The Australian National University

Centre for Economic Policy Research

DISCUSSION PAPER

Student Loan Reforms for German Higher Education: Financing Tuition Fees

Bruce Chapman
Crawford School of Economics and Government, ANU

Mathias Sinning
Research School of Economics, ANU, RWI and IZA

DISCUSSION PAPER NO. 646

November 2010

ISSN: 1442-8636
ISBN: 978-1-921693-27-4

Student Loan Reforms for German Higher Education: Financing Tuition Fees

Bruce Chapman
Crawford School of Economics and Government, ANU

Mathias Sinning
Research School of Economics, ANU, RWI and IZA

November 2010

Abstract

Due to the unknown future economic situation of students, private banks are unwilling to provide student loans in the absence of collateral. This market failure requires government intervention to prevent socially sub-optimal and regressive outcomes. Income contingent loans, whose repayment depends on the borrowers' future capacity to pay, can offer a possible solution to this problem. In this paper, we compare alternative income contingent loans for financing tuition fees at German universities. Several German states have introduced tuition fees at their universities since summer 2007 and publicly owned banks have started to offer student loans to cover these fees. Our empirical findings highlight the benefits of income contingent loans and demonstrate that tuition fees at German universities could increase considerably if an income contingent loan system would be implemented to provide students with the financial resources they need to pay these fees.

JEL-Classification: H52, I22, I28

Keywords: Educational Finance; Student Financial Aid; State and Federal Aid; Government Expenditures on Education

---

The authors are grateful to Kiatanantha Lounkaew for very helpful comments. All correspondence to Mathias Sinning, Research School of Economics (RSE), HW Arndt Building 25a, Australian National University, Canberra ACT 0200, Australia, Tel: 61 2 6125 2216, Fax: 61 2 6125 1816, E-mail: mathias.sinning@anu.edu.au.

1 Introduction

Despite the high demand for qualified people in the German economy, government spending on tertiary education in Germany is below the OECD average (OECD, 2010). Although the German government recognizes the need for larger investments in higher education of young generations, the financial scope in the presence of unprecedented public debt and declining tax revenue is rather small. Several German states have introduced tuition fees of up to €500 per semester since summer 2007 to cover a small fraction of the annual cost of about €7,000 per student and publicly owned banks have started to offer student loans to finance these fees.[1]

In this paper, we propose an alternative approach to student financing that involves the design of income contingent loans (ICLs) for financing tuition fees, similar to Australia's Higher Education Contribution Scheme (HECS) and the student loan system of the UK. We examine the case in which annual tuition fees at German universities increase to €3,500 per student to cover about 50% of the total cost.[2] The attraction of ICLs is that they can be designed to avoid many of the problems associated with alternative financing policies. First, there is no concern with intra-family sharing so long as the scheme is universal. That is, no students would be denied access through the imposition of means-testing arrangements that could exclude some whose parents or partners are unwilling to help.

Second, given an efficient collection mechanism, there is no default issue as such for the government. That is, if the tax system works well and is used to collect the debt, it is extremely difficult for the vast majority of graduates to avoid repayment. There is a form of a default issue in that some students will not pay back in full, because ICLs are designed to excuse some former students' payments when their

[1] According to the Federal Statistical Office (2008), the average annual public expenditure on tertiary education per student in 2005 was €7,180.

[2] This amount is comparable to the current maximum tuition fee of £3,290 (about €4,000) for the 2010/2011 academic year in the UK.

lifetime incomes are low. Other reasons loans may not be repaid include death and emigration.

Third, because repayments depend on income, there should be no concern for students with respect to incapacity to repay, or repayment hardships due to low income. Once an individual's income determines repayment, and so long as the repayment parameters are sufficiently generous, the students' prospects of default or repayment hardship are eliminated. This is the critical practical advantage of ICLs – unlike other forms of assistance the arrangement provides insurance against default and repayment difficulties.

ICLs have significant advantages over alternative financing arrangements in that they can be designed to avoid the major problems of their alternatives. However, as noted above, it is essential that there is an efficient collection mechanism to make an ICL operational and effective. While most OECD countries will have income tax or social security systems that enable efficient collection of income contingent debts, it is unlikely that the majority of developing countries has the capacity to meet the requirements for a successful ICL. There is no doubt that the German income tax system is sufficiently sophisticated to allow efficacious ICL collection.

The following analysis focuses on two important elements of ICLs: implicit interest rate subsidies (which result from the collection of low or no interest and constitute a cost to the taxpayer) and repayment burdens (the share of a person's income that is needed to service the debt). These elements, which are described in detail below, allow us to draw inferences about the efficiency of alternative loan schemes. Our analysis departs from a consideration of implicit interest rate subsidies of conventional loan schemes that are based on current design parameters. In order to calculate repayment burdens, we use data from the German Microcensus 2007, which constitutes an excellent data source for the purpose of our analysis because it includes a large representative sample of university graduates in Germany. To calculate repayment flows, we estimate age-earnings profiles, using linear and unconditional quantile regression models. We differentiate between men and women residing in East and West Germany and calculate separate repayment flows for university graduates and

PhDs. The estimates obtained from the regression models allow us to compare implicit interest rate subsidies and repayment burdens of conventional loans and ICLs across the earnings distribution.

Our empirical findings highlight the benefits of ICLs and demonstrate that tuition fees at German universities could increase considerably if ICLs would be implemented to provide students with the financial resources they need to pay these fees. Our findings further suggest that conventional loans would either produce very high interest rate subsidies or unacceptable repayment burdens if annual tuition fees would increase to €3,500 per student, while ICLs can exhibit both low interest rate subsidies and low repayment burdens. Depending on the implicit interest rate subsidy and the default rates of the respective ICL, higher tuition fees could generate a public revenue of about €3-4 billion per year if they were introduced at all public universities in Germany.

The paper is organized as follows. Section 2 explains the concept of implicit interest rate subsidies and repayment burdens. Section 3 outlines relevant aspects of institutional conditions in the German context and discusses the design of alternative loan schemes. A description of the data and a discussion of age-earnings profiles is given in Section 4. Section 5 discusses design issues for ICLs. Section 6 concludes.

2 Interest Rate Subsidies and Repayment Burdens

2.1 Interest Rate Subsidies

The efficiency of a loan system depends on its recoverability which may be reduced by intended and unintended subsidies. An interest rate subsidy is typically the unintended consequence of the design of a financing scheme. To distinguish interest rate subsidies from other intended tuition fee subsidies, they are usually called "implicit interest rate subsidies". An implicit interest rate subsidy is defined as the difference between the present value of the tuition fee paid through the loan scheme (PV_F) and

the present value of the repayment flow (PV_R):

$$\text{implicit subsidy} \quad = \quad \sum_{t=1}^{T} \frac{F_t}{(1+\delta)^{t-1}} - \sum_{d=T+1}^{T+D} \frac{R_d}{(1+\delta)^d} = PV_F - PV_R,$$

where F_t is the tuition fee paid in year t ($t = 1, ..., T$), R_d is the loan repayment in year d ($d = T+1, ..., T+D$) and δ is the discount rate. The share of the present value of the tuition fee that is repaid through the loan scheme is given by

$$\text{percentage of implicit subsidy} \quad = \quad \frac{PV_F - PV_R}{PV_F} \times 100.$$

This share may be considered as a benchmark that allows comparisons of the relative fiscal burden of alternative loan schemes. The implicit interest rate subsidy is equal to zero if the nominal debts are repaid in full using a real rate of interest equal to the discount rate of the government. In this case, the present value of the tuition fee equals the present value of the repayment flow. The subsidy will be positive, however, if the real rate of interest is less than the discount rate because the resulting loan repayment will take longer and the present value of repayment will be reduced.

2.2 Repayment Burdens

The repayment burden of a loan is the share of a person's income needed to service a debt at a time period t ($t = 1, ..., T$):

$$\text{Repayment burden}_t \quad = \quad \frac{\text{Loan repayment}_t}{\text{Income}_t}.$$

Repayment burdens are important for the comparison of student loans. A greater repayment burden allows less consumption and/or savings at a given income and increases the likelihood that debtors default on loan repayments. Woodhall (1987) highlights the trade-off between taxpayer interest rate subsidies and former students' repayment burdens and mentions the possibility that lower interest rate subsidies can increase default probabilities and ultimately result in higher taxpayer contributions.

ICLs are explicitly designed to avoid high repayment burdens. However, the proportion of a debtor's income to which repayment burdens should be limited to remains unclear. Based on an extensive body of literature, Baum and Schwartz

(2006) suggest that the repayment of student loans should not exceed 8 percent of the gross income of a former student. The design of all ICLs presented in this paper is based on a repayment burden of 6 percent.

3 Institutional Setting and Student Loan Design

3.1 Student Loans for Tuition Fees in Germany

In 2009/2010, almost 250,000 students started to study at one of the 110 universities in Germany. Less than 11,000 students currently attend one of the 10 private universities, while the total number of students at German universities is about 1.4 million. About 11 percent of the students at German institutions of higher education are foreign-born.[3] Since German universities used to be free for all students (except for a lump-sum fee for administrative and other purposes), student loans used to focus exclusively on the funding of student's living expenses.[4]

Tuition fees of up to €500 per semester were introduced in the following seven states since summer 2007: Baden-Württemberg, Bavaria, Hamburg, Hesse, Lower Saxony, North Rhine-Westphalia and Saarland. The introduction of these fees was very unpopular and led to student protests at many universities. In summer 2008, general tuition fees were abolished in Hesse because they were considered unconstitutional. At the same time, Hamburg eliminated the need for a student loan to finance tuition fees by starting to collect a general tuition fee of €375 per semester after the end of the study period. Finally, after state elections in Saarland, a new coalition abolished general tuition fees in summer 2010.

As a result of the introduction of tuition fees, publicly owned banks offer student

[3]Both the Federal Statistical Office (http://www.destatis.de) and the association of universities and other higher education institutions (*Hochschulrektorenkonferenz*, http://www.hochschulkompass.de) regularly publish the most recent student and university numbers on their websites.

[4]The Federal Training Assistance Act (*Bundesausbildungsförderungsgesetz* or *BAföG*) that regulates student loans for financing living expenses focuses on students from low-income households. The eligibility for these student loans typically depends on the parents' income. A more detailed discussion of these loans is beyond the scope of this paper.

loans to cover these fees. Table 1 gives an overview of these loans.[5] In general, all students are eligible for a loan if general tuition fees are collected in their state. However, there are age limits in all states that vary between 35 years in Lower Saxony and 60 years in North Rhine-Westphalia. In addition, students may only receive a loan for up to 2 years after their regular period of study (which depends on the field of study). Foreign students are usually only eligible if they either come from an EU member state, have received their university-entrance diploma in Germany, or are recognized as refugees or asylum seekers.

The loan repayment typically starts after the end of a deferment period, which lasts between 1.5 and 2 years and monthly repayment installments vary between €20 and €150. Nominal interest rates also vary considerably across states (see Table 1) and upper limits are not guaranteed for the entire study period. Table 1 further reports an upper debt limit, which constitutes the highest amount that has to be repaid. Since this debt limit may also include loans that were provided for financing living expenses, former students who have received a sufficiently high loan for their living expenses do not have to pay back the loan they received for tuition fees.

The student loans provide default insurance, i.e. they do not have to be repaid if the individual (monthly) net income is below a certain threshold (see Table 1). Specifically, former students with a sufficiently low income can apply for postponing their payment. Loan defaults due to income and repayment limits are being financed through the tuition fees themselves and universities have to pay a part of their revenue into a default fund.

3.2 The Design of Student Loans

Although existing student loans appear to work if tuition fees are sufficiently low, it seems likely that they perform less well if tuition fees increase considerably because higher tuition fees result in longer repayment durations and/or higher repayment burdens. Departing from the loans currently offered by publicly owned banks, we

[5]Detailed information about public loans for financing tuition fees at German universities is provided on http://www.studis-online.de and http://www.bafoeg-aktuell.de.

may ask the question: "How would the repayments look like if tuition fees would increase but the rates of repayment would stay the same?" To address this question, we design hypothetical loans based on current repayment flows. Since the monthly repayment rate of a student loan typically varies between €50 and €150 in most states (with the exception of Bavaria, where the minimum rate is only €20), we consider monthly repayment rates of €50 and €150 (i.e. annual repayment rates of €600 and €1,800) as two extreme cases of conventional loans. We will later compare these conventional loans to alternative ICLs.

The design of both the conventional and the income contingent loan schemes relies on a number of (weak) assumptions about the size of relevant parameters. Specifically, we assume a discount rate of 3 percent per annum in real terms for the calculation of present values.[6] The tuition fee is set to €17,500 for a 5-year study period.[7] We consider the case in which former students start to repay the loan after the end of a 3-year deferment period if their income is above the tax-free amount. In 2007, unmarried persons did not pay taxes if their annual income was below €7,671.[8] Given these parameters, we consider three schemes that depend on the choice of the real interest rate and a tuition surcharge:

- Scheme 1: 0 percent real interest, no surcharge,
- Scheme 2: 0 percent real interest, 25 percent surcharge,
- Scheme 3: 3 percent real interest, no surcharge.

Introducing a 25 percent surcharge is similar to Australia's HECS arrangement except for one important difference: The HECS system provides a 20 percent discount

[6]This rate corresponds approximately to the return of a long-term government bond (*Bundesanleihe*).

[7]We further assume that PhDs study three years longer than other university graduates without paying additional tuition fees.

[8]As a result of the sharp discontinuity in the taxable income, university graduates may face a very high effective marginal tax rate at this threshold. In the Australian context, Chapman and Leigh (2009) find that taxpayers bunch below this repayment threshold but that the effect is economically small, suggesting that the sharp discontinuity in the repayment threshold is no problem for the design of ICLs.

for an upfront payment of the tuition obligation, implying a 25 percent surcharge for graduates who choose to take the debt (Chapman and Lounkaew, 2009).[9]

To investigate interest rate subsidies and repayment burdens of conventional loan schemes (similar to those currently offered by publicly owned banks), we start by designing two hypothetical loans based on current repayment rates that vary between €600 (type a) and €1,800 (type b) per year. The repayments of the conventional schemes are presented in Figure 1. We assume that the two loans are being repaid according to Scheme 1 and label them Scheme 1a and Scheme 1b, respectively. Using the assumptions about the size of relevant parameters outlined above, we consider two additional repayment schemes for each loan that either include a tuition surcharge of 25 percent (Schemes 2a and 2b) or a real rate of interest of 3 percent (Schemes 3a and 3b). To allow comparisons across schemes, we hold repayment durations constant. As a result, the repayment duration of Schemes 1a through 3a is 28 years, while it takes 10 years to repay the loan according to Schemes 1b through 3b.

Since we hold the repayment durations constant, the repayment rates increase across schemes. Specifically, while the repayment rate of Scheme 1a is €600, a repayment rate of €750 is needed to repay the loan according to Scheme 2a. The repayment rate of Scheme 3a is €1,075 for graduates without and €1,175 for graduates with a PhD. Introducing a tuition surcharge of 25 percent increases the repayment rate of €1,800 (Scheme 1b) to €2,100 (Scheme 2b), while a real rate of interest of 3 percent results in a repayment rate of €2,400 for graduates without and €2,600 for graduates with a PhD.

Due to the long repayment duration of Schemes 1a through 3a, annual repayments of less than €1,200 appear to be rather unrealistic because it seems likely that most university graduates do not want to repay their student loans beyond the age of 55 years. In contrast, Schemes 1b through 3b represent realistic examples for financing annual tuition fees of €3,500 over a five-year period through a conventional loan with

[9] A 20 percent discount corresponds to and 25 percent surcharge because a charge of €1,000 can be avoided by paying €800. Students paying later take on an additional €200/€800=25 percent.

a repayment duration of 10 years. Since the ICLs that will be designed in Section 5 have a repayment duration of about 10-15 years, our discussion of conventional loans will focus predominantly on Schemes 1b through 3b.

3.3 Interest Rate Subsidies of Conventional Loans

Table 2 includes the implicit interest rate subsidies of the conventional loan schemes. We find sizable differences in interest rate subsidies across schemes. Specifically, the implicit interest rate subsidy of a conventional loan with a real rate of interest of zero percent and no surcharge is between 30 and 50 percent. Imposing a surcharge of 25 percent reduces the interest rate subsidy considerably. In particular, the interest rate subsidy of Scheme 2b is only 15-22 percent. As discussed earlier, there is no subsidy if the real rate of interest is set to 3 percent, which equals the discount rate of the government.

Faster repayment improves the recoverability of the loan if the real rate of interest is lower than the discount rate. Consequently, the subsidies of Schemes 1b and 2b are lower than the respective subsidies of Schemes 1a and 2a. On balance, these numbers reveal that implicit interest rate subsidies of a loan can be very high if the real rate of interest is below the discount rate of the government. However, interest rate subsidies may be reduced considerably by imposing a surcharge. In contrast to ICLs, interest rate subsidies of conventional loans are constant across the entire population of university graduates because the repayments of these loans are not income contingent.

4 Data and Predicted Earnings Functions

4.1 Data

In our empirical analysis, we use data from the German Microcensus 2007, an annual representative cross-sectional survey of 1 percent of all German households collected by the German Federal Statistical Office. The data set includes information

about the population structure, the economic and social situation of the population, families, consensual unions and households, employment, job search, (continuing) education/training, the housing situation and health. The Microcensus constitutes an excellent data source for the purpose of our analysis, because it includes a large sample of university graduates and allows a construction of all relevant variables. However, due to the design of the survey and the questionnaire, assumptions have to be made to construct the income variables that are needed for the empirical analysis. Specifically, information about the monthly net income of employed individuals is used to generate two relevant dependent variables: "annual gross earnings" and "hourly gross wages". The monthly gross income is obtained by using an online income tax calculator for the year 2007.[10] We define annual gross earnings as 12 times the monthly gross income, while hourly gross wages are obtained by dividing the monthly gross income by the number of working hours per month.[11]

In order to investigate the overall impact of income contingent loans and allow comparisons between individuals with and without university degree, we impose very few sample restrictions. Specifically, we restrict our sample to German citizens between 26 and 65 years of age. We further drop persons who are either self-employed, in the military or working as civil servants. We also remove employed persons without positive income. After dropping all observations with missing values on one of the variables used in our analysis, our sample includes 70,019 men and 78,201 women residing in West Germany as well as 20,967 men and 22,428 women residing in East Germany. 54,251 men and 48,938 women in West Germany as well as 14,088 men and 13,932 women in East Germany are employed. The sub-sample of university graduates (both employed and not employed) consists of 7,459 men 6,447 and women in West Germany and 2,224 men and 2,085 women in East Germany.

Table 3 includes summary statistics for the sample of both employed and not em-

[10]See http://www.parmentier.de/steuer/incometax.htm. The monthly gross income is calculated separately for single and married households with and without children.

[11]The Microcensus includes information about "actual" and "normal" (contractual) working hours. We focus on the number of normal working hours as long as it is below the reported number of actual working hours. The number of actual working hours is considered if it exceeds the number of normal working hours.

ployed individuals. The numbers do not only reveal sizable differences between men and women but also between West and East Germany. In particular, differences in the labor markets of the two regions persist even two decades after the reunification. Considerable earnings differentials do not only exist between men and women but also between West and East Germany. Moreover, while almost 78 percent of the 26-65 year old men are employed in West Germany, the corresponding employment rate is only 67.3 percent in East Germany. At the same time, the labor force participation rate of women is about 63 percent both in West and East Germany. Despite the large earnings differential, the numbers do not suggest that the East German population is less educated than the West German population. Instead, women in East Germany are on average better educated than women in West Germany. Overall, these numbers highlight considerable differences between men and women in the two regions. For that reason, our empirical analysis is performed separately for these four groups.

The numbers in Table 4 refer to the sample of employed and not employed university graduates. Again, we distinguish between men and women in West and East Germany. We find that average earnings of male graduates in West Germany are much higher than those of male graduates in East Germany. While female graduates earn less than male graduates, the earnings differential between female graduates in West and East Germany is rather small. Female labor force participation among graduates is about 78 percent in both regions, while the employment rate among male graduates is about 88 percent in West Germany and 80 percent in East Germany. Finally, Table 4 includes the distribution of graduates across disciplines. The numbers suggest that graduates in East Germany were much more likely to study sciences, while a larger share of West German graduates focused on education. A higher share of male graduates in West Germany studied business, while the share of female business graduates is slightly higher in East Germany. Differences in the distribution across other disciplines are rather small.

4.2 Predicted Earnings Functions

In order to calculate the repayment flow of an income contingent loan, we estimate the age-earnings profile for each subgroup by employing a standard earnings regression model which includes a set of indicator variables for different levels of education and a quadratic function of age. A methodological problem arises from the nonlinear nature of the dependent variables because income is measured in brackets rather than on a continuous scale. For that reason, interval regressions represent the most appropriate way of estimating our earnings functions. However, accounting for nonlinearity causes several methodological problems that have to be addressed. First, hourly gross wages cannot be constructed without additional assumptions. Second, the interval regression model does not always achieve convergence, which prevents us from estimating earnings functions for all sub-samples. Third, the interval regression model inhibits distributional analyses because it may only be used to estimate mean effects of the regressors on the dependent variable. Fortunately, the number of income brackets is sufficiently large (there are 24 categories) to justify the use of mean points and to estimate linear rather than interval regression models.[12]

The predicted average age-earnings profiles for the four groups are presented in Figure 2.[13] Within each of the four groups, we differentiate between individuals with and without university degree. We further distinguish between university graduates with and without a PhD. All figures show that average earnings increase over the life cycle (and slightly decrease in old age). Moreover, the age-earnings profiles start at different points of the life cycle and at different levels, depending on educational attainment. For simplicity, we assume that individuals with a university degree start to work at age 29, while those with a PhD start at age 32. While average annual earnings of individuals without university degree remain relatively low over the entire

[12] A comparison of linear and interval regression estimates (in cases where convergence could be achieved) suggests that there are no qualitative differences in the results between the two approaches and that quantitative differences are relatively small. The estimates of the interval regression models are available from the authors upon request.

[13] The age-earnings profiles were derived from earnings functions similar to those presented in Tables A1 and A2 of the appendix. Our estimates provide strong evidence for significant private returns to education and an inverted U-shaped age-earnings profile.

life cycle (below €35,000 for men in West Germany and below €20,000 for the remaining groups), earnings of graduates increase to about €25,000-60,000 around age 43. Annual earnings of graduates with a PhD even increase to about €35,000-85,000 around age 50. In sum, the predicted earnings functions presented in Figure 2 do not only suggest that graduates have much higher earnings than non-graduates but also reveal that the earnings of graduates increase substantially over the life cycle. The age-earnings profiles of graduates constitute the starting point for the calculation of loan repayments and implicit interest rate subsidies that we discuss below.

4.3 Unconditional Quantile Results

Since age-earnings profiles may differ considerably across the earnings distribution, we extend our calculation of age-earnings profiles beyond the mean. To estimate the age-earnings profiles at certain quantiles of the distribution, we employ unconditional quantile regressions based on so-called "recentered influence functions" (Firpo et al., 2009). Since unconditional quantile regression estimates capture the effect of the change in the regressors on the quantile of the unconditional distribution of the dependent variable, we may use them to predict age-earnings profiles at different quantiles of the earnings distribution. A distributional analysis is crucial in the context of student loans because repayment burdens are typically most important for debtors with low incomes.

The uncondtitional quantile regression estimates for the 25th, 50th and 75th percentiles of the earnings distribution of men and women in West and East Germany are reported in Tables A3 and A4 in the appendix. The estimates show substantial heterogeneity in the returns to a university degree or a PhD across the distribution and with regard to gender and region. The returns to education of university graduates are particularly low at the 25th percentile, suggesting that the predicted age-earnings profiles will be relatively low at the bottom of the earnings distributions. Considerable differences may also be observed between the quadratic functions

that describe the relationship between age and earnings. Specifically, an increase in age has a relatively small effect on earnings at the 25th percentile (the effect is even negative for women in West Germany), indicating that debtors with low incomes may face high repayment burdens in the presence of a conventional loan scheme.

4.4 Repayment Burdens of the Conventional Loan Scheme

Consumption smoothing constitutes a critical element of ICLs. In the absence of consumption smoothing, borrowers with low income may have to use a considerable proportion of their income to repay a loan. Since earnings typically increase over the life cycle, conventional loans exhibit high repayment burdens during the first years of the repayment period, resulting in high default probabilities.

Table 5 reports the repayment burdens for the conventional Scheme 3b over the first five years of the repayment period. The numbers reveal that university graduates with average earnings face repayment burdens of 7-16 percent in the first year of the repayment period, clearly exceeding the "8 percent rule" advocated by Baum and Schwartz (2006). The repayment burdens are much higher at the 25th percentile of the earnings distribution, ranging from 11-77 percent at the beginning of the repayment period. In contrast, the repayment burdens are relatively low (between 4 and 10 percent) at the 75th percentile of the earnings distribution, suggesting that many university graduates at the top of the distribution could repay their student loans much faster.

The numbers in Table 5 explain why currently existing conventional student loans do not leave much room for higher tuition fees. ICLs are needed to broaden the scope for tuition fees at German universities and to provide both default insurance and consumption smoothing.

5 Design Issues for an Income Contingent Loan Scheme

5.1 Alternative Interest Rate Regimes

Figures 3 and 4 include the average repayment flows for the three schemes described earlier. Due to increasing earnings over the life cycle, the repayments increase with higher age. In all cases, the loans are repaid by the age of 50. However, there is substantial heterogeneity in the repayment duration, depending on the scheme and the group that is considered. As a result of the large earnings differentials discussed earlier (see Table 4), male graduates can repay their loans faster than female graduates and the repayment duration in East Germany is longer than in West Germany. The repayment duration further increases if a 25 percent surcharge is imposed and is even longer if a 3 percent rate of real interest is levied. In all cases, we assume that graduates start to repay their loans later if they have a PhD. However, due to the earnings differential between graduates with and without a PhD, the repayment duration is reduced if a graduate holds a PhD.

5.2 Interest Rate Subsidies

The implicit interest rate subsidies for the three schemes are presented in Table 6. Since we are not only interested in subsidies of average university graduates, we also perform similar calculations at other points of the earnings distribution using unconditional quantile regressions (Firpo et al., 2009). We use the estimates to predict the age-earnings profiles across the distribution and to calculate repayment burdens and implicit interest rate subsidies. Investigating subsidies across the distribution is relevant because ICLs require no repayments if debtors experience sufficiently low earnings.

The numbers in Table 6 reveal considerable differences in interest rate subsidies between the three schemes and across the distribution. While the interest rate subsidy of average graduates is about 30-35 percent for an ICL with a real rate of in-

terest of zero percent and no surcharge, the subsidy is substantially lower (between 13 and 23 percent) if a 25 percent surcharge is imposed.

Sizable differences in interest rate subsidies may also be observed across the earnings distribution. In particular, subsidies at the bottom of the distribution are larger than those observed at the mean or the median, while subsidies at the top of the distribution are lower. The interest rate subsidies decline at higher quartiles of the distribution because graduates with higher earnings can repay their loans faster than those with low earnings. Faster repayment improves the recoverability of the loan if the real rate of interest is lower than the discount rate. In almost all cases, interest rate subsidies of West German women are equal to 100 percent at the bottom of the distribution, suggesting that female graduates in West Germany, who are at or below the 25th percentile of their earnings distribution, are unable to repay the loan. Finally, while we observe large differences in interest rate subsidies between ICLs and across earnings distributions, differences between graduates with and without a PhD are rather small. We also find that interest rate subsidies of graduates in West and East Germany are about the same (with the exception of the low-income female graduates mentioned above).

6 Conclusions

Germany represents an interesting example for the design of an ICL for tuition fees. Since 2007, several German states have introduced tuition fees at their universities and publicly owned banks have started to offer student loans to cover these fees. Although default insurance is an important income contingent element of these loans, their design leaves no room for higher tuition fees.

Against this background, this paper compares alternative ICLs for tuition fees at German universities using data form the German Microcensus 2007. To calculate repayment flows, we estimate age-earnings profiles, using linear and unconditional quantile regression models. We differentiate between men and women residing in East and West Germany and calculate separate repayment flows for university graduates

and PhDs. The estimates obtained from the regression models further allow us to calculate implicit interest rate subsidies and repayment burdens across the earnings distribution which provide important information about the efficiency of alternative loan schemes.

We demonstrate that the implementation of an income contingent loan system would broaden the scope for tuition fees at German universities considerably. Since ICLs require reasonably good knowledge of a former students' income, a collection of ICLs through the German tax system is essential. Higher tuition fees could generate a public revenue of about €3-4 billion per year if they were introduced at all public universities in Germany. Specifically, if about 1.4 million students would receive an ICL to pay tuition fees of €3,500 per year, then a loan recoverability of about 60-80 percent would be sufficient to generate this revenue. Given the implicit interest rate subsidies of the alternative ICLs compared in this paper, these recoverability rates appear to be realistic.

Tables and Figures

TABLE 1.–TUITION FEES AND PUBLIC LOANS

State	Tuition Fees p.a.	Bank	Nominal Interest	Maximum Debt	Minimum Net Income
Baden-Württemberg	€500	L-Bank	3.78% (max. 5.5%)	€15,000	€1,060
Bavaria	€500	KfW Förderbank	2.69% (max. 7.75%)	€15,000	€1,060
Hamburg (until summer 2008)	€375	KfW Förderbank	2.87% (max. 7.5%)	€17,000	€1,060
Hesse (until summer 2008)	€500	Landes-treuhandstelle	6.16% / 0% (max. 7.5%)	€15,000	€1,260
Lower Saxony	€500	KfW Förderbank	3.06% (max. 7.5%)	€15,000	€1,060
North-Rhine Westfalia	€500	NRW.Bank	3.896% (max. 5.90%)	€10,000	€1,040
Saarland (until winter 2009/2010)	€500	KfW Förderbank	0% <2.85% (-)	€15,000	€1,060

SOURCE: http://www.studis-online.de; http://www.bafoeg-aktuell.de.

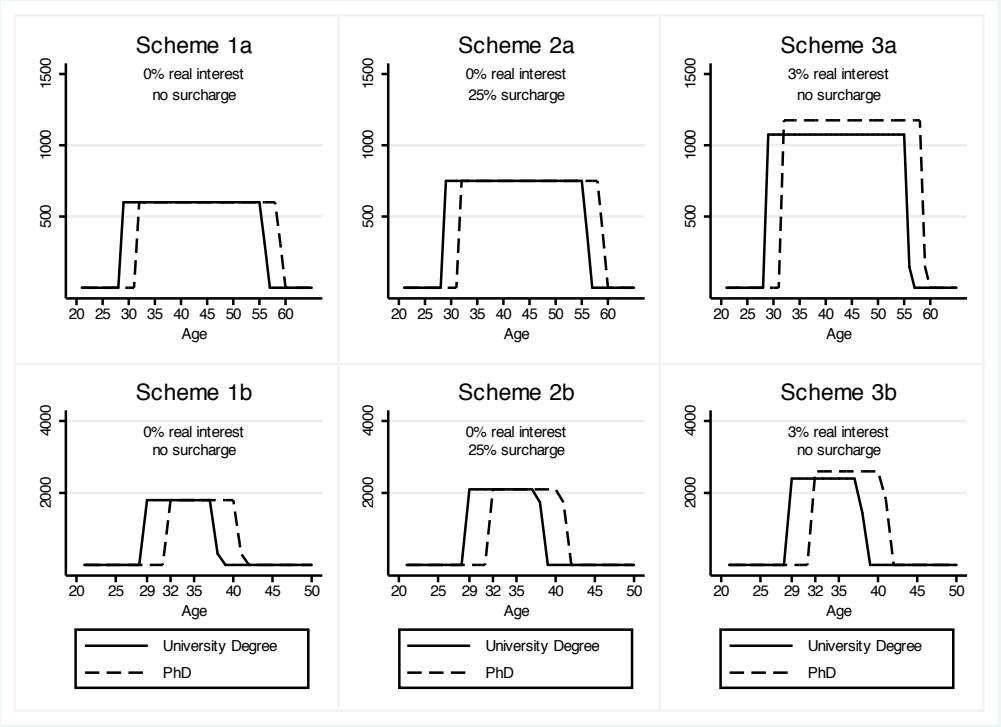

FIGURE 1: **Conventional loan repayment schemes**

TABLE 2.–IMPLICIT INTEREST RATE SUBSIDIES FOR CONVENTIONAL LOAN SCHEMES (PERCENT)

	University Degree	PhD
Scheme 1a	45.18	49.83
Scheme 2a	31.47	37.29
Scheme 3a	0.00	0.00
Scheme 1b	29.84	35.80
Scheme 2b	13.11	20.48
Scheme 3b	0.00	0.00

TABLE 3.–SUMMARY STATISTICS, SAMPLE OF EMPLOYED AND NOT EMPLOYED PERSONS

	Men		Women	
	Mean	Std. dev.	Mean	Std. dev.
		WEST GERMANY		
Annual gross earnings	26,444	27,509	10,816	14,770
Annual gross earnings if > 0	33,941	26,774	17,104	15,409
Hourly gross wages	12.30	14.33	7.47	12.14
Hourly gross wages if > 0	15.79	14.44	11.82	13.48
Employed	0.779	0.415	0.632	0.482
Basic qualification (*Hauptschulabschluss*)	0.076	0.265	0.132	0.338
Secondary school degree (*Realschulabschluss*)	0.025	0.155	0.045	0.207
Vocational diploma (*Fachabitur*)	0.006	0.076	0.005	0.070
University-entrance diploma (*Abitur*)	0.023	0.150	0.018	0.132
Vocational qualification (*Ausbildungsabschluss*)	0.591	0.492	0.633	0.482
Master/Foreman (*Meister*)	0.087	0.282	0.044	0.205
University of applied science degree (*Fachhochschulabschluss*)	0.087	0.281	0.041	0.198
University degree	0.091	0.287	0.077	0.267
PhD	0.015	0.123	0.006	0.078
Age	45.3	10.9	45.9	10.9
Number of observations	70,019		78,201	
		EAST GERMANY		
Annual gross earnings	14,672	17,277	10,383	12,247
Annual gross earnings if > 0	21,795	16,975	16,548	11,707
Hourly gross wages	6.97	8.34	6.12	7.72
Hourly gross wages if > 0	10.36	8.26	9.76	7.71
Employed	0.673	0.469	0.627	0.483
Basic qualification (*Hauptschulabschluss*)	0.029	0.166	0.038	0.191
Secondary school degree (*Realschulabschluss*)	0.034	0.181	0.041	0.197
Vocational diploma (*Fachabitur*)	0.002	0.043	0.002	0.043
University-entrance diploma (*Abitur*)	0.017	0.130	0.012	0.110
Vocational qualification (*Ausbildungsabschluss*)	0.685	0.465	0.701	0.458
Master/Foreman (*Meister*)	0.066	0.247	0.066	0.249
University of applied science degree (*Fachhochschulabschluss*)	0.064	0.244	0.048	0.213
University degree	0.091	0.288	0.086	0.280
PhD	0.014	0.117	0.007	0.081
Age	45.9	11.0	46.6	10.9
Number of observations	20,967		22,428	

NOTE.–Weighted numbers based on weights provided by the Microcensus.

TABLE 4.–SUMMARY STATISTICS, SAMPLE OF EMPLOYED AND NOT EMPLOYED UNIVERSITY GRADUATES

	Men		Women	
	Mean	Std. dev.	Mean	Std. dev.
	WEST GERMANY			
Annual gross earnings	49,535	44,685	24,789	26,627
Annual gross earnings if > 0	56,576	43,385	31,666	26,228
Hourly gross wages	20.75	17.40	13.77	21.19
Hourly gross wages if > 0	23.70	16.61	17.59	22.50
Employed	0.876	0.330	0.783	0.412
University degree	0.855	0.352	0.927	0.261
PhD	0.145	0.352	0.073	0.261
Age	45.2	10.7	43.1	10.7
DISCIPLINE				
Medicine	0.066	0.249	0.076	0.264
Law	0.065	0.247	0.059	0.236
Social sciences	0.055	0.228	0.060	0.238
Humanities	0.076	0.265	0.126	0.332
Sciences	0.400	0.490	0.143	0.350
Business	0.130	0.337	0.082	0.274
Education	0.166	0.372	0.368	0.482
Number of observations	7,459		6,447	
	EAST GERMANY			
Annual gross earnings	31,090	28,147	21,786	18,977
Annual gross earnings if > 0	38,878	26,227	27,866	17,063
Hourly gross wages	13.83	12.54	11.19	9.95
Hourly gross wages if > 0	17.29	11.70	14.31	9.05
Employed	0.800	0.400	0.782	0.413
University degree	0.868	0.339	0.928	0.258
PhD	0.132	0.339	0.072	0.258
Age	47.1	11.1	45.1	10.6
DISCIPLINE				
Medicine	0.069	0.253	0.071	0.257
Law	0.079	0.271	0.056	0.231
Social sciences	0.075	0.264	0.086	0.280
Humanities	0.085	0.279	0.123	0.328
Sciences	0.449	0.497	0.212	0.409
Business	0.070	0.256	0.095	0.293
Education	0.119	0.324	0.291	0.454
Number of observations	2,224		2,085	

NOTE.–See note to table 3.

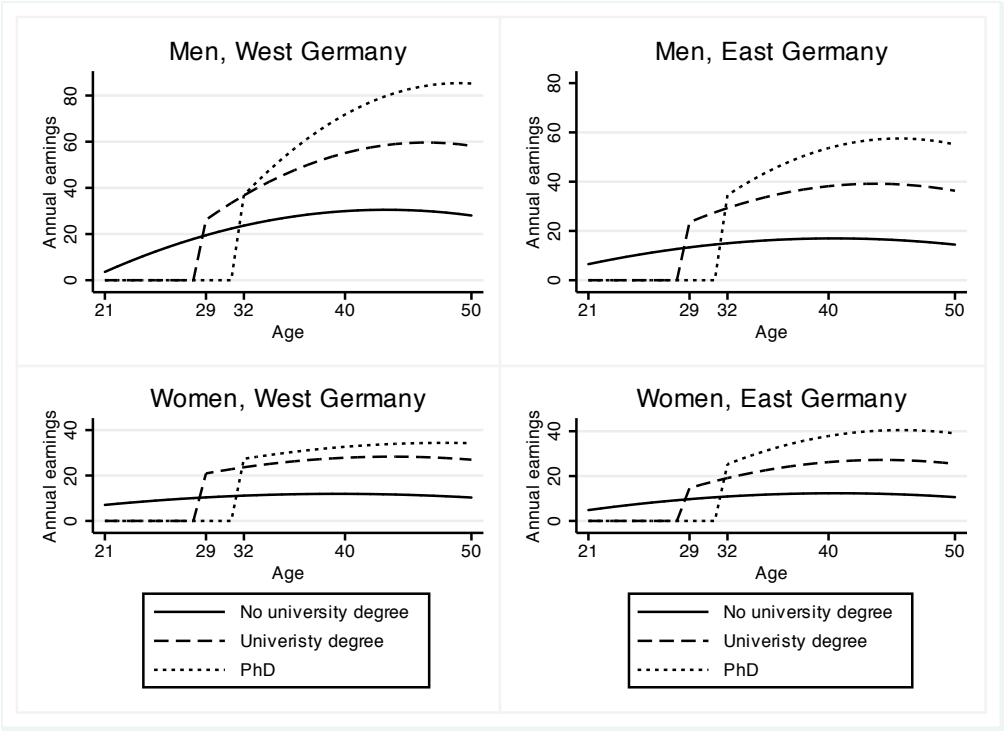

FIGURE 2: **Average age-earnings profiles (in thousands of €)**

Table 5.–Repayment burdens of scheme 3b over the first five years of the repayment period (percent)

	West Germany				East Germany			
	Men		Women		Men		Women	
	University Degree	PhD	University Degree	PhD	University Degree	PhD	University Degree	PhD
Mean								
Year 1	9.17	7.04	11.47	9.50	10.18	7.53	16.36	10.28
Year 2	8.02	6.12	10.96	9.21	9.37	6.88	14.76	9.48
Year 3	7.18	5.46	10.53	8.96	8.72	6.37	13.53	8.84
Year 4	6.54	4.95	10.16	8.74	8.20	5.97	12.56	8.33
Year 5	6.03	4.56	9.84	8.54	7.77	5.64	11.78	7.91
Q25								
Year 1	39.61	16.16	22.09	22.00	21.99	11.29	77.22	16.00
Year 2	23.52	12.41	20.05	21.04	16.92	9.87	40.01	13.04
Year 3	17.04	10.20	18.53	20.31	13.97	8.86	27.70	11.18
Year 4	13.57	8.75	17.38	19.77	12.04	8.11	21.61	9.91
Year 5	11.41	7.74	16.51	19.40	10.71	7.54	18.02	9.02
Q50								
Year 1	11.47	8.93	11.91	7.78	10.66	6.85	17.20	10.37
Year 2	9.88	7.49	11.28	7.85	9.83	6.56	15.33	9.66
Year 3	8.73	6.51	10.76	7.92	9.17	6.32	13.92	9.09
Year 4	7.87	5.79	10.32	7.99	8.62	6.11	12.83	8.61
Year 5	7.21	5.25	9.95	8.06	8.18	5.94	11.96	8.22
Q75								
Year 1	6.15	4.67	8.47	6.98	7.84	6.40	9.86	6.35
Year 2	5.61	4.30	8.15	6.69	7.33	5.81	9.17	6.15
Year 3	5.17	4.00	7.87	6.43	6.92	5.34	8.62	5.98
Year 4	4.82	3.76	7.63	6.21	6.57	4.97	8.16	5.82
Year 5	4.53	3.55	7.41	6.02	6.28	4.67	7.77	5.68

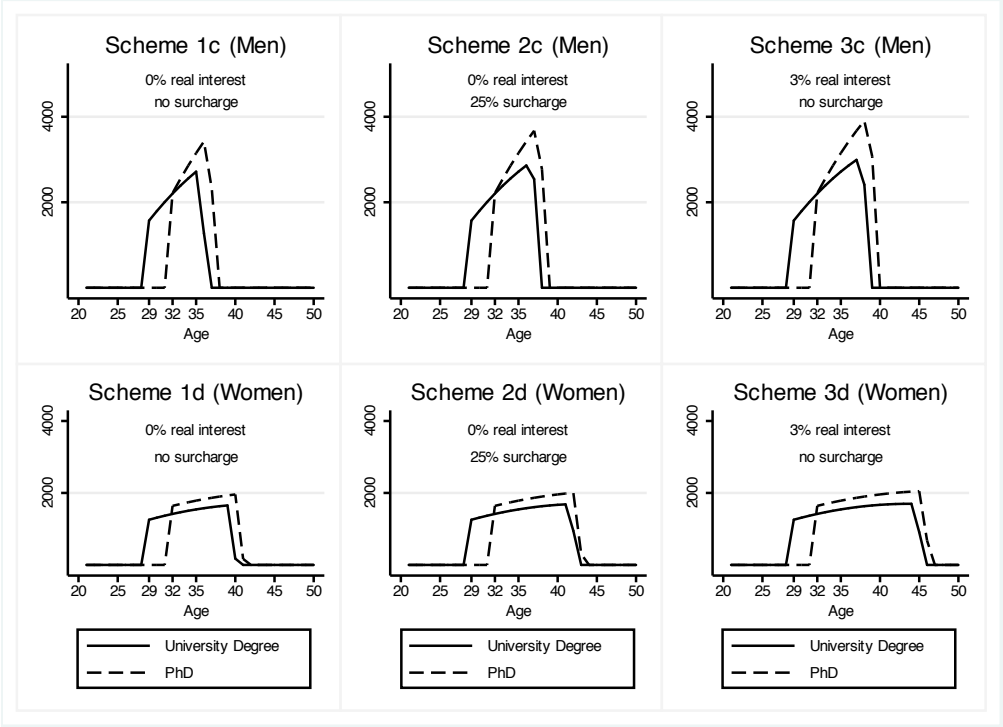

FIGURE 3: **Average repayment schemes, West Germany**

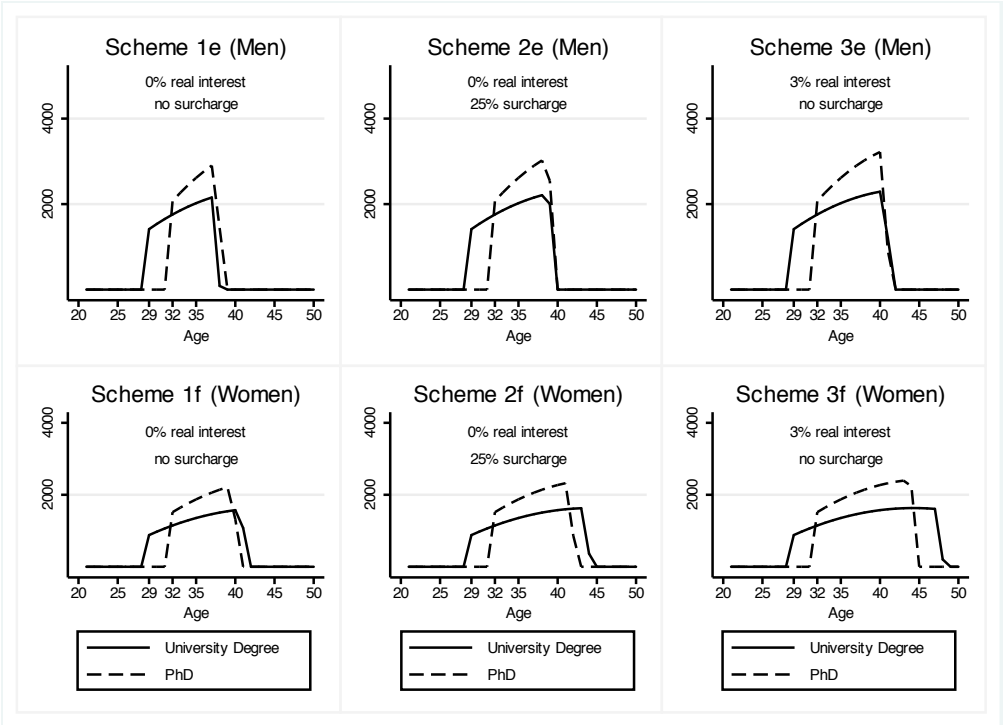

FIGURE 4: **Average repayment schemes, East Germany**

Table 6.–Implicit interest rate subsidies for income contingent loan schemes (percent)

		West Germany			
	Scheme	Mean	Q25	Q50	Q75
Men					
University degree:					
0% real interest, no surcharge	1c	29.0	35.5	30.3	26.8
0% real interest, 25% surcharge	2c	13.2	21.8	15.1	10.2
3% real interest, no surcharge	3c	0.0	0.0	0.0	0.0
PhD:					
0% real interest, no surcharge	1c	33.0	36.7	34.0	31.5
0% real interest, 25% surcharge	2c	17.8	22.8	19.1	15.6
3% real interest, no surcharge	3c	0.0	0.0	0.0	0.0
Women					
University degree:					
0% real interest, no surcharge	1d	32.3	39.0	32.4	29.6
0% real interest, 25% surcharge	2d	18.4	100.0	18.6	14.5
3% real interest, no surcharge	3d	0.0	100.0	0.0	0.0
PhD:					
0% real interest, no surcharge	1d	36.0	100.0	35.1	33.7
0% real interest, 25% surcharge	2d	22.4	100.0	21.3	18.9
3% real interest, no surcharge	3d	0.0	100.0	0.0	0.0
		East Germany			
	Scheme	Mean	Q25	Q50	Q75
Men					
University degree:					
0% real interest, no surcharge	1e	30.4	34.1	30.9	28.7
0% real interest, 25% surcharge	2e	15.5	20.3	16.1	13.0
3% real interest, no surcharge	3e	0.0	0.0	0.0	0.0
PhD:					
0% real interest, no surcharge	1e	33.8	35.9	33.6	32.8
0% real interest, 25% surcharge	2e	18.9	21.9	18.8	17.5
3% real interest, no surcharge	3e	0.0	0.0	0.0	0.0
Women					
University degree:					
0% real interest, no surcharge	1f	34.4	42.9	34.6	30.3
0% real interest, 25% surcharge	2f	21.2	31.6	21.4	15.4
3% real interest, no surcharge	3f	0.0	100.0	0.0	0.0
PhD:					
0% real interest, no surcharge	1f	35.9	35.9	35.9	35.9
0% real interest, 25% surcharge	2f	22.0	22.0	22.0	22.0
3% real interest, no surcharge	3f	0.0	0.0	0.0	0.0

References

Baum, S., Schwartz, S., 2006. How Much Debt is Too Much? Defining Benchmarks for Manageable Student Debt. Washington, D.C.: The Project on Student Debt and the College Board.

Chapman, B., Leigh, A., 2009. Do Very High Tax Rates Induce Bunching? Implications for the Design of Income-Contingent Loan Schemes. The Economic Record 85(270), 276-289.

Chapman, B., Lounkaew, K., 2009. The Effects of Different Loan Schemes for Higher Education Tuition: An Analysis of Rates of Return and Government Revenue in Thailand. Higher Education in Europe 34(2), 239-254.

Federal Statistical Office, 2008. *Bildungsfinanzbericht 2008*. Wiesbaden: Federal Statistical Office.

Firpo, S., Fortin, N.M., Lemieux, T., 2009. Unconditional Quantile Regressions. Econometrica, 77(3), 953-973.

OECD, 2010. *Education at a Glance – OECD Indicators*. Paris: Organisation for Economic Co-operation and Development (OECD).

Woodhall, M. 1987. *Establising Student Loans in Developing Countries: Some Guidelines*. Washington, D.C.: The World Bank.

Appendix

TABLE A1.–HOURLY WAGE REGRESSION

	West		East	
	Men	Women	Men	Women
Secondary school degree	0.268***	0.186***	0.162**	-0.034
	(0.017)	(0.016)	(0.052)	(0.055)
Vocational diploma	0.344***	0.228***	0.336**	0.149
	(0.033)	(0.038)	(0.127)	(0.142)
University-entrance diploma	0.390***	0.286***	0.388***	0.334***
	(0.023)	(0.024)	(0.075)	(0.073)
Vocational qualification	0.238***	0.155***	0.195***	0.053
	(0.010)	(0.010)	(0.046)	(0.046)
Master/foreman	0.444***	0.289***	0.377***	0.170***
	(0.012)	(0.014)	(0.048)	(0.048)
University of applied science degree	0.682***	0.524***	0.679***	0.393***
	(0.012)	(0.014)	(0.049)	(0.049)
University degree	0.715***	0.623***	0.795***	0.539***
	(0.012)	(0.013)	(0.048)	(0.048)
PhD	0.930***	0.722***	1.077***	0.764***
	(0.020)	(0.031)	(0.055)	(0.063)
Age	0.052***	0.005	0.022***	0.004
	(0.002)	(0.003)	(0.004)	(0.005)
$Age^2/1000$	-0.465***	-0.009	-0.232***	-0.040
	(0.025)	(0.030)	(0.050)	(0.056)
Constant	0.890***	1.873***	1.353***	1.879***
	(0.045)	(0.053)	(0.099)	(0.109)
R^2	0.215	0.093	0.206	0.107
N	54,251	48,938	14,088	13,932

NOTE.–Weighted regressions based on weights provided by the Microcensus. Robust standard errors in parentheses. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

TABLE A2.–ANNUAL EARNINGS REGRESSION

	West		East	
	Men	Women	Men	Women
Secondary school degree	0.319***	0.366***	0.268***	0.168**
	(0.018)	(0.020)	(0.053)	(0.052)
Vocational diploma	0.386***	0.486***	0.491***	0.417***
	(0.038)	(0.054)	(0.130)	(0.109)
University-entrance diploma	0.144***	0.381***	0.228**	0.230**
	(0.030)	(0.033)	(0.072)	(0.076)
Vocational qualification	0.290***	0.329***	0.341***	0.322***
	(0.010)	(0.012)	(0.046)	(0.042)
Master/foreman	0.536***	0.594***	0.565***	0.521***
	(0.012)	(0.018)	(0.048)	(0.044)
University of applied science degree	0.809***	0.940***	0.896***	0.807***
	(0.012)	(0.017)	(0.049)	(0.046)
University degree	0.859***	1.070***	1.014***	0.944***
	(0.013)	(0.015)	(0.048)	(0.044)
PhD	1.179***	1.279***	1.363***	1.345***
	(0.021)	(0.041)	(0.057)	(0.065)
Age	0.088***	-0.019***	0.064***	0.041***
	(0.002)	(0.003)	(0.004)	(0.005)
$Age^2/1000$	-0.898***	0.198***	-0.739***	-0.508***
	(0.024)	(0.033)	(0.046)	(0.054)
Constant	7.770***	9.484***	8.033***	8.331***
	(0.045)	(0.061)	(0.094)	(0.104)
R^2	0.255	0.145	0.248	0.168
N	54,251	48,938	14,088	13,932

NOTE.–See Notes to Table A1. $^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$.

TABLE A3.–UNCONDITIONAL QUANTILE REGRESSION ESTIMATES: ANNUAL GROSS EARNINGS, WEST GERMANY

	Men			Women		
	Q25	Q50	Q75	Q25	Q50	Q75
Secondary school degree	0.230***	0.225***	0.261***	0.317***	0.441***	0.333***
	(0.017)	(0.014)	(0.018)	(0.023)	(0.026)	(0.020)
Vocational diploma	0.285***	0.304***	0.388***	0.362***	0.556***	0.452***
	(0.029)	(0.026)	(0.041)	(0.049)	(0.066)	(0.059)
University-entrance diploma	0.092***	0.197***	0.349***	0.267***	0.380***	0.457***
	(0.020)	(0.015)	(0.021)	(0.034)	(0.041)	(0.035)
Vocational qualification	0.249***	0.177***	0.166***	0.289***	0.392***	0.267***
	(0.010)	(0.007)	(0.008)	(0.016)	(0.015)	(0.009)
Master/foreman	0.409***	0.375***	0.454***	0.460***	0.724***	0.549***
	(0.011)	(0.009)	(0.012)	(0.020)	(0.024)	(0.020)
University of applied science degree	0.474***	0.503***	0.803***	0.598***	1.036***	1.062***
	(0.010)	(0.008)	(0.012)	(0.017)	(0.021)	(0.021)
University degree	0.442***	0.499***	0.857***	0.608***	1.063***	1.175***
	(0.011)	(0.008)	(0.011)	(0.016)	(0.018)	(0.016)
PhD	0.486***	0.570***	1.070***	0.608***	1.202***	1.402***
	(0.012)	(0.009)	(0.018)	(0.027)	(0.036)	(0.044)
Age	0.058***	0.068***	0.079***	-0.012***	-0.042***	0.017***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.003)
$\text{Age}^2/1000$	-0.603***	-0.712***	-0.787***	0.053	0.437***	-0.170***
	(0.021)	(0.017)	(0.024)	(0.036)	(0.045)	(0.037)
Constant	8.321***	8.506***	8.445***	9.101***	10.047***	9.260***
	(0.042)	(0.033)	(0.044)	(0.065)	(0.085)	(0.070)
R^2	0.100	0.166	0.230	0.051	0.090	0.152
N	54,251	54,251	54,251	48,938	48,938	48,938

NOTE.–See Notes to Table A1. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

TABLE A4.–UNCONDITIONAL QUANTILE REGRESSION ESTIMATES: ANNUAL GROSS EARNINGS, EAST GERMANY

	Men			Women		
	Q25	Q50	Q75	Q25	Q50	Q75
Secondary school degree	0.205***	0.169***	0.130*	0.131*	0.241***	0.098**
	(0.046)	(0.040)	(0.053)	(0.053)	(0.057)	(0.035)
Vocational diploma	0.224*	0.403**	0.340*	0.303**	0.526**	0.223
	(0.105)	(0.132)	(0.173)	(0.115)	(0.182)	(0.128)
University-entrance diploma	0.074	0.296***	0.277***	0.196**	0.324***	0.230***
	(0.058)	(0.053)	(0.073)	(0.069)	(0.081)	(0.057)
Vocational qualification	0.275***	0.236***	0.124**	0.253***	0.447***	0.162***
	(0.040)	(0.031)	(0.040)	(0.045)	(0.044)	(0.026)
Master/foreman	0.386***	0.465***	0.402***	0.423***	0.728***	0.275***
	(0.041)	(0.035)	(0.049)	(0.047)	(0.050)	(0.032)
University of applied science degree	0.445***	0.721***	1.046***	0.477***	1.022***	0.695***
	(0.040)	(0.033)	(0.050)	(0.046)	(0.050)	(0.036)
University degree	0.447***	0.750***	1.175***	0.500***	1.086***	0.834***
	(0.040)	(0.032)	(0.047)	(0.046)	(0.047)	(0.031)
PhD	0.488***	0.839***	1.600***	0.534***	1.268***	1.174***
	(0.040)	(0.034)	(0.059)	(0.049)	(0.056)	(0.043)
Age	0.038***	0.051***	0.080***	0.017***	0.052***	0.031***
	(0.003)	(0.004)	(0.006)	(0.004)	(0.007)	(0.005)
$Age^2/1000$	-0.482***	-0.573***	-0.920***	-0.271***	-0.594***	-0.335***
	(0.038)	(0.044)	(0.066)	(0.047)	(0.074)	(0.054)
Constant	8.555***	8.319***	8.222***	8.776***	7.941***	8.958***
	(0.079)	(0.086)	(0.123)	(0.095)	(0.143)	(0.102)
R^2	0.067	0.155	0.232	0.069	0.104	0.165
N	14,088	14,088	14,088	13,932	13,932	13,932

NOTE.–See Notes to Table A1. $^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$.