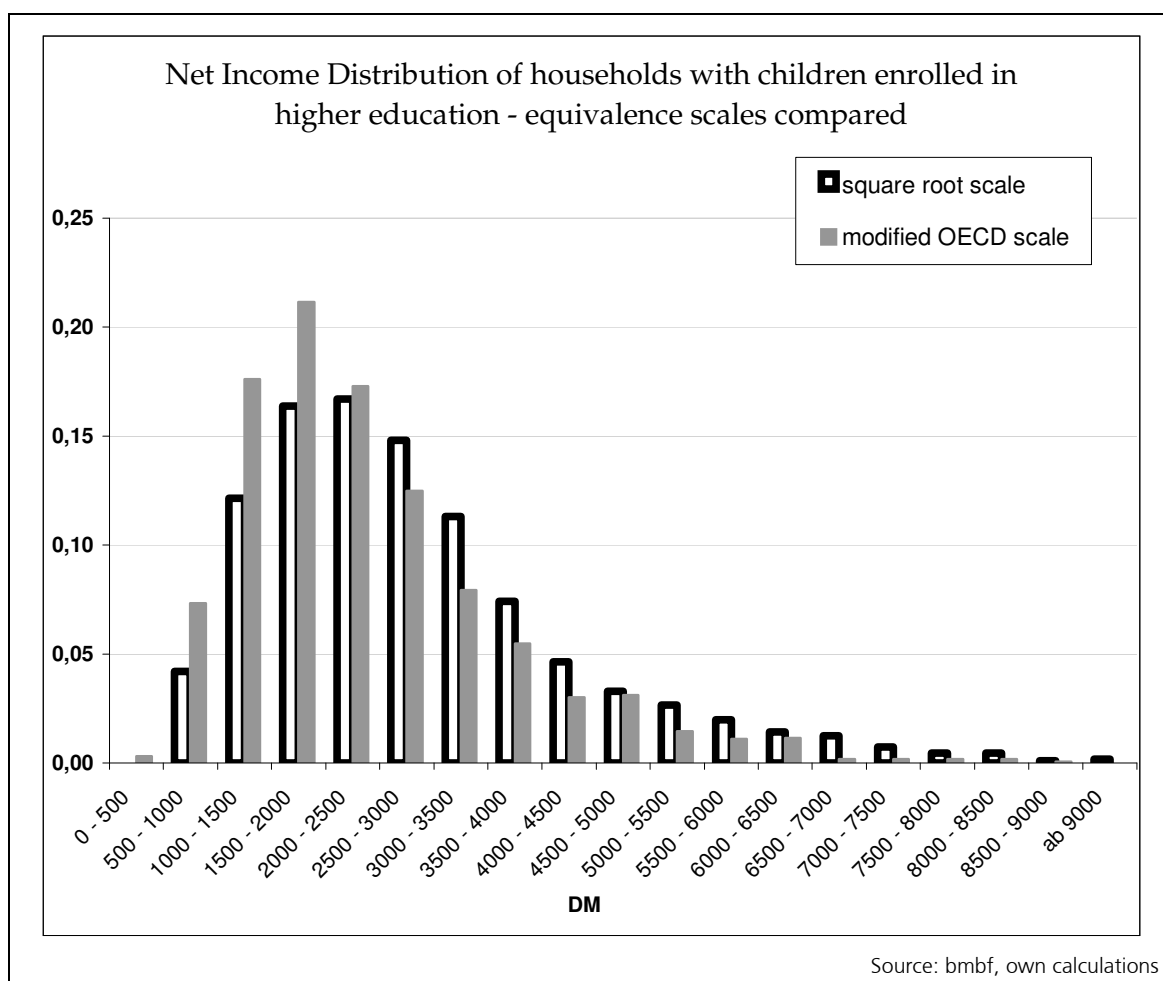
Figure 5:

Previous studies from the 70s did often not take into account the household size. The unweighted income level of a household was treated as a proxy for its level of welfare since, at the very least, income is the means to achieve welfare. It has become part of the conventional methodology to use equivalized incomes. One can expect that its use determines the findings, as the effect of equivalizing is to *make* poorer the households with

children. It could be presumed that households which are part of an intermediate decile would be part of an upper one if unweighted income levels were used and vice versa. By performing the same procedure as in the previous chapters, it is interesting to find is that the picture does not change considerably. Most households remain in their original decile of only move a step upwards of downwards. The correlation coefficient is about 0.83.

6.3 The Distributional Impact within the Households with Children enrolled in Higher Education

The impact of public subsidization on income distribution is twofold. Firstly, it affects the distribution among all households in the population and, secondly, public provision affects the income distribution within the population subgroup of the net wealthier, thus, the households with children enrolled in higher education. Since the package of benefits consists of in-kind benefits (tuition fee subsidy), direct cash benefits and indirect benefits through allowances, the distributional impact of such an allowances is not clear cut, due to income tax progression. Using Theil's entropy measure

$$T(\mathbf{Y}) = \frac{1}{n} \sum_i \left(\frac{Y_i}{\overline{\overline{Y}}} \right) \cdot \log \left(\frac{Y_i}{\overline{\overline{Y}}} \right)$$

(where $\overline{Y}$ indicates the mean of the incomes over all individuals i, and n indicates the number of observations, respectively), we might ask

Does public subsidization lead to a significant change in income distribution and, if it does, which benefits affect to which extent the final change?

Result (1.)

T falls from 0.1233 (before subsidization) to 0.0708 (after subsidization) and the confidence intervals (99 % confidence) do not overlap (0.1189;0.1280 − 0.0679;0.0738). Therefore, public subsidization leads to a significant reduction in income inequality.

In order to answer the second question, we use the decomposition rule for T, as expressed in Shorrocks (1984):

$$s_k = \frac{S_k}{T(\mathbf{Y})} = \frac{\sum_i Y_{ik} \cdot \log \left(\frac{Y_i}{\overline{\overline{Y}}} \right)}{\sum_i Y_i \cdot \log \left(\frac{Y_i}{\overline{\overline{Y}}} \right)}$$

where S_k might be regarded as the contribution to factor k to overall income inequality and s_k indicates the proportional factor contributions. $\overline{Y}$ indicates the mean.

Result (2.)

Disposable Income without subsidization:	1.1773 (1.1619;1.1842)
Child Benefits /Child allowances	-0.0179 (-0.0183; -0.0174)
Other Allowances	-0.0072 (-0.0074; -0.0072)
Bafög	-0.0904 (-0.0957; -0.0861)
In-Kind	-0.0620 (-0.0634; -0.0608)

(Bootstrap BCa-Confidence Intervals with 99 % confidence in brackets, 1000 rep.)

A single benefit reduces inequality if its s_k is negative in sign. It reduces inequality significantly, if the confidence intervals do not overlap zero. It can be shown that each benefit reduces T significantly, but there is only a negligible effect of the allowances.

7. Conclusion

In the last decades, discussing the consequences of a given unwanted distributional impact of public higher education has become more and more important. Only to a smaller extent, it has been focused on empirical investigations, and the few ones are often ignored by textbook authors as well as by model constructors.

So far, no one had analyzed the distributional impact by using a net-transfer calculation with equivalized income data and with notes on statistical inference. Only Sturn/Wohlfahrt (1999) considered the net transfer calculation and used weighted income data.

In contrast to a widespread belief in economics, the use of the net-transfer calculation provides an incidence, which is clearly in favor of the lower income deciles. As noted above, the pattern of the net-transfer calculation depends to a great extent on the student representation effect. The student representation effect itself depends in particular on the general social stratification within and among the income deciles and on the selectivity of the educational system with respect to parents' incomes. Even if it is true that the processes of selection and allocation of students are more in favor of the upper income brackets and that this effect may support the thesis of many economists, the so-called level effect may overcompensate this structural effect.

Furthermore, the assumption of a proportional revenue incidence (tax incidence) implies that a distributional-neutral situation could only be obtained if the share of students who descended rose proportionally with the gross income. Consider for example two

deciles with incomes of 2500 and 5000 currency units respectively, and a given distribution of the benefits proportional to the student-distribution (i. e., if an income bracket enrolled y % of the entire students, it would also receive y % of the benefits). The net incidence can only be zero for both if the better-off household group enrolls twice as many students in higher education. Therefore, even if wealthier households enroll significantly more children, a regressive distributional impact can still not be confirmed.

Some strong assumption (first of all, the proportional tax incidence) had to be made due to a lack of data. Bedau/Teichmann (1995) have shown that in 1994, the indirect tax regression in Germany did not settle the progressivity of the income taxation and that the whole tax system was slightly progressive. Therefore, it shall be noted that my assumptions are conservative. Considering a progressive taxation, the net-incidence would be more in favor of the lower income brackets. The same is true for the used square root scale, which concentrates the income stronger than the modified OECD scale. Furthermore, since the Socio-Economic Panel defines a household that consists only of a student as an independent household, some households have been counted twice.

As the majority of single-student households receive a lower disposable income, they are mainly part of the bottom decile. Therefore, the share of enrolled students from the bottom decile is underestimated. This problem could not be solved due to a data-lack, but if we could deduct these households from the whole population, the result would still be more in favor of the lower deciles.

On the other hand, this problem leads to a slight overestimation of the decile bounds, thus, this data problem leads to an overestimation of the progressive incidence. Summarizing up the data problems and the assumptions that were made, we could assume that they will lead to an underestimation of the progressive incidence.

Apart from the interesting questions related to the distributional impact in the cross section view, it is often expressed that the distributional impact should also be considered in the long run. As Musgrave/Musgrave pointed out, by discussing the incidence of various fiscal activities in the longer run, the distributional impact will depend on the resulting effects on factor supplies, rates of return, and growth (cf. Musgrave/Musgrave 1984:678). Additionally, examinations for the long run depend on the use of longitudinal data and on an own framework for analyzing the impact.

References

BARBARO, SALVATORE: *Profitieren die 'Reichen' auf Kosten der 'Armen' von der öffentlichen Hochschulfinanzierung? Tragen Akademiker die Kosten ihres Studiums? Einige methodologische Anmerkungen zum Forschungsstand über die Verteilungswirkungen der öffentlichen Hochschulfinanzierung in der BRD.* Hochschule Ost, 10. Jg. (2001), S. 254 - 289.

BEDAU, KARL-DIETRICH; TEICHMANN, DIETER: *Die Belastung der privaten Haushalte in West- und Ostdeutschland durch direkte und indirekte Steuern.* DIW-Wochenbericht, 62. Jg. (1995), H. 46, S. 781 - 788.

BIEWEN, MARTIN: *Bootstrap inference for inequality, mobility and poverty measurement.* Journal of Econometrics, 108. Jg. (2002), S. 317 - 342.

BLAUG, MARK: *The Distributional Effects of Higher Education Subsidies.* Economics of Education Review, 2. Jg. (1982), S. 209 - 231.

BLOSSFELD, HANS-PETER; SHAVIT, YOSSI (Eds.): *Persistent Inequality. Changing Educational Attainment in Thirteen Countries.* Oxford et. alii (Westview Press) 1993.

BMBF: *Student Life in Germany. The Socio-Economic Picture. Summary of the 15th Social Survey of the Deutsches Studentenwerk (DSW) produced by HIS* Bonn 1999.

BUHMANN, B.; RAINWATER, L; SCHMAUS, G; SMEEDING, T.: *Equivalence scales, well-being, inequality, and poverty: sensitivity estimates acres ten countries using the Luxembourg Income Study (LIS) database.* Review of Income and Wealth, 34. Jg. (1988), S. 115 - 142.

BURR, DEBORAH: *A Comparision of Certain Bootstrap Confidence Intervals in the Cox Model.* Journal of the American Statistical Association., 89. Jg. (1994), S. 1290 - 1296.

CONSLIK, JOHN: *A Further Look at the Hansen-Weisbrod-Pechman Debate.* Journal of Human Resources, 12. Jg. (1977), S. 147 - 163.

CREAN, JOHN F.: *The Income Redistributive Effects of Public Spending on Higher Education.* Journal of Human Resources, 10. Jg. (1975), S. 116 - 123.

HAISKEN-DENEW, JOHN; FRICK, JOACHIM: *DTC - Desktop Companion to the German Socio-Economic Panel (GSOEP) Study.* Berlin 2000.

EFRON, BRADLEY; TIBSHIRANI, ROBERT J.: *An Introduction to the Bootstrap.* New York et. al. (Chapman & Hall) 1993.

FERNANDEZ, RAQUEL; ROGERSON, RICHARD: *On the Political Economy of Education Subsidies.* Review of Economic Studies, 62. Jg. (1995), S. 249 - 262.

FIELDS, GARY S.: *Higher Education and Income Distribution in a Less Developed Country.* Oxford Economic Papers, 27. Jg. (1975), S. 245 - 259.

FRIEDMAN, MILTON: *Capitalism and Freedom.* Chicago (The University of Chicago Press) 1962.

FRIEDMAN, MILTON; FRIEDMAN, ROSE: *Free to Choose. A Personal Statement.* New York / London (Harcourt Brace Jovanovich) 1979.

GRÜSKE, KARL-DIETER: *Die personale Budgetinzidenz. Eine Analyse für die Bundesrepublik.* Göttingen (Vandenhoeck & Ruprecht) 1978.

GRÜSKE, KARL-DIETER: *Verteilungseffekte der öffentlichen Hochschulfinanzierung in der Bundesrepublik Deutschland - Personale Inzidenz im Querschnitt und Längsschnitt.* In: Lüdeke, Reinar (Ed.) (Hrsg.): *Bildung, Bildungsfinanzierung und Einkommensverteilung Vol. 2* Berlin (Springer) 1994. S. 71 - 147.

HALL, PETER: *The Bootstrap and Edgeworth Expansion.* Berlin et. al. (Springer) 1992.

HANSEN, LEE W.; WEISBROD, BURTON A.: *Benefits, Costs, and Finance of Public Higher Education.* Chicago (Markham) 1969.

JAMES, ESTELLE; BENJAMIN, GAIL: *Educational Distribution and Income Redistribution through Education in Japan.* Journal of Human Resources, 22. Jg. (1987), S. 469 - 489.

LEMELIN, CLÉMENT: *Short-Term Redistributive Effects of Public Financing of University Education in Quebec.* Canadian Public Policy - Analyse de Politiques, 18. Jg. (1992), S. 176 - 188.

MACHLIS, PETER D.: *The Distributional Effects of Public Higher Education in New York City.* Public Finance Quarterly, 1. Jg. (1973), S. 35 - 57.

MARE, **ROBERT D.**: *Social Background and School Continuation Decisions.* Journal of the American Statistical Association., 75. Jg. (1980), S. 295 - 305.

MARE, **ROBERT D.**: *Educational Stratification on Observed and Unobserved Components of Familiy Background.* Aus: Blossfeld, Hans-Peter; Shavit, Yossi (Eds.) (Hrsg.): *Persistent Inequality. Changing Educational Attainment in Thirteen Countries.* Oxford et. alii (Westview Press) 1993. S. 351 - 376.

MARX, KARL, ENGELS, FRIEDRICH: *Kritik des Gothaer Programms.* Berlin (Dietz) 1962. (= MEW, Vol. 19)

MCGUIRE, **JOSEPH W.**: *The Distribution of Subsidies to Students in California Public Higher Education.* Journal of Human Resources, 11. Jg. (1976), S. 343 - 353.

MCPHERSON, **MICHAEL S.**; **SHAPIRO**, **MORTON O.**: *Does Students Aid Affect College Enrollment? New Evidence on a Persistent Controversy.* American Economic Review, 81. Jg. (1991), S. 309 - 318.

MERZ, **DOMINIQUE**: *Umverteilungswirkungen der schweizerischen Hochschulpolitik.* Basel 1981.

MILLS, **JEFFREY A.**; **ZANDVAKILI**, **SOURSUSHE**: *Statistical Inference via Bootstrapping for Measures of Inequality.* Journal of Applied Econometrics, 12. Jg. (1997), S. 133 - 150.

MUSGRAVE, **RICHARD A.**; **MUSGRAVE**, **PEGGY B.**: *Public Finance in Theory and Practice. 4th ed.* New York et. alii (McGraw Hill) 1984.

PECHMAN, **JOSEPH A.**: *The Distributional Effects of Public Higher Education in California.* Journal of Human Resources, 5. Jg. (1970), S. 361 - 370.

PECHMAN, **JOSEPH A.**: *The Rich, the Poor, and the Taxes they Pay.* Sussex (Wheatsheaf Books) 1986.

SCHENKER, **NATANIEL**; **GENTLEMAN**, **JANE F.**: *On Judging the Significance of Differences by Examining the Overlap Between Confidence Intervals.* The American Statistican, 55. Jg. (2001), S. 182 - 186.

SHEA, **JOHN**: *Does parent's money matter?* Journal of Public Economics, 77. Jg. (2000), S. 155 - 184.

SHORROCKS, **ANTHONY F.**: *Inequality Decomposition by Factor Components.* In: Econometrica, 50. Jg. (1982), S. 193 - 211.

STURN, **RICHARD**; **WOHLFAHRT**, **GERHARD**: *Der gebührenfreie Hochschulzugang und seine Alternativen.* Wien (Verlag Österreich) 1999.

SVR (German Council of Economic Experts): *Annual Report 1999.* Wiesbaden 1999.

TSAKLOGLOU, **PANOS**; **ANTONINIS**, **MANOS**: *On the distributional impact of public education: evidence from Greece.* Economics of Education Review, 18. Jg. (1999), S. 439 - 452.

WISSENSCHAFTSRAT: *Finanzstatistische Kennzahlen ausgewählter Studiengänge. Eine Modellstudie* Köln 1997

XU, **KUAN**: *Inference for Generalized Gini Indices Unsing the Iterated-Bootstrap Method.* Journal of Business and Econoimc Statistics, 18. Jg. (2000), S. 223 - 227.

Appendix to the GSOEP

The German Socio-Economic Panel (GSOEP) is a longitudinal household survey conducted on an annual basis since 1984. In the first wave, some 12,000 individuals aged 16 and over, and distributed across roughly 6,000 households, were interviewed. The information available is drawn from the statements of the individuals. Individual and household identifiers make it possible to track individuals over time. Due to panel attrition, sample size reduces somewhat each year, but in 1998, a refreshment sample of about 2,000 persons has been added to the data base and in 2000, another sample of about 11,000 new individuals has been included. Initially, the sample only referred to residents in West Germany, but following German unification, the sample was extended to the former German Democratic Republic in 1990. The GSOEP is representative of the population residing in Germany and contains a large number of socio-economic variables on demography, education, employment, income, housing and health. For further information on the GSOEP, see Haisken-DeNew and Frick (2000).