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**Working Paper**

## The distributional impact of subsidies to higher education: Empirical evidence from Germany

Diskussionsbeiträge, No. 114

**Provided in Cooperation with:**

Department of Economics, University of Goettingen

*Suggested Citation:* Barbaro, Salvatore (2002) : The distributional impact of subsidies to higher education: Empirical evidence from Germany, Diskussionsbeiträge, No. 114, Georg-August-Universität Göttingen, Volkswirtschaftliches Seminar, Göttingen

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# **Diskussionsbeiträge / Discussion Paper Series**

**Volkswirtschaftliches Seminar  
Universität Göttingen**

**/ Department of Economics  
/ University of Goettingen, Germany**

Beitrag Nr. 114 / Issued No. 114

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

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September 2002

# The Distributional Impact of Subsidies to Higher Education - Empirical Evidence from Germany.

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September 2002

## Abstract

This paper presents empirical evidence on the distributional impact of public higher education through analysis of a cross-sectional view of West Germany in 1997. In contrast to a widely-held hypothesis in economics, our findings do not show evidence for a regressive impact. The use of a net-transfer calculation clearly provides a progressive distributional effect of the benefits from subsidization - at least when viewed in the cross-sectional perspective. The decisive factors are (1) the general social stratification within and among the adjusted income deciles and (2) the incidence of the granted benefits. Complementary to the existing widespread literature in this field, we propose the  $BC_a$ -bootstrap procedure in order to perform statistical inference.

**Keywords:** Higher Education Funding, Income Distribution

**JEL Classification:** H22, H23, I22, I28

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\*Discussions with Helga Pollak, Walter Zucchini, Andreas Haufler, Tara M. Sinclair and Jens Südekum were quite helpful. The author also thanks session participants of the 17<sup>th</sup> Annual Congress of the European Economic Association, Venice, the 2002 Conference of the Association of Public Economic Theory, Paris, and the 58<sup>th</sup> Conference of the IIPF, Helsinki, where an earlier version of this paper was presented. The author is also grateful to two anonymous referees.

# 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. In other words, the nurse is being taxed to support the higher education of the dentist's son. In Germany and possibly elsewhere, this reproach concerning the fiscal activity in higher education is 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 "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 and Engels, 1875[1962], p. 30); own translation) Over a century later, 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, p. 105). Due to Friedman's expression, this thesis is henceforth referred as 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 obtain 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 and Friedman, 1979, p. 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 (1969). In their article, they showed that worse-off households in California 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 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, p. 361)). Furthermore, he demonstrates 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 in which the head of the family is between the ages of 35 and 60 years 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 (1975) for Kenya, Crean (1975) for Canada, Merz (1981) for Switzerland, James and Benjamin (1987) for Japan, Lemelin (1992) for Quebec and Griske (1994) for Germany provided more empirical results. All of them used a net-transfer calculation. Except for Fields, Lemelin and Merz, all authors found that the distributional impact is progressive. Merz concluded with a proportional incidence, Fields determined the middle-income groups as the net wealthier, and Lemelin provide a regressive impact when parent's education is used to define the social position of families. 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. Tsakoglou and Antoninis (1999) used the equivalence consumption expenditure for each household as an indicator for the household's welfare level. In order to judge to what

degree inequality was reduced through public education on various levels, they used some inequality indices. Unfortunately, they did not consider that the incidence of the tax burden to finance the subsidization and statistical inference is neglected. Irrespective of these methodological problems, they hint at regressive effects for tertiary education. The first research using equivalence incomes and a net-transfer calculation was done by Sturn and Wohlfahrt (1999). They concluded that public subsidization in Austria in 1994 had a clearly progressive impact. Regardless of the fact that empirical evidence is at least inconclusive, international research initiatives and most textbooks often refer to the thesis of a regressive distributional impact and many models take it for 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 provides 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 going through their life-cycle. For the former, using a cross-sectional examination is only possible; for the latter a long run analysis might be appreciated. One of the possible questions related to longitudinal analysis that needs to be addressed is whether or not graduates actually *pay back* their received benefits from public subsidization within their lifetime (for example: Gröske 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. Gröske 1994, Barbaro (2001)). The relation to such a socioeconomic variable is possible only if an under-representation of students from socio-economically disadvantaged backgrounds in higher education could be ascertained. Then, one can argue that students from higher-income families benefit the most from the subsidies and that those fortunately able to get their higher education subsidized would receive all the returns from the human capital investment, but the costs would be borne by all taxpayers, including the poorer ones. This paper deals with topics associated with the distribution of children from various income brackets in German higher education institutions. Hence, cross-sectional analysis also makes a contribution to this view, even if this research is not concerned with the long-run effects directly. For instance, suppose that most of the students have descended from poor families. How can the thesis noted above be supported? In any case, an empirical analysis concerning the long-run effects would be very interesting and useful, but would also exceed the usual size of a journal paper.

### 1.2 Organization of the paper

The present paper is organized as follows: section 2 deals with methodology and data, in section 3, empirical evidence for the distribution of children from various income brackets in the German higher education system is presented. On this analysis, a net transfer calculation is built in order to ascertain the net incidence which is outlined in section 4. Section 6 provides further extensions including the distributional impact of a partial cut of the subsidies. Additionally, it shall be investigated in subsection 6.3 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 ( $BC_a$ ) are used.

## 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 particularly on the student representation effect, that is, does each income bracket contributes a pro rata share of students to the higher education system. Furthermore, but to a less 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 both the German and the US case (Grüske (1978), Pechman (1986) ) indicates 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 and Wohlfahrt (1999) and Grüske (1994). As a consequence, each income bracket contributes a portion of the whole tax revenue, which is the exactly 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<sup>1</sup>. Students / households also receive cash benefits through the student financial 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:  $\frac{AR}{CE-ES}$ , where AR denotes the administrative revenues, CE denotes the current expenditure and ES denotes the revenues from external sources<sup>2</sup>. Using this procedure, the wanted share comes to 75.6 %. Furthermore, we define half of the rest (distributed to non-medicinal faculties) as public subsidization, according to a procedure proposed by the Wissenschaftsrat<sup>3</sup> (cf. Wissenschaftsrat 1997:32f). Thus, every student / household receives an

<sup>1</sup>In 1997, an amount of 220 DM per month (Child benefit) was granted for the first and second child, 300 DM for the third and 350 DM for the fourth, fifth and so on. Better-off households assert a child allowance of 288 DM (divorced parents) and 576 DM (married Parents). The *Haushaltsfreibetrag* was an allowance of monthly 468 DM, and the *Ausbildungsfreibetrag* accounts for 200 DM.

<sup>2</sup>The author is grateful to Heinz-Werner Hetmeier from the Federal Statistical Office, Wiesbaden for helpful advices concerning that issue and to an anonymous referee for a helpful remark

<sup>3</sup>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 with respect to content and structure, as well as on the construction of new universities.

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 part of the 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 obtain 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 to as revenue incidence (tax incidence, therefore revenue of the state) and the incidence of the benefits is henceforth referred to as expenditure incidence. The difference is the result of the net transfer calculation and can be called the net incidence (cf. Grüske (1994)). 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 15<sup>th</sup> social survey (bmbf (1999)). 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 whether or not their parents were living together in the same household. 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, see, for further details, the appendix).

### 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 and Zandvakili 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 further details: Mills and Zandvakili (1997) and 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<sup>4</sup>. 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  $(\hat{\theta}_{lb}, \hat{\theta}_{ub})$  of intended coverage  $1-2\alpha$ , is obtained directly from these percentiles, therefore,  $(\hat{\theta}_{lb}, \hat{\theta}_{ub}) = (\hat{\theta}^{*(\alpha)}, \hat{\theta}^{*(1-\alpha)})$ , whereby  $\hat{\theta}^{*(\alpha)}$  indicates the  $100 \cdot \alpha^{th}$  percentile of B

<sup>4</sup>E.g., Burr (1994) studied bootstrap confidence intervals for three types of parameters in Cox's proportional hazards model, Mills and Zandvakili (1997) using the bootstrap percentile method proposed by Efron and Tibshirani (1993), Xu (2000) appealing inference using the iterated-bootstrap method proposed by Hall (1992). See also Mac Kinnon (2002) for a recent survey on the role of bootstrap inference in econometrics.

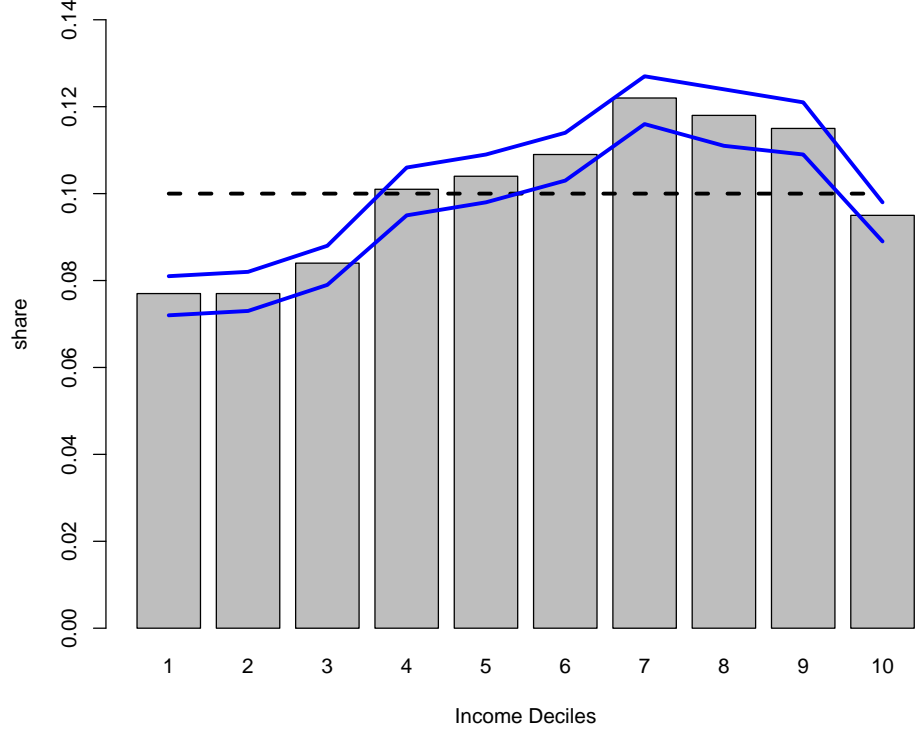


Figure 1: The Distribution of Children from various income brackets enrolled in higher education compared with the entire population. Source: bmbf, GSOEP, own calculations

bootstrap replications. Percentiles of the bootstrap distribution also give the  $BC_a$  intervals endpoints, but they further depend on an accelerator ( $acc$ ) and the bias-correction ( $z_0$ ). The  $BC_a$  interval of intended coverage  $1 - 2\alpha$ , is given by  $(\hat{\theta}_{lb}, \hat{\theta}_{ub}) = (\hat{\theta}^{*(\alpha_1)}, \hat{\theta}^{*(\alpha_2)})$ , where

$$\begin{aligned}\alpha_1 &= \Phi\left(\hat{z}_0 + \frac{\hat{z}_0 + z^{(\alpha)}}{1 - acc(\hat{z}_0 + z^{(\alpha)})}\right) \\ \alpha_2 &= \Phi\left(\hat{z}_0 + \frac{\hat{z}_0 + z^{(1-\alpha)}}{1 - acc(\hat{z}_0 + z^{(1-\alpha)})}\right)\end{aligned}$$

$\Phi(\cdot)$  is the standard normal cumulative distribution function and  $z^{(\alpha)}$  is the  $100\alpha^{th}$  percentile point of a standard normal distribution (for further details see Efron and 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 particularly on the amount of children each income decile sends to the higher education system.

Figure 1 depicts the distribution of children from various income brackets enrolled in higher education compared with the entire population. The horizontal line indicates the entire population. Every income deciles consists of 10 % of the whole population according to the definition of income deciles. The filled bars indicate whether or not households with children enrolled in higher education are over- or under-represented, respectively. The lines around the bars indicate the confidence intervals with 95 % confidence.



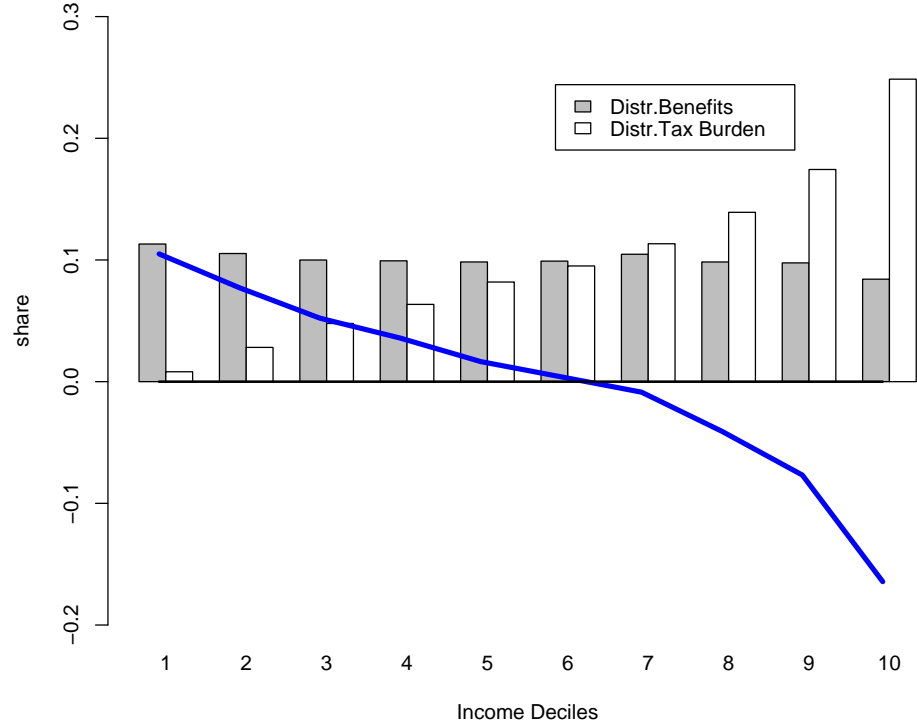


Figure 2: Net Incidence. Source: bmbf, GSOEP, own calculations

For example, 10 percent of the entire population is part of the bottom decile, but 7.65 percent of all students are descended from this decile and, hence, the bottom decile, is significantly under-represented in higher education. The same applies to the second and the third decile but also for the top one. While the 4<sup>th</sup> and 5<sup>th</sup> deciles are neither under- nor over represented in higher education (because the confidence intervals overlap the 10 %-line), an over-representation applies to the 6<sup>th</sup> to the 9<sup>th</sup> 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 over-representation 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 over-representation is not excessive.

## 4 Net Transfer Calculation

### 4.1 The Distribution of the Benefits (Expenditure Incidence)

The filled bars in Figure 2 show the distribution of benefits among the income deciles. It can be seen that the benefits are more or less evenly distributed, regardless of the fact that the students are less evenly distributed. The bottom to the 3<sup>rd</sup> decile receives a disproportionately high share of all the 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 primarily attributed to 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 small, in comparison to the upper deciles. 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 show the tax incidence. According to the assumption made in regards 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 all the 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 7<sup>th</sup> 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 would experience the same. At no point do we contradict this commonly observed fact (cf. Shea (2000), Blossfeld and Shavit (1993), McPherson and 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-sectional view, only children who are actually 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 5<sup>th</sup> decile is about 2.5 times larger compared 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 5<sup>th</sup> one to enroll the same amount of students. This is the consequence of the level effect. Roughly speaking, there are not enough children in top decile-households who could get a 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-sectional view.

## 6 Extensions

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

Analyzing the distributional effect of a modified net price (i.e., through an abolition of the student aid or of a reduction of the tuition fee subsidy) is another interesting issue with respect to policy implications. We could not simply rework the net transfer curve from Figure 2 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. McPherson and Shapiro (1991) investigated the overall schemes between student aid and enrollment. Their analysis demonstrates that changes in the net price (e.g., a decrease of the student aid)

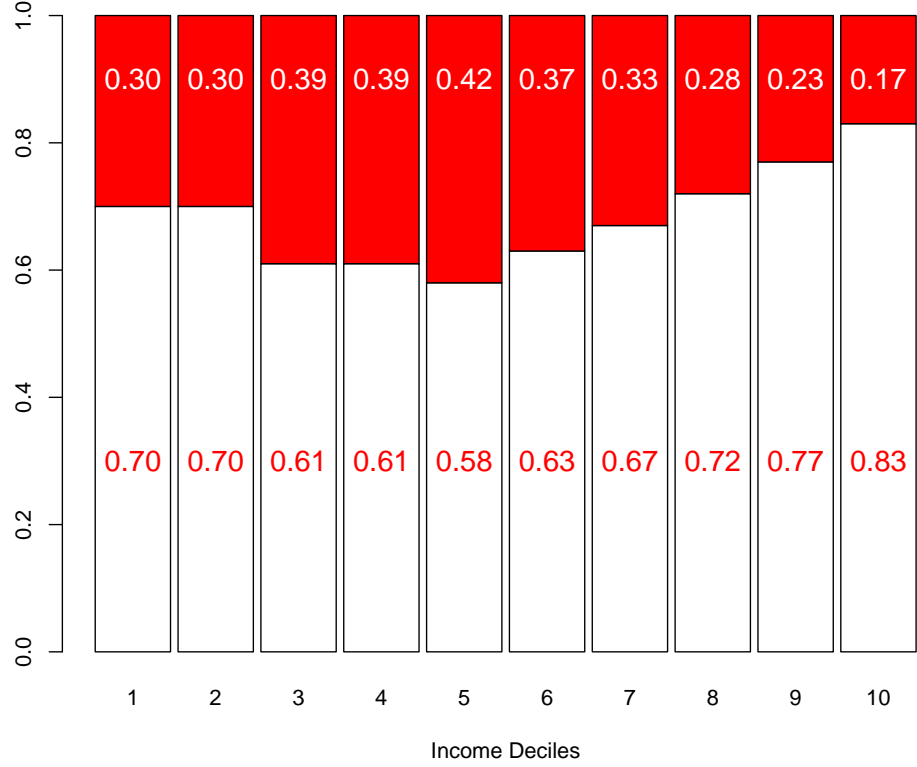


Figure 3: The distribution of households with and without children among the income deciles. The filled bars indicate the households with children. Source: own calculations based on GSOEP.

in the case of 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 effect because they would contribute by means of taxes in order to provide for 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 an abolition of the student aid, we 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 bold line (indicated by circles) in Figure 4 is taken from Figure 2. The line, which is indicated by triangles indicates the net incidence resulting from the first scenario (elasticity  $\eta = 0$ ) and the 3<sup>rd</sup> lines (indicated by crosses) shows the net incidence resulting from the assumption of  $\eta \rightarrow \infty$ . 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. Furthermore, even when enrollment behavior remains unchanged (as in the former 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 and 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

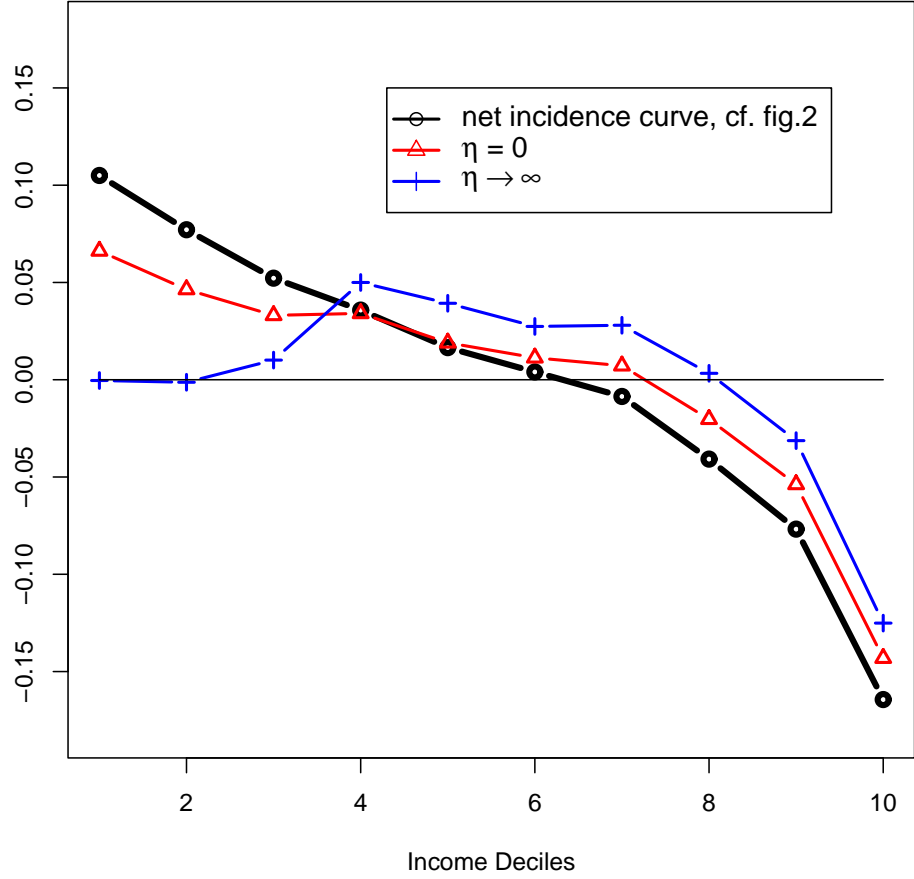


Figure 4: Alternative scenarios for a repeal of the student aid with various elasticities of demand.  $\eta$  indicates the elasticity of enrollment with respect to the student aid. Source: own calculations

from the subsidies.

## 6.2 The Effect of the Equivalence Elasticity

As noted above, the equivalence elasticity is set to  $\frac{1}{2}$  to compute roughly equated income deciles. Recent studies use the so-called modified OECD scale. The modified OECD scale assigns a normalized weight of unity 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

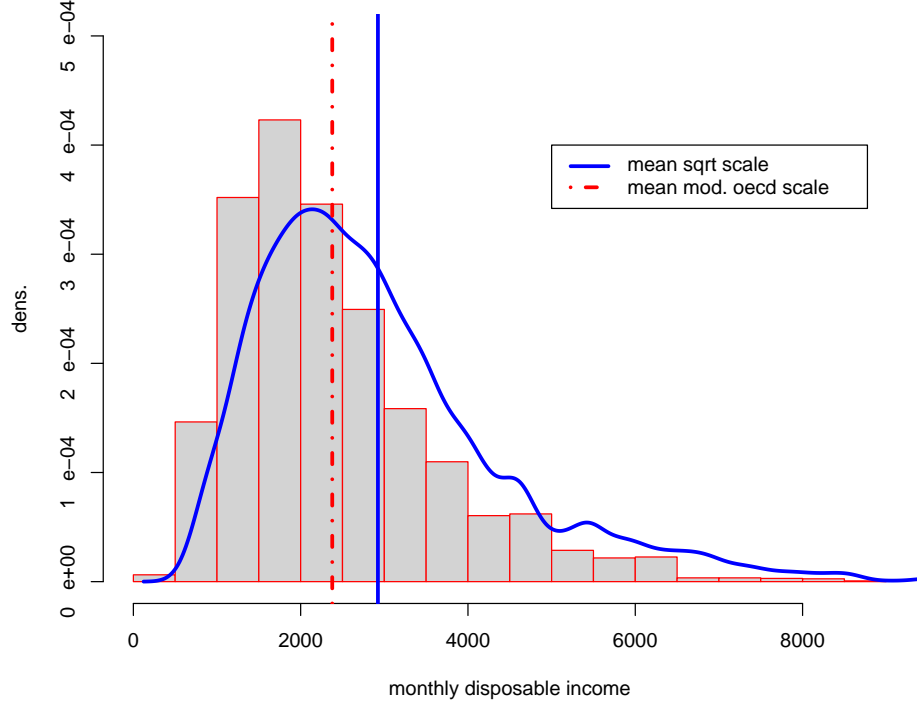


Figure 5: Net income distribution of households with children enrolled in higher education - equivalence scales compared. Source: bmbf, own calculations.

on the student representation effect, the use of the square root scale is more conservative (i.e., brings out a less progressive distributional impact). 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 makes the households with children poorer. It could be presumed that households which are part of an intermediate decile would be part of an upper one if unequivalized income levels were used and vice versa. By performing the same procedure as in the previous chapters, it is interesting to note that the picture does not change considerably. Most households remain in their original decile plus or minus 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 two-fold. First, it affects the distribution among all households in the population and, second, 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

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

(where  $\bar{Y}$  indicates the mean of the incomes over all individuals  $i$ , and  $n$  indicates the number of observations, respectively), we might ask 1. Does public subsidization lead to a significant change in income

distribution and, 2. 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 (1982):

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

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

**Result (2.)**

Disposable income without subsidization	1.1773	(1.1619; 1.1842)	
Child Benefit / Child allowances	-.0179	(-.0183 ; -.0174)	
Other Allowances	-.0072	(-.0074 ; -.0072)	(Bootstrap BC <sub>a</sub> -Confidence Inter-
Bafög	-.0904	(-.0957 ; -.0861)	
In-Kind	-.0634	(-.0634 ; -.0608)	

vals with 99 % confidence in brackets, 1000 replications) 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 lesser extent, it has been focused on empirical investigations where it has been ignored by both textbook authors as well as the 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 and 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 particularly 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 still cannot be confirmed. Some significant assumptions (first of all, the proportional tax incidence) had to be made due to a lack of data. Bedau and 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 our 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 more effectively 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 ended up being counted twice. As we have described in subsection 2.4, two sources of data have been used, the GSOEP and the 15<sup>th</sup> Social Survey. In the latter, students are invited to give information on parents' income. Unfortunately, we cannot judge whether students tend to

underestimate (or overestimate) their family income. 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 lack of data, 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-sectional view, it is often expressed that the distributional impact should also be considered in the long-run. As Musgrave/Musgrave pointed out, in discussing the incidence of various fiscal activities in the longer run, the distributional impact will depend on the resulting effects of factor supplies, rates of return, and growth (cf. (Musgrave and Musgrave, 1984, p. 678)). Additionally, examinations for the long run depend on the use of longitudinal data and on a personal framework for analyzing the impact.

## 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. 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).

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