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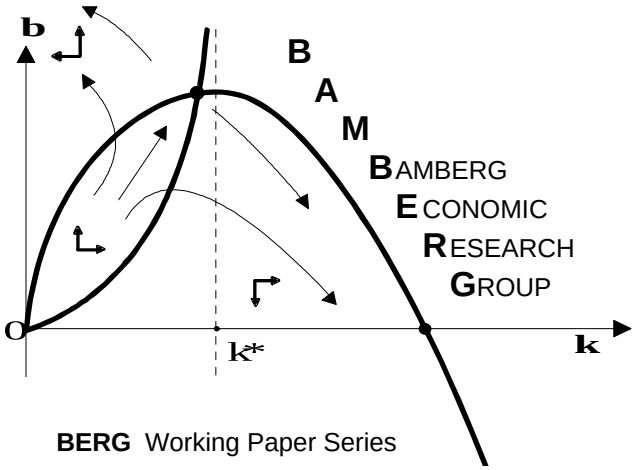

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Non-take-up of Student Financial Aid: A Microsimulation for Germany

Stefanie P. Herber*and Michael Kalinowski†

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Abstract

This paper estimates the percentage of students who do not take up their federal need-based student financial aid entitlements and sheds light on determinants of this behavior. Against the background that educational mobility in Germany is low although extensive student financial aid for needy students is available, it is crucial to know whether students assert their claims for student aid at all. To investigate non-take-up, we set up a microsimulation model for the German Socio-Economic Panel Study 2002–2013 and estimate the respective aid amounts students would have received, had they filed an application for need-based aid. The results indicate that about 40% of the eligible low-income students do not take up their entitlements. We employ instrumental variable techniques and a sample selection model to consider several potential explanatory factors for this behavior. Our results suggest that non-take-up is inversely related to the level of benefits, though the elasticity is rather low. Apart from that, a shorter expected duration of benefit receipt is related to a higher non-take-up rate, whereas the possibility to draw upon older siblings' experience with completing the complex application for aid is associated with higher probabilities to claim. Moreover, we find robust evidence that significantly more students socialized in the former socialist East Germany choose to take up student aid than similar West German students. Finally, in line with behavioral economic theory, debt aversion of highly impulsive and impatient students is associated with higher rates of non-take-up.

JEL: I22; I23; I24; I38
Keywords: Non-take-up of social benefits; welfare program participation; federal student aid; student loans; microsimulation; behavioral economics; debt aversion; self-control

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1 Introduction and background

Imagine you are a student in financial need and the government offers you about EUR 38,000 to finance your studies at the following conditions: Given your earnings five years after finishing your studies are sufficiently high, you have to repay 20% of the present value in small rates over the next 20 years.[1] Would you accept the offer?

From a traditional economic perspective you should definitely claim the money. This paper shows, however, that about two fifths of the eligible German students turn down the offered means-tested student financial aid amounts, called "BAföG". We draw upon rich household data from the German Socio-Economic Panel Study for the years 2002 through 2013 to calculate individual taxes and net incomes in a detailed microsimulation model. Drawing upon the simulated data, we determine those students eligible to receive BAföG and calculate their student financial aid amounts. Subsequently, we give insights into potential explanations why students, who would receive lucrative amounts of student financial aid if they filed an application, do not take up BAföG.

Studying non-take-up of means-tested student financial aid is important for three main reasons.

First of all, BAföG aims at reducing inequalities in educational opportunities for students from low-income families. Federal need-based aid would miss its targets if its design prevented eligible students from claiming their benefits and consequently endangered their enrollment at university or fostered later drop out. Previous research shows indeed that, also for Germany where studying is relatively inexpensive, financial factors are related to students' lower transition rates to university (Schindler and Reimer, 2010; Hübner, 2012) and the intergenerational educational mobility is low (OECD, 2014, p. 93). Moreover, students who decide in favor of studying but against taking up need-based aid have to spend a considerable time working to earn their living. This is generally associated with a higher likelihood to prolong studying (Avdic and Gartell, 2015), dropping out of higher education without a degree (Triventi (2014) provides a review), and performing worse academically (Stinebrickner and Stinebrickner, 2003; Callender, 2008). Against the background that completing higher education goes hand in hand with a non-trivial monetary return, the "sheepskin effect" (Heckman et al., 2006, e.g.), social inequalities can corroborate even if students make their way to university.

Apart from that, evidence on the existence of non-take-up or its low elasticity with respect to the benefits available would moreover contribute to explaining the low responsiveness of students' university enrollments to higher student financial aid amounts in industrialized countries (Dynarski, 2002; Rubin, 2011; Steiner and Wrohlich, 2012).

[1] The numbers are in present values, calculated at an interest rate of 2%, see Grave and Sinning (2014).

Last but not least, our results have consequences for researchers and policy makers wanting to anticipate or evaluate student financial aid reforms. As shown by Wiemers (2015), ignoring non-take-up when considering an increase in social assistance benefits leads to striking overestimation of the fiscal costs and the number of (factual) beneficiaries involved.

We contribute to two separate strands of literature on non-take-up: One large strand of literature investigates non-take-up of social benefits, especially social assistance, unemployment, and pension benefits. This literature builds mainly on a straightforward utility maximization of consumers who take up benefits as long as the expected amounts exceed the anticipated claiming costs (Moffitt, 1983; Blundell et al., 1988; Anderson and Meyer, 1997).[2] Previous studies found that the benefits amount available as well as the anticipated duration (Anderson and Meyer, 1997) of support increase the probability that people take up benefits. The counterweight to these encouraging factors are barriers especially introduced by high transaction costs associated with the claiming process, such as complex forms (Currie, 2004), but also information gaps (Strauss, 1977), and stigma costs (Weisbrod, 1970; Moffitt, 1983).

The unifying feature of the literature on non-take-up of social benefits is that benefit amounts have to be calculated for those who do not claim the benefits and for whom data on benefits received is naturally unavailable. Explaining non-take-up requires then finding suitable proxy variables for the expected costs and benefits of (not) taking up.

Although we stick, methodologically, to this strand of literature, we combine it with insights from a second, separate, strand concerned with debt-averse behavior and students' under-usage of student financial aid, mostly students loans.

So far, only few papers have investigated non-take-up of means-tested student financial aid. Among the related previous studies, Kofoed (2015) draws upon data from the National Center for Education Statistics. The dataset already contains imputed needs for students who did not file the Free Application for Federal Student Aid (FAFSA) which is essential for applying for most federal student aid programs in the US. He finds that about one fifth of eligible US-students fail to complete the FAFSA. Although a minor percentage of the non-takers receives financial assistance from elsewhere (King, 2006; Kofoed, 2015), students still forgo significant amounts of aid they would have been entitled to (Kofoed, 2015). Bird and Castleman (2014) show that even after having completed the application process once, 20% of eligible first semester Pell Grant recipients do not re-file the FAFSA in the subsequent year.

[2] An extensive review of the literature is beyond the scope of this paper. Currie (2004), Hernanz et al. (2004), and Finn and Goodship (2014) provide comprehensive reviews.

Existing US-studies do not account for the potential endogeneity likely to arise from omitted variables driving both the levels of means-tested benefits and the decision to claim the benefit. We contribute methodologically to this literature by addressing endogeneity with an instrumental variable regression and a sample selection model. More specifically, we instrument the factual, means-tested benefit amount with the BAföG system's generosity and with an indicator for whether the student is independently funded. The implications of the latter are twofold: On the one hand, students who are independently funded have been working before their higher education enrollments. Accordingly, they are also likely to have lower benefits, ceteris paribus. On the other hand, parents' income is not considered in the means test if students are independently funded. Therefore, the level of benefits is higher, ceteris paribus. In any case are benefit amounts and being independently funded highly correlated. Our sample selection model relies, by contrast, on the exclusion restriction that students who have completed a vocational training before studying are more likely to earn high incomes when studying and selecting themselves out of the sample of eligible, financially needy students.

We are not aware of any study analyzing systematically why students forgo these substantial aid amounts. Previous studies provide, however, mixed evidence as to whether information constraints and complexity of the claiming process can explain non-take-up of student financial aid (Bettinger et al., 2012; Booij et al., 2012; Herber, 2015), while the results are heavily dependent on the design of the aid scheme.

Non-take-up might, however, be higher if student aid is provided as a loan but students are not inclined to bear the psychological costs of having debts (Field, 2009; Oosterbeek and van den Broek, 2009; Cho et al., 2015).[3] This debt aversion is mainly driven by risk aversion and the fear to be unable to repay the loan, but also by cultural differences (Boatman et al., 2014). Regarding the zero interest loans studied in this paper, debt averse behavior is possible (and rational) for individuals who are willing to save but lack self-control to prevent overspending of the benefit amounts (Cadena and Keys, 2013).[4]

For the German case which we focus on here, only some descriptive statistics stemming from a broad survey of students indicate possible reasons why students do not file the application for BAföG (Middendorff et al., 2013, p. 312). Unfortunately, the survey data do not allow to distinguish between eligible and ineligible students. Therefore, it is not surprising that the most frequently reported reasons are high incomes of parents' or partners' (80%), high own incomes and assets (30%), and low anticipated benefits (14%).

[3] Note however that, contrary to BAföG, most loans are supplementary and not means-tested.

[4] Cadena and Keys (2013) exploit that eligible US-students who have to pay for room and board and live off-campus can receive a part of the interest-free Stafford loan payed in cash rather than as a credit to their university account. The authors show that if students regard different assets as nonfungible and lack self-control to limit their expenses to prevent overspending, non-take-up can be a rational reaction to avoid overspending.

Yet, 25% of the students also name debt aversion as a reason why they did not file an application. Information constraints and perceptions of the complexity of claiming are, however, not questioned.

Our study confirms the previous finding that longer expected duration of benefit receipt and higher benefits are important factors of higher take-up rates. Nevertheless, the elasticity of the level of benefits with respect to the probability not to take up BAföG is rather inelastic with an estimate of -.41. Furthermore, our analyses yield very robust evidence that students socialized by East German parents are considerably less likely to turn down the money, controlling for various characteristics of students and their parents. Moreover, in line with findings from behavioral economics, suggesting that students at risk to exert too little self-control to restrict their consumption to necessary expenditures (Thaler and Shefrin, 1981; Cadena and Keys, 2013), we detect debt-averse behavior of students low in self-control and high in impatience. Last, being able to draw upon older siblings' experience in the application process is related to substantially higher probabilities to claim BAföG.

The rest of the paper proceeds as follows: After giving an overview of the German funding scheme BAföG, we elaborate on potential explanations for non-take-up and suitable proxy variables, drawing upon the literature presented above and with an eye on the restrictions of our data. We define the non-take-up rate and outline the empirical models in section 4. A description of the data and the sample follows, before we present results in section 6 and robustness checks in section 7. We close with the discussion. The appendices provide more detailed information on the official calculation of the BAföG benefits (section 9.1), how we simulate these benefits (section 9.2), and additional sensitivity analyses for our microsimulation model (section 9.3).

2 The German BAföG scheme for higher education students

Need-based income-contingent aid is regulated in the Federal Training Assistance Act (*Bundesausbildungsförderungsgesetz*), called "BAföG". BAföG was introduced in 1971 and aims at providing equal educational opportunities for all students, irrespective of their social or financial background. While a special form of BAföG is available under certain conditions for students at (higher) secondary schools, this paper is concerned only with the most frequent target group of BAföG: students enrolled in higher education.

For students in higher education, funding is generally provided for the standard period of studying and intends to support the costs of living and studying. Being the most common form of financial aid for higher education students in Germany, BAföG

supported approximately 647,000 students in 2014 at public expenses of about EUR 2.28 billion (Federal Statistical Office, 2015, p.32). Based on the recent official data from 2012 (German Bundestag, 2014), 66.7% of all students were formally eligible for BAföG, i.e., they met the prerequisites to apply but might have been rejected if they did not pass the means test. 28% of these formally eligible received funding—this equaled 17% of all enrolled students in Germany.

As can be seen from figure 1, the funded students' percentages of all formally eligible students (upper line) and of all students (lower line) show an upward trend since 1998. The lines reflect the BAföG reforms of 2001, 2008, and 2010 (see tables 9 and 10 for details). The reforms increased the relative scope of BAföG by raising basic income allowances and made BAföG relatively more attractive by increasing the available aid amounts. Yet, the BAföG scheme is neither indexed to the development of incomes or assets nor inflation-adjusted so that reforms are rather used as readjustment to higher price and income levels.

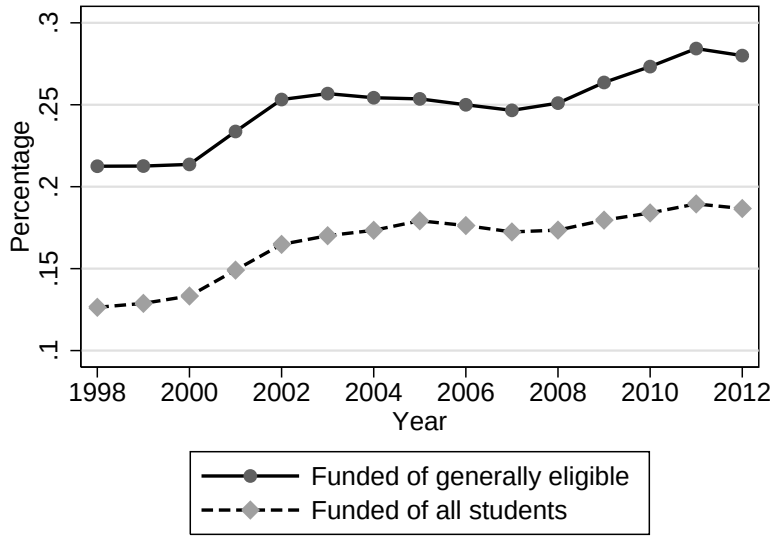


Figure 1:
Funded students' percentage of the formally eligible and of all students in Germany

Notes: Own figure based on the numbers reported in German Bundestag (2014) and German Bundestag (2010).

BAföG is designed as a grant-loan combination: Half of the amount is generally granted as a subsidy, the other half as a federal zero interest loan. The loan must be repaid within 20 years after a grace period of five years in installments of at least EUR 105 a month. BAföG provides insurance against default risks inasmuch as the repayment is capped at EUR 10,000 and its start can be delayed in case the single, childless claimant's monthly

income does not exceed EUR 1,070. The maximum repayment burden for students with very low incomes amounts, therefore, to 9.8%. This burden is in range with proportions of debt usually considered reasonable and bearable (Baum and Schwartz, 2006). Graduates repaying their loan upfront can save monetary amounts up to half of their debts. Grave and Sinning (2014) sum up all direct (grant and loan cap) and indirect subsidies (subsidies of the interest rate). They calculate that students can receive subsidies of up to EUR 30,381, i.e., about 80% of the total BAföG amount (Grave and Sinning, 2014, p. 112).[5]

Before the students' and parents' incomes are considered, students have to meet institutional and personal requirements in order to determine if they are formally eligible at all. The most important requirements (see Appendix 9.2 for details) are: Students have to be enrolled in their first degree at higher education institutions, i.e., universities, universities of applied sciences, colleges for professional education, or academies. Furthermore, students must hold German citizenship or have prospects of permanent residency, and, in general, have started their studies before they turn 30 (or 35 for consecutive programs). All students who pass these eligibility checks are formally eligible to receive funding.

Whether *formally* eligible students are also eligible for *positive* funding amounts is then assessed in a means test that proceeds in two steps:

First, the means test takes the students' levels of needs (see table 10) as a base value and deducts his or her own economic capabilities. Moreover, the economic capabilities of parents—if they have the legal obligation to support their children—or spouses (or registered partners) are assessed and deducted. If students are older than 30 or have been working for at least five years[6] before enrolling at university, students are independently funded and parents' incomes are not considered for the BAföG calculation. Contrary to the United States' student financial aid system where students' expected expenses resulting from visiting a specific school are imposed, BAföG uses fixed amounts based on the students' living situation. Therefore, students who are not living at the parents' home, have children, or have to cover social security contributions themselves are considered to have additional financial needs which are addressed by (fixed) additions to the basic need levels. Until autumn 2016, the maximum BAföG amount offered to a student who lives outside of the parents' home, has no children but has to pay own social security contributions equals EUR 670. Consequently, the maximum BAföG amount corresponds roughly to the minimum subsistence level of a single person (German Bundestag, 2015, p. 8). Parents are required to support their offspring up to this maximum rate if the means

[5] The maximal subsidy cited here is based on the maximum monthly benefits of EUR 670, a repayment of EUR 105 a month, starting after the grace period, and given an interest rate of 2%. The upfront repayment implies another implicit subsidy of the interest rate, though upfront payment is not worthwhile for high BAföG amounts (Grave and Sinning, 2014, p. 113).

[6] These five years of working experience may include having completed vocational training of up to three years prior to studying.

test results in lower BAföG amounts. The maximum BAföG amount granted reduces to EUR 495 if the student is still living at home.

Second, own income and assets, but also the spouse's, partner's or parents' income exceeding the respective levels of allowances are subtracted from these general lump-sum amounts, see section 9.1 for details. While students' current incomes and assets are relevant, the parents' or spouse's/partner's incomes as of the second last year's tax assessment enter the means test. Students can, however, request that their parents' or spouse's/partner's last year's or current income is used if this is considerably lower than the second last year's income.

The student can generally earn own income from a minor employment paying up to approximately EUR 400 a month without any deductions (see section 9.1). Higher earnings are subject to social insurance contributions, personal income tax, and require the student to opt out of the non-contributory dependents' co-insurance, so that most of the students work in jobs that usually pay EUR 400 at a maximum (Middendorff et al., 2013, p. 395).

After accounting for the students' own and familial financial situation, the remaining amount is automatically cashed as a monthly upfront payment to the students' bank account. We refer to all students whose remaining funding amount is positive as "eligible" in the following. In 2014, the average per person per month funding amount (based on the average of the monthly expenditures and assuming that students were funded all year round) was EUR 448; 38% of the funded students received the maximum amounts (Federal Statistical Office, 2015, p. 32).

3 Potential explanations for non-take up of BAföG

From a traditional economic perspective, the student is liquidity constrained, i.e., cannot borrow on the capital market because she cannot offer a collateral for human capital investments. She faces a problem of intertemporal choice where she decides whether or not to take-up BAföG. Given this choice, she maximizes utility from the study and repayment period. In the study period, she can consume both her own income and BAföG or invest it at the capital market to save at the market interest rate. After graduation, the student is constrained by her current income and the repayment of the interest-free loan.

The availability of BAföG during the study period relaxes her budget constraint by allowing her to borrow. Moreover, the subsidies shift her budget constraint outwards so that she can reach a higher indifference curve as long as her preferences are (weakly) monotone and non-satiated. It would, therefore, be rational for the student to accept the money. Even if she does neither want to spend nor invest BAföG at the capital market, she

should keep the money at home and pay back the (not inflation-adjusted) loan component some years later.

There might be various reasons for the (seemingly) irrational non-take-up of BAföG. From a rational choice perspective, we can model take-up as the student weighing claiming costs against benefits as has been widely done in the literature analyzing the non-take-up of other social benefits (Blundell et al., 1988; Anderson and Meyer, 1997; Riphahn, 2001; Whelan, 2010; Bruckmeier and Wiemers, 2012, e.g.). Unfortunately, available data sets lack direct measures of the determinants of non-take-up. We discuss suitable proxies and the hypotheses we can investigate with the data at hand in the following.

3.1 Utility from claiming BAföG

Previous studies have identified that both the degree and duration of needs influence the utility derived from social benefits positively (Moffitt, 1983; Anderson and Meyer, 1997; Hernanz et al., 2004, e.g.). Accordingly, the probability not to claim BAföG should be higher if students are in higher semesters and closer to the completion of their studies, i.e., the expected duration of the receipt of BAföG is lower. In line with previous research, we proxy the degree of needs by the level of individual, means-tested benefits which result from our simulation. We expect that higher benefits decrease the probability to turn down BAföG, ceteris paribus and that the students will take up BAföG as long as the level of benefits exceeds the claiming costs.

As the students' factual costs of living are not accounted for by the BAföG calculation—apart from a rent subsidy if living outside the parents' home—, we include further proxies associated with the students' factual level of needs. Student financial aid addresses a very homogeneous group of mainly childless, unmarried persons that is similar with respect to age, previous education, and current living situation. Moreover, the BAföG calculation already takes into account contextual factors such as the students' and parents' or partners' living situation and financial capabilities, so that we can restrict our proxies to the individual level. We add a dummy for whether students still live at home because this may decrease their financial need over and above its consideration of the students' place of living in the BAföG calculation. Furthermore, we include an indicator for whether the student lives in East Germany where rents[7]—and therefore need, controlling for parents' income—are lower. To control for differences in living costs but also differences in availability (and accessibility) of minor employment, we also include a dummy for whether the student is living in an urban or rural area.

Compared to the expected family contribution in the US, the German law expects parents to support their dependent children with the amount of their incomes exceeding

[7] See Federal Institute for Research on Building, Urban Affairs and Spatial Development (2013), p. 3.

the respective thresholds (for more details see section 9.1). Therefore, we implicitly control for the parents' transfers to their children when keeping the amount of benefits constant. Yet, the official BAföG calculation takes parents' incomes in the second-last year as a default, unless students request using the current, lower, incomes. For that reason, very high current incomes might be associated with higher transfers to the offspring not reflected in the BAföG amount. Consequently, we also add the log of parents' monthly current gross labor income in 2007-EUR.[8]

3.2 Disutility from claiming BAföG

Studies investigating social assistance benefits (Riphahn, 2001; Whelan, 2010; Bruckmeier and Wiemers, 2012, e.g.) usually decompose claiming costs into information and stigma costs. Nevertheless, we doubt for three reasons that BAföG involves a social stigma comparable to that possibly felt by persons dependent on social assistance: College is seen as an investment in aspirant future labor market participants. The fact that students do not work (enough to fully finance themselves) is a productive and voluntary "joblessness" because they study full-time and are expected to contribute taxes on their later high incomes after finishing their studies. Moreover, the main calculation basis falls off the person who applies and receives aid so that the reasons for being eligible cannot be attributed to one party. Lastly, the BAföG status cannot be easily inferred from just knowing that someone is studying. The identification as being poor is, however, a necessary feature of external stigma costs (Weisbrod, 1970).

Different preferences about the welfare state

Nevertheless, we hypothesize that the preferences and perceptions of the welfare state might be different for students socialized in families living in the former socialist German Democratic Republic (GDR) before 1989. Alesina and Fuchs-Schündeln (2007) show that socialism increased the East German's approval of redistribution and provision of social services. While the authors expect the large differences in preferences to prevail for one to two generations (20–40 years) after reunification, i.e., for the sample we consider here, others have shown that differences in social behavior are even more persistent (Brosig-Koch et al., 2011; Heineck and Süssmuth, 2013). Moreover, a recent report demonstrates that East Germans have stronger preferences for high levels of social security and equality

[8] We are able to separate the level of benefits and the parents' monthly labor income because the BAföG calculation uses a special, non-deflated income measure. Owing to extensive means-testing and imposition of complex allowances and exemptions, labor income and BAföG benefits are non-linearly related. We report further robustness checks on parents' transfers in section 7.2.

and more frequently agree that the state is responsible to achieve these goals (DESTATIS et al., 2013, p. 370ff).

Therefore, we hypothesize that East German families are more likely to regard it as the state's responsibility to provide student financial aid. They should, consequently, find it more natural to take up the assistance they are eligible for than students without an East German background. If this were the case, students with parents living in the East before 1989 should show higher take up rates than similar children to West German parents socialized in an environment more focused on individual responsibility.

To investigate this hypothesis, we include a dummy for whether at least one parent[9] was living in East Germany in 1989 and refer to this variable as "East German background" interchangeably.

Information constraints and complexity of claiming

Students must be aware of the existence of federal aid, be able to understand the aid scheme and file the application. A lack of knowledge and high complexity of claiming the benefits, by contrast, increases claiming costs. A large strand of the literature casts doubt on the assumption of perfectly informed students (Bettinger et al., 2012; Loyalka et al., 2013; Herber, 2015), emphasizes the complexity of federal aid applications (Dynarski and Scott-Clayton, 2006; Dynarski and Wiederspan, 2012), and shows that information deficits drive non-take-up of other social benefits (Coady et al., 2013).

Our expectations of the role of information constraints and the complexity of claiming aid for the German case are ambiguous: One the one hand, BAföG is the only broad federal student aid scheme and administrated by the student service departments of the universities which makes BAföG a well-known funding source. Moreover, calculators to approximate the prospective benefits are available online (e.g., www.bafoeg-info.de or www.bafoeg-rechner.de/Rechner). On the other hand, students and their parents perceive the 170 questions of the BAföG application forms as confusing and hard to understand; the average time to file the application amounts to 4.5–5.5 hours (Bundeskanzleramt and Nationaler Normenkontrollrat, 2010, p. 41). Apart from that, students might have flawed expectations about their eligibility because the calculation of benefits and the means test are also very complex. In this regard, students might not even consider the possibility that they are eligible, especially if their parents' current labor incomes are high and they are unaware of the fact that the BAföG calculation uses parents' incomes two years ago.

To shed light on the competing mechanisms, we include an indicator for the parents' current labor income, arguing that a higher current labor income decreases not only the perceived level of needs as described in the last section but contributes to the misconcep-

[9] In more than 98% of these cases, both parents were living together either in East or West Germany.

tion of eligibility. Families with higher current income should, therefore, show a lower probability to take up BAföG if high labor income and high misconception of benefits are correlated, over and above the fact that the need for additional resources is lower.

Moreover, we include an indicator for parents' college degree, assuming that parents with a college degree are, ceteris paribus, better informed about higher education, show higher levels of financial literacy, and might have more resources to assist their children in filing the complex forms. The relationship between non-take-up of BAföG and parents' college degree should, consequently, be negative if a lack of information is important.

In the same line of reasoning, we control for whether students can draw upon the assistance of older siblings who claimed BAföG themselves and are, therefore, well acquainted with filing the forms.

Finally, different groups might lack awareness of the attractiveness of BAföG or the student financial aid system in general. First of all, migrants might suffer from (parents') language barriers or little (parental) knowledge about German student financial aid, making them less likely to file the application. Furthermore and contrary to the positive relationship between East German background and take-up described above, East Germans might equally well show higher non-take-up rates because they have gained less institutional experience with BAföG which was established in West Germany. They might moreover have trouble to file the application because East Germans still lag behind with respect to financial literacy (Bucher-Koenen and Lamla, 2014). If information gaps were more important than different welfare preferences, we would expect a higher non-take-up probability of students with East German background. The existence and direction of the overall effect of the East German background variable is, consequently, unclear.

Parents' experience with public transfers

If East German families or families with a migration background are more likely to be in contact with the public administration, for example, because they receive other welfare benefits already or because they need to file applications for work and residence permits, an economies of scales argument moderates the mechanisms described above: A closer contact to administration officers or receipt of other welfare benefits implies economies of scale when getting informed and filing the applications for BAföG (Dorsett and Heady, 1991).

At the same time, parents' experiences with receiving public benefits may also capture a part of the intergenerational persistence of welfare receipt ("welfare trap"): It might be more socially acceptable for students to claim BAföG if they grew up in a family that

received welfare benefits (see, for example, Black and Devereux (2011, p. 1530f) for a review).

To control for these mechanisms, we include a variable for whether someone in the parents' household received public transfers (except maternity benefits and student financial aid) in the previous year. Lacking data on parents' complete welfare receipt histories, we cannot disentangle to which extent our coefficient captures a short-run scale effect or some part of a long-run preference.[10] As both mechanisms point to the same direction, we can, however, hypothesize that parents' (successful) experience with filing forms decreases the likelihood that students reject BAföG if they are eligible.

Time inconsistent preferences, self-control, and debt aversion

Above, we have implicitly assumed a constant exponential discount function resulting in dynamically consistent preferences. Or, in other words, the student's time preferences when deciding about whether or not to take up the aid amount equal those when deciding how to shift consumption between periods. Allowing for hyperbolic discounting relaxes this assumption and can create settings in which consumers wanted to behave patiently in the long-run but are tempted by the immediate gratification of the moment and choose impatiently (Berns et al., 2007, and references cited therein). While impulsivity is the contrary of self-control and associated with impulsive and impatient behavior (Duckworth and Kern, 2011, p. 259),"Self-control refers to the capacity for altering one's own responses, especially to bring them into line with standards such as ideals, values, morals, and social expectations, and to support the pursuit of long-term goals" (Baumeister et al., 2007, p. 351). Low self-control involves the susceptibility to succumb to impulses, a lack of thinking before acting, not finishing boring or difficult tasks, and striving for exiting, possibly dangerous, activities (Whiteside and Lynam, 2001).

Anticipating their own difficulty to spend the borrowed money reasonably as to limit unnecessary debt—or even anticipating that it might be tough to restrict themselves to pay back the loan after graduating—, sophisticated students might abstain from borrowing completely.

Following the "Economic Theory of Self-Control" (Thaler and Shefrin, 1981), we can think of the student being composed of two selves, one of the selves acting as a far-sighted planner and one as a myopic (low self-control) doer. The far-sighted planner might want to save a part of the benefits not necessarily needed to repay the loan faster. Foreseeing that they will not be able to save because they succumb to their impulses, students might rationally choose a "debt ethic" completely prohibiting borrowing (Thaler and Shefrin,

[10] In our case, the scale effects argument seems more plausible, however, because we have to restrict parents' welfare receipt to a single year, resulting usually in a downward biased degree of intergenerational persistence in welfare receipt (Page, 2004).

1981, p. 397). This debt aversion is then not at all irrational but "the logical conclusion of the desire to precommit one's future economic activity" (Strotz, 1955, p. 173). Indeed, Cadena (2008) and Keys (2009) show theoretically and empirically that, if a sophisticated student is sufficiently impatient and her discount function is quasi-hyperbolic, she rejects an interest-free loan offer in order to limit her own overspending during the study period.

Consequently, we expect present-biased sophisticated students low in self-control not to take out the money and spend it carelessly but rather to show debt-averse behavior and turn down the aid offer completely. As we discuss in more detail in paper 5, we add two self-reported indicators of low self-control/high impulsivity and impatience and their interaction to our model to test for the existence of the effects elaborated on above. We expect that students are more likely to reject BAföG if they are high both in impulsivity and impatience.

Because the estimated impact of time preferences significantly depends on whether risk aversion is allowed for or not (Andersen et al., 2008), we also control for willingness to take risk, although we do not expect to find an independent effect of risk aversion due to the specific design of the BAföG scheme.[11]

4 Method

4.1 Definition of non-take-up

Defining a non-take-up rate as the percentage of students who do not take up the benefits available, although they are eligible, requires data on whether the student receives the benefits or not. As eligibility for BAföG is unobservable, eligibility and the respective funding amounts the student would have received had she claimed the benefits must be determined in our microsimulation model.

Four situations can arise when we compare take-up and eligibility: 1., Students simulated as being eligible report funding (take-up), 2., students simulated as eligible do not report funding (non-take-up), 3., students simulated as ineligible report funding (misclassified), 4., students simulated as ineligible do not report funding.

We are mainly interested in why eligible students do or do not claim (cases 1 and 2). Let E denote the number of students simulated as eligible to receive BAföG and let T denote the number of those students who report funding in our data. Let upper bars of these variables represent the contrary, i.e., ineligible $\overline{E}$ and no take-up of the benefit

[11] We moreover tested whether our results were affected by omitted variable bias of personality traits that are also strongly associated with self-control (Whiteside and Lynam, 2001). As adding personality traits increases neither fit nor changes our results remarkably, we decided for the more parsimonious models in the following.

reported $\overline{T}$. The non-take-up rate (NTU) is then defined as the percentage of those who report not to take up the benefits though eligible, $(\overline{T} \mid E)$, to all eligible:

$$NTU = \frac{E - (T \mid E)}{E} = \frac{(\overline{T} \mid E)}{E}. \tag{1}$$

While NTU exploits the first two cases arising from our microsimulation model, we can confidently discard the fourth case as ineligible, non-claiming students are of no interest to us.

Even with high-quality data, it is possible that we classify students as ineligible although they are in fact eligible (case 3). This happens when incomplete or erroneous survey information results in measurement errors. Other than that, students might be classified erroneously as eligible by the public authorities, the administrative process and the students filling in the forms also not being devoid of errors. We use the number of misclassified students to calculate the beta error rate. The beta error rate is defined as the percentage of the students classified as ineligible but reporting benefit receipt $(T \mid \overline{E})$, divided by the sum of all who report to take up the benefits:

$$\beta = \frac{(T \mid \overline{E})}{T}. \tag{2}$$

The beta error rate is often seen as a measure of quality of the simulation. This is somewhat misleading because a very detailed eligibility check and a precise calculation of the benefits with the data at hand (potentially containing measurement error) increase the beta error rate (Frick and Groh-Samberg, 2007). Nevertheless, we follow Bargain et al. (2012) and interpret NTU as the upper bound of the non-take-up rate because it ignores those students classified as ineligible by our simulation and calculate a lower bound of the NTU that subsumes misclassified cases under the eligible cases:

$$NTU_L = \frac{(\overline{T} \mid E)}{E + (T \mid \overline{E})}. \tag{3}$$

4.2 Baseline specification

We can model take up of eligible students in a standard binary choice model where the latent non-take up of BAföG is equal to one if the utility from claiming is larger than the claiming costs (or the utility from non-take-up) and equal to zero otherwise (Moffitt, 1983; Blundell et al., 1988). In our baseline specification, we run a straightforward pooled Probit model and regress our dependent variable NTU on the controls discussed above plus time dummies, age, and gender of the student. We use cluster-robust standard errors

to account for the fact that the similarity between observations of a single individual over time is higher than the similarity of observations between different individuals.[12]

4.3 Endogeneity of the benefits amount

As students' labor income is deducted from their respective needs, students can influence their level of benefits by earning more or less. If unobserved variables like ability or motivation drive both the level of benefits by higher or lower earnings as well as the decision to file the complex application for BAföG, endogeneity of the level of benefits might bias our estimates. Although incentives to increase own incomes above the threshold of maximum allowances are low, we want to investigate the possibility that endogeneity of the level of benefits affects our results. Thus, we estimate a pooled instrumental variable (IV) Probit model with the structural equation

$$NTU^* = \boldsymbol{z}_1\boldsymbol{\delta}_1 + \alpha b + u_1, \tag{4}$$

$$NTU = 1[NTU^* > 0], \tag{5}$$

and the reduced form for the level of benefits

$$b = \boldsymbol{z}_1\boldsymbol{\delta}_{12} + \boldsymbol{z}_2\boldsymbol{\delta}_{22} + u_2 = \boldsymbol{z}\boldsymbol{\delta}_2 + u_2. \tag{6}$$

We assume a bivariate normal distribution of the errors u_1, u_2, independence between the errors and the explanatory variables $\boldsymbol{z}$ (which includes our vector of instruments $\boldsymbol{z_2}$), and normality of our reduced form. If u_1 and u_2 are correlated, our baseline specification suffers from endogeneity. As $u_1|u_2 = \rho u_2 + \epsilon$ and $E(\epsilon|u_2) = 0$, we can formally test whether the benefits level b is exogenous by testing $H_0 : \rho = 0$. We estimate the set of equations by conditional maximum likelihood with clustered standard errors.

As a reference point, we also run a linear two-stage least-squares regression (TSLS) because TSLS requires less distributional assumptions, e.g., errors need not be multivariate normal. Because TSLS ignores the fact that NTU is binary, we again calculate heteroskedasticity-robust standard errors, accounting for the clustered nature and inherent heteroskedasticity of our pooled data.

Similar to McGarry (1996), Whelan (2010), Bruckmeier and Wiemers (2012), and Wiemers (2015), we instrument the level of benefits by the generosity of the system, i.e., the maximum amount of benefits available. Contrary to previous studies on the

[12] In addition to the models presented in the following, we also ran various panel data models. Although the results were mostly identical, we decided in favor of cross-sectional analyses because of the small sample size, the fact that we observe students only twice on average, and the resultant low within and between variations.

take-up of social assistance, we can calculate *individual* exogenous maximum benefit amounts because we can exploit the fact that students' benefits do not only depend on their own, endogenous incomes but also on exogenous other features, such as parents' income or family situation. Individual exogenous maximum benefits are more powerful than general maximum amounts: Individual amounts exploit both variation between students due to different exogenous characteristics but also within students over time because of changes in the parents' exogenous characteristics or reforms of the BAföG scheme.

We calculate individual maximum benefit amounts as follows: We take the maximum level of individual needs as a base value by assuming that the student is not living with her parents and receives the maximum rent subsidy. We keep all other factors that determine the student's needs (e.g., whether the student has to pay health insurance herself because she is older than 25 years or has own children) at their observed values as these are arguably not endogenous. From this sum, we deduct only the parents' or the spouse's allowable incomes but not the student's own income or assets. The resulting maximum amounts are, of course, highly correlated with the factual amounts students receive but should, apart from that, not directly drive whether the student claims the money or not.

Our second instrument is an indicator for whether the student is independently funded. The relevance of this instrument exploits the fact that benefit levels and being independently funded are highly correlated: Independently funded students have had the possibility to accumulate higher incomes and assets likely to be deducted from the BAföG funding amounts.[13] Yet, as the parents' income is not deducted, the direction of the effect of being independently funded on the expected level of benefits is, a priori, ambiguous. Exogeneity of the instrument requires that the students' funding states do not directly explain why they accept or reject the money if their income and assets are low enough to yield positive funding amounts.

4.4 Selection on eligibility

A last issue we address here is the possibility that students may self-select out of the sample by earning so much that they lose their eligibility to positive funding amounts. Ineligible students are not considered by the non-take-up rate defined above. If sample-selection was relevant, instrumental variable techniques could not account for endogeneity introduced by dropping out of the sample.

Self-selection is a cause of concern as the decision to work and drop out is very likely to be non-random, and the same factors driving this decision might also be correlated

[13] The incomes reported by independent students in our sample are about 50% higher than the incomes reported by dependent students.

with the take-up of benefits. Picking up on the example delineated above, the unobserved motivation and ability of students might simultaneously determine the probability to earn very high additional incomes and the likelihood to successfully file the BAföG application, whereas the direction of this bias is a priori ambiguous. In the example discussed in the last section, the respective level of benefits is simply reduced by the additional income. Here, students' incomes lead to a complete loss of eligibility.

To take into account the incidental truncation caused by the endogenous choice of students' own incomes and assets, we specify a pooled Heckman-type binary response model (Van de Ven and van Praag, 1981):[14]

$$NTU = 1[\boldsymbol{x}_1\boldsymbol{\beta}_1 + \alpha b + u_1 > 0] \tag{7}$$

$$y_2 = 1[\boldsymbol{x}\boldsymbol{\delta}_2 + \alpha b + u_2 > 0], \tag{8}$$

where b represents, again, the level of benefits. The explanatory variables $\boldsymbol{x}_1$ are a subset of $\boldsymbol{x}$, the cluster-robust errors (u_1, u_2) are independent of $\boldsymbol{x}$ and normally distributed with a mean of zero, a variance of one, and $corr(u_1, u_2) = \rho$. Equation (7) is the regression equation with NTU being the binary non-take-up of student financial aid equal to one if the eligible students do not take up their benefits and equal to zero if they do take up. The selection equation is represented by equation (8). y_2 is an indicator equal to one if the student's income and assets are below the *individual* threshold of eligibility and equal to zero if the student's income and assets are above the threshold so that she loses eligibility. The non-take-up decision NTU is only observed if $y_2 = 1$, i.e., if the student's income and assets are below their individual thresholds.

To calculate students' individual thresholds, we take the sample of students fulfilling the formal eligibility criteria, including parents' or spouses' incomes, but irrespective of the students' own incomes and assets. We calculate the threshold as the maximum amount a specific student can earn and hold as assets before her simulated benefit amount drops to zero and leads to her self-selection out of the sample. If this drop-out is systematically related to u_1, the estimates of β_1 might be inconsistent.

To identify our system of equations by more than functional form alone, we need at least one variable that is in $\boldsymbol{x}$ but not in $\boldsymbol{x}_1$. As our exclusion restriction, we use a dummy indicating whether the student completed any form of vocational training before studying. Having completed vocational training proxies labor market experience and implies a higher likelihood to have a job and to earn high incomes while studying. We

[14] Previous to our study, Kayser and Frick (2001) and Frick and Groh-Samberg (2007) used a Heckman-type approach to correct for sample selection into non-take-up of social assistance. Wilde and Kubis (2005) address the issue of sample selection in a simultaneous equation model.

have to assume that having completed vocational training influences the take-up decision only via the income-channel but does not directly explain (non-)take-up.

5 Data and variable construction

Our microsimulation, see section 9.2 for details, is based on the Socio-Economic Panel (SOEP), which is a representative micro data source for Germany and includes detailed information on household and individual characteristics, as well as extensive information on income (Wagner et al., 2007).

The BAföG calculation was subject to several substantial structural changes between 2001 and 2002, e.g., the unification of needs over Germany and changes in the regulation on additional need amounts, making the system before and after 2001 difficult to compare. Therefore, we restrict our analyses to the waves between 2002 and the most recent wave of 2013. Because we calculate BAföG benefits on an annual basis and according to the law applicable in that year, changes in the BAföG regulation induced by reforms between 2002 and 2013 are taken care of by our microsimulation model.

On the one hand, microsimulation requires high quality data on income and household composition. Analyzing the factors of non-take-up at the same time requires, on the other hand, also suitable proxy variables to be constructed from survey scales. Although the SOEP is generally well-suited for the purpose of microsimulation, not all questions to construct the proxies previously discussed are available for each and every year as we outline in the following.

5.1 Constructing the sample and variables

To construct our sample, we proceed in three steps. We keep all students, 1., surveyed between 2002 and 2013, 2., formally eligible for BAföG but not receiving any different student financial aid amounts and, 3., for whom we have enough information to perform the means test and simulate BAföG amounts.

For the last step, we require information on the student's complete family, i.e., parents, siblings, and the student's partners if married or in a registered partnership. Yet, full information on the parents' incomes[15] is only available for students raised in families drawn as a part of the SOEP—and where parents therefore answer the survey—, but not for cases where students have been drawn as a separate SOEP household after moving out. In order to keep the maximum number of cases for our descriptive analyses, we check whether the student is independently funded or whether the parents died, both

[15] The SOEP provides readily imputed income measures so that we do not lose cases due to item non-response.

cases implying that the parents' income is not relevant for the assessment of eligibility. In these cases, we can keep the student in the sample, although parents' income information is unavailable.

This procedure leaves us with a sample size of 2,827 cases formally eligible to receive BAföG and where enough information on parents' income and living situation is available. Among the formally eligible, about 28% reported to receive BAföG. 53% of all formally eligible cases do not receive BAföG in the SOEP and are also deemed ineligible for positive founding by our simulation. 22% both claim BAföG as reported in the data and are simulated as eligible. 18% are eligible as of our simulation but do not claim the benefits. About 6% of all theoretically eligible observations are beta error observations allegedly claiming benefits but failing eligibility in our simulation.

Some part of this simulation error may be explained by the fact that the SOEP contained only an aggregate measure for all forms of student financial aid through 2006. Consequently, we cannot distinguish between receivers of merit-based aid and those of need-based aid through 2006. Yet, less than 1% of all German students received merit-based aid at this time (Federal Ministry of Education and Research, 2014). Therefore, this lack in distinction between BAföG and other aid should not be substantive. Accordingly, neither does the simulation quality differ significantly before and after 2007, nor does restricting the sample to the survey years of 2007–2013 affect our results much as we show in the robustness checks later (see section 7.3).

For most of the following descriptive analyses, we focus on the group of students simulated as eligible, irrespective of whether they claim BAföG or not, i.e., 1,315 observations. With respect to the sample used for our multivariate analyses, we face the issue that not all of the covariates needed in order to address the possible mechanisms as intended above are available for all years. Moreover, information on parents never questioned by the SOEP could not always be generated from the students' answers. The sample used for our multivariate analysis is, therefore, smaller (i.e., 986 observations).

In order to prevent a loss of too many observations, we combine responses by parents and information by children about their parents to construct parental background information.

More specifically, we use parents' answers to the question "Where did you live in 1989?" to derive students' East or West German background. If at least one parent indicates to have lived in the East during the fall of the wall, we set the East German background dummy to one and to zero otherwise. The answer to this question is missing only if parents have never been part of the SOEP or were already dead at the time the question was asked. To prevent systematic missings of these cases, we fill the East

German background dummy with information on the students' own place of living in 1989 for students already born before 1989.

We face the same issue for the parents' educational degrees. After exploiting the parents' direct information on educational degrees, we substitute missings by using the childrens' information on parents' educational degrees, which is also available if the parents have never been surveyed.

Our indicator for whether the parental household received public transfers in the previous year is, however, unavailable if parents are not part of the SOEP. Accordingly, we can only replace missings as 0 if we know that both parents were already dead last year. All these missings due to the student being sampled as a new SOEP household and the parents never having been surveyed are, however, not systematically related to the factors of non-take-up.

We use survey measures to assess the students' time and risk preferences, all of them measured on a 11-point scale from 0 "not at all" to 10 "very much". The survey questions are worded as follows:

- Impulsivity: "Do you generally think things over for a long time before acting—in other words, are you not impulsive at all? Or do you generally act without thinking things over a long time–in other words, are you very impulsive?"
- Impatience:[16] "Are you generally an impatient person, or someone who always shows great patience?"
- Willingness to take risk: "Are you generally willing to take risks, or do you try to avoid risks?"

Data on impulsivity and impatience were collected only in 2008 and 2013, data on willingness to take risks were collected in 2006 and between 2008–2013 so that we have to assume stability of the concepts over time.[17] Mainly due to the fact that not all eligible students participated in one of the waves where these scales were questioned, our sample is reduced to 986 observations. Yet, again, we see no reason why the year when the student was part of the sample should be systematically related to her non-take-up-behavior. We take the upper quartiles of our impulsivity and impatience scales to construct indicators of high impatience and high impulsivity.

[16] This item was originally reversely coded with 0 representing "very impatient" and 10 "very patient". We reverse the scale to harmonize it with our other measures.

[17] The concept of self-control is generally regarded as being stable over the course of life (Gottfredson and Hirschi, 1990; Arneklev et al., 2006) and recent evidence on the longitudinal stability of time preferences elicited in an experimental set-up shows that individual time preferences are also stable for most individuals (Meier and Sprenger, 2015). Harrison et al. (2005) find no significant changes in risk aversion when assessed 6 months later.

5.2 Descriptives

Table 1 gives an overview over the weighted analytic sample in general (column 1) and by whether students forgo funding (column 2) or not (column 3). We stick to discussing overall averages, highlighting striking differences by non-take-up in the following.

On average, students are eligible for EUR 314 a month, and, surprisingly, the amount left on the table is only EUR 36 lower on average than the amount taken. Students in our sample are about 23 years old and about half of them is female. Migrants (18% of our sample) are significantly more likely to forgo the benefits (weighted t-test $p < 0.05$). Moreover, we can differentiate between scholarships and BAföG for three quarters of the sample and this percentage does not differ significantly by whether students turn down BAföG or not ($p > 0.1$). Most of those who take up live outside their parents' home and in an urban area, whereas non-takers are much more likely to still live at their parents' home and in rural areas. 17% of the students currently live in East Germany. As can be seen from the numbers of working hours, students who do not take up BAföG work considerably more hours ($p < 0.01$) to support their living.

Remarkably however, students who take out the money do not come from families who are strikingly worse off financially, though non-takers are somewhat less likely to come from a family where at least one parent holds a college degree.

While about one third of the parents lived in the former GDR in 1989, the descriptive difference between takers and non-takers is considerable: The percentage of students with East German background is two thirds higher in the group of those who claim the benefits and the difference is highly statistically significant.

The same is true for older siblings as a potential source of support in filing the BAföG application: The percentage of claimants in the group of students with older siblings who have already claimed is twice as large as the percentage of those who cannot draw upon older siblings' experiences ($p < 0.01$).

Finally, the percentage of the students rating themselves as very impulsive and impatient is higher in the group of students who turn down the benefits, whereas the willingness to take risk does not differ significantly ($p > 0.1$).

6 Non-take-up of BAföG

6.1 Estimated rates of non-take-up

Figure 2 reveals that about two in five students do not claim BAföG, though eligible; the non-take-up rates range between 36% (NTU_L) and 40% (NTU) on average. Reassuringly,

Table 1: Descriptive statistics by whether students take up BAföG or not

	All		Non-take-up		Take-up	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Simulated BAfoeG amount♮	3.14	(1.39)	2.93	(1.35)	3.29	(1.40)
Age of Individual	23.20	(2.26)	23.05	(2.03)	23.30	(2.41)
Female	0.46	(0.50)	0.43	(0.50)	0.49	(0.50)
Student has direct migration background	0.18	(0.39)	0.22	(0.41)	0.16	(0.36)
Scholarship/BAfoeG can be separated	0.73	(0.44)	0.71	(0.46)	0.75	(0.43)
Living situation controls						
Student living in urban area	0.75	(0.43)	0.83	(0.37)	0.70	(0.46)
Student living at parents' home	0.67	(0.47)	0.80	(0.40)	0.58	(0.49)
Student lives in East Germany	0.17	(0.38)	0.14	(0.35)	0.19	(0.39)
Annual hours worked	197.79	(362.79)	234.16	(404.03)	171.88	(328.17)
Parent and sibling controls						
Parents' current gross labor income♮	31.56	(25.13)	31.06	(19.99)	31.91	(28.24)
At least one parent holds college degree	0.40	(0.49)	0.35	(0.48)	0.43	(0.50)
Parents received social transfers	0.17	(0.38)	0.14	(0.35)	0.20	(0.40)
East German background	0.31	(0.46)	0.21	(0.41)	0.38	(0.49)
Older sibling claimed BAfoeG	0.14	(0.34)	0.09	(0.29)	0.17	(0.37)
Time-inconsistent preferences						
Willingness to take risks 0-low, 10-very high	5.33	(2.26)	5.27	(2.37)	5.38	(2.18)
Very impulsive	0.30	(0.46)	0.34	(0.47)	0.28	(0.45)
Very impatient	0.27	(0.44)	0.33	(0.47)	0.22	(0.42)
Observations	986		452		534	

Notes: SOEP 2002–2013, weighted. ♮ = Deflated to base year 2007 and in hundreds of Euro.

both rates do not differ much so that the impact of potentially misclassified cases should be low.[18]

Moreover, we do not find statistically significant differences in the NTUs (and beta error) over time, which reassures us once more that the non-separability of BAföG and scholarships through 2006 is not an issue.[19]

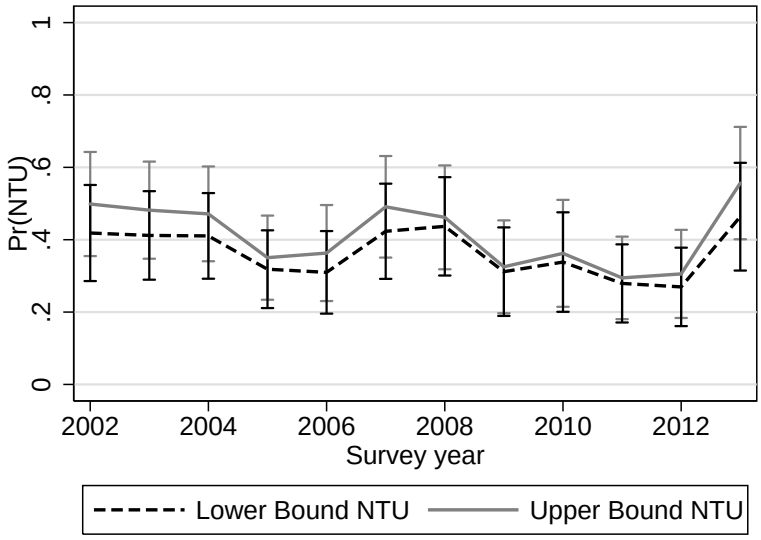


Figure 2:
The development of the upper and lower bound of the non-take-up rate of BAföG over time

Notes: SOEP data 2002–2013, weighted with individual weights, without further controls. The spikes indicate 95% confidence intervals.

To shed some more light on the relationships between our main variables, we plot the deflated BAföG amounts from our microsimulation against the parents' deflated last year's monthly net household income (figure 3). To account for scale effects in consumption within the household, we use the modified OECD equivalence scale. The simulated funding amounts for eligible students, i.e., students with positive amounts, are depicted in dark grey, the zero funding amounts for students fulfilling only the formal criteria in light grey. As expected, the relationship between both variables is negative with students from more affluent families being eligible for lower or zero funding amounts. At the same time, the variance in BAföG amounts over parents' equivalized income is high as

[18] As our sensitivity check in section 9.3 shows, relaxing our restrictive assumptions decreases the beta error rate substantially. As these manual modifications do not affect the regression results, we present the conservative results without any manual corrections only. Corrected results are available upon request.

[19] Although we do not find evidence for a time-trend or statistically significant differences through 2006, we include separate year-dummies in all our regressions.

it is not the income used for the BAföG calculation. All in all, our microsimulation model seems to work well in calculating sensible BAföG amounts and yields results comparable to microsimulations from the SOEP-STSM (Steiner and Wrohlich, 2012, p. 130).

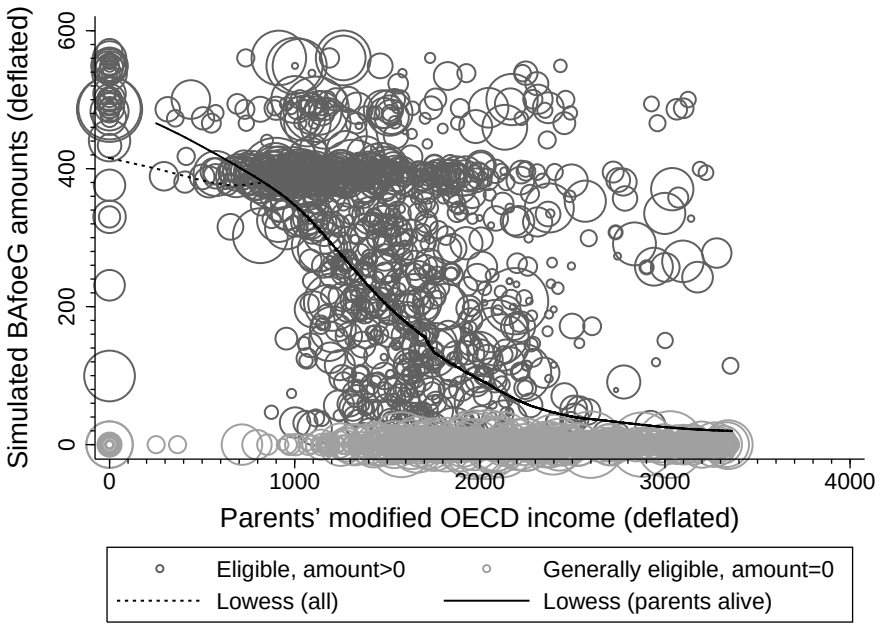


Figure 3:
Simulated amounts of BAföG benefits over parents' monthly household equivalized income

Notes: SOEP data 2002–2013, weighted with individual weights, without further controls. Parents' monthly equivalized household income (modified OECD-scale) is deflated to base year 2007 and presented here if it is below EUR 3728, i.e., below the sum of the mean and one standard deviation of the equivalized household income. The equivalized household income is zero if both parents are deceased but the student is independently funded. The data are weighted so that the relative size of the circles indicate how much weight a respective observation, having been over- or underrepresented in the SOEP, receives. Larger circles indicate that the respective observation receives relatively more weight.

Moreover, we investigate which percentage of students is eligible by parents' income and whether eligible students from the lowest tail of the income distribution, where benefits are higher, claim more often than eligible students from higher income families, where benefits are lower (see also Bargain et al. (2012)). Figure 4 shows the eligible students' percentage of all formally eligible students, the average benefit amounts of eligible students, and both NTUs up to the 80% percentile of their parents' household equivalized incomes in the previous year (modified OCED-equivalent).

As can be seen from the grey dashed and dotted curves, BAföG is well targeted to the students from families with low income and/or many children. Accordingly, nearly all students up to the second decile of parents' equivalized income are eligible to positive funding of EUR 400 on average. The differences between the upper and the lower bound

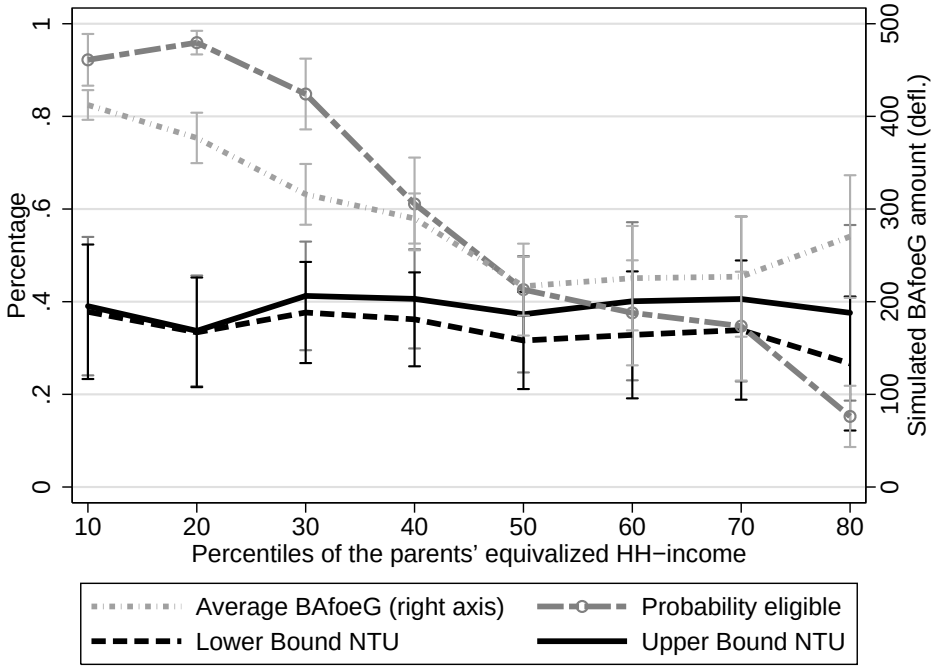


Figure 4:
Non-take-up rate of BAföG and probability to be eligible by percentiles of the parents' equivalized household income

Notes: SOEP data 2002–2013, weighted with individual weights, without further controls and cluster-robust standard errors. Parents' monthly equivalized household income (modified OECD-scale) and the BAföG amount are deflated to base year 2007.

NTU are, moreover, negligible. Small differences are reassuring because they indicate a low number of misclassified cases. After the third decile, the curves of the probability to be eligible and the average funding levels slope steeply downward until less than 20% of the students are eligible to an average amount of EUR 270 in the eighth decile. The non-take-up rates are, however, very stable over the whole range of parents' household incomes. More specifically, students from poorer families who are eligible to higher benefits are not more likely to take up than students from households with higher incomes and eligible to lower benefits. These results already suggest the limited contribution of parents' income and the level of funding available to explain why a large percentage of the students does not take up BAföG.

6.2 Factors of non-take-up

In this section, we want to investigate more closely why students turn down high subsidies. Table 2 gives an overview over coefficients and average marginal effects (AME) from our multivariate analyses. We start with discussing the AMEs from the pooled Probit model in column 1 first, and outline later differences with respect to the IV Probit (column 2), the TSLS model (column 3), and the Heckprobit model (column 4).

The average baseline predicted probability of a student not to take up BAföG is about 42%, which is roughly in line with estimates from the literature on the NTU of social assistance in Germany reviewed by Bruckmeier et al. (2013).

For every EUR 100 of benefits available each month, the probability to turn down BAföG decreases by rather modest 4.4 percentage points (13.8%) on average. Accordingly, the elasticity of the level of benefits with respect to the NTU implies that an increase in BAföG by 10% decreases the probability not to take up by 4.6%. To assess the economic significance of increases in the level of the benefits further, we calculate the AME of changing BAföG from the 5th to the 95th percentile, keeping all other variables at their observed values: On average, the probability not to take up BAföG decreases by roughly 20 percentage points from Pr(NTU=1)=0.54 to Pr(NTU=1)=0.33 when BAföG increases from EUR 48 to EUR 500 ($p < 0.05$).

The controls for the students' living situation reveal that students living in urban areas with, presumably, more employment opportunities are about 19 percentage points more likely not to claim BAföG. Those who profit from low living costs because they live at their parents' homes are 27 percentage points more likely not to take up BAföG, whereas living in East Germany does not significantly affect NTU, although the coefficient points to the expected direction.

Investigating our proxies for information constraints, complexity of claiming, and parents' receipt of welfare benefits reveals two things: First, students from families where

Table 2: Different specifications for the predicted probability not to take up BAföG, i.e., $\Pr(NTU = 1|\mathbf{X})$

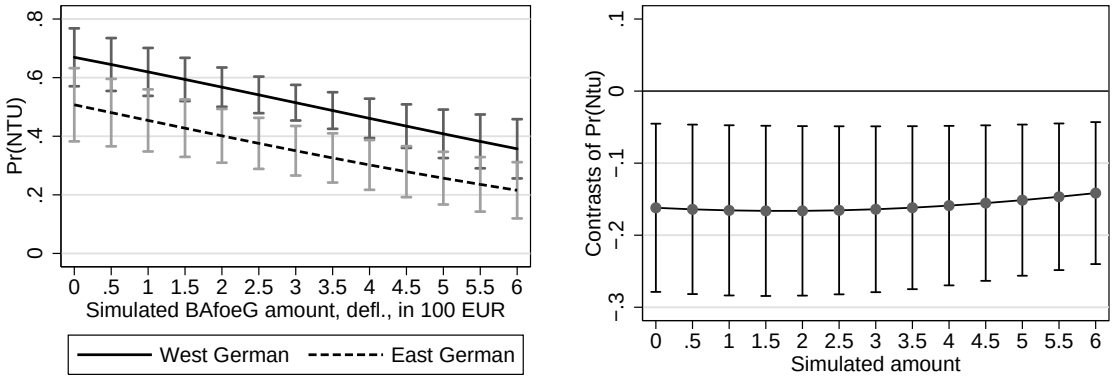
	(1) Probit		(2) IV Probit		(3) TSLS	(4) Heckprobit	
	Coeff	AME	Coeff	AME	AME&Coeff	Coeff	AME
Simulated BAfoeG amount$^{\natural}$	−0.137**	−0.044**	−0.150**	−0.048**	−0.048**	−0.133**	−0.043**
	(0.054)	(0.017)	(0.062)	(0.019)	(0.020)	(0.053)	(0.016)
Age (centered)	−0.003	−0.001	−0.002	−0.001	−0.001	0.017	0.005
	(0.034)	(0.011)	(0.034)	(0.011)	(0.011)	(0.033)	(0.011)
Female	−0.095	−0.030	−0.096	−0.031	−0.037	−0.078	−0.025
	(0.144)	(0.046)	(0.144)	(0.046)	(0.048)	(0.139)	(0.045)
Migration background	−0.108	−0.034	−0.104	−0.033	−0.038	−0.182	−0.058
	(0.209)	(0.066)	(0.210)	(0.066)	(0.072)	(0.203)	(0.064)
Living situation controls							
Student living in urban area	0.607***	0.190***	0.607***	0.190***	0.203***	0.563***	0.180***
	(0.163)	(0.049)	(0.163)	(0.049)	(0.052)	(0.161)	(0.050)
Student living at parents' home	0.838***	0.268***	0.834***	0.267***	0.283***	0.853***	0.277***
	(0.195)	(0.058)	(0.195)	(0.058)	(0.062)	(0.192)	(0.057)
Student lives in East Germany	0.287	0.092	0.293	0.094	0.094	0.308	0.099
	(0.234)	(0.074)	(0.234)	(0.074)	(0.073)	(0.234)	(0.073)
Parent and sibling controls							
Log parental gross labor income$^{\natural}$	−0.031	−0.010	−0.036	−0.012	−0.011	−0.014	−0.005
	(0.056)	(0.018)	(0.057)	(0.018)	(0.018)	(0.055)	(0.018)
Parent(s) have college degree	−0.132	−0.042	−0.137	−0.044	−0.041	−0.113	−0.037
	(0.154)	(0.049)	(0.154)	(0.049)	(0.050)	(0.149)	(0.048)
Parents received social transfers	−0.265	−0.084	−0.260	−0.082	−0.085	−0.269	−0.086
	(0.203)	(0.063)	(0.203)	(0.063)	(0.064)	(0.198)	(0.062)
East German background	−0.458**	−0.148**	−0.456**	−0.147**	−0.159**	−0.523***	−0.170***
	(0.203)	(0.065)	(0.204)	(0.065)	(0.062)	(0.202)	(0.065)
Older sibling claimed BAfoeG	−0.677***	−0.204***	−0.680***	−0.205***	−0.239***	−0.712***	−0.218***
	(0.192)	(0.053)	(0.193)	(0.053)	(0.062)	(0.190)	(0.054)
Time-inconsistent preferences							
Willingness to take risks (std)	−0.096	−0.031	−0.095	−0.030	−0.033	−0.094	−0.031
	(0.068)	(0.022)	(0.067)	(0.021)	(0.022)	(0.066)	(0.021)
Very impulsive	−0.098	0.032	−0.104	0.030	−0.027	−0.076	0.043
	(0.199)	(0.053)	(0.198)	(0.053)	(0.063)	(0.194)	(0.053)
Very impatient	−0.005	0.068	−0.003	0.069	0.010	−0.060	0.056
	(0.238)	(0.059)	(0.238)	(0.059)	(0.079)	(0.234)	(0.058)
Very impulsive × Very impatient	0.695**		0.694*		0.228*	0.744**	
	(0.353)		(0.354)		(0.116)	(0.345)	
Instruments (1st stage)							
Individual max. BAfoeG amount			0.934***		0.934***		
			(0.022)		(0.023)		
Independently funded			0.516***		0.512***		
			(0.155)		(0.157)		
Exclusion restriction (1st stage)							
Vocational training completed						−0.675***	
						(0.231)	
Year controls	✓		✓		✓	✓	
Observations	986		986		986	1041	
Baseline predicted probability	0.417		0.417		0.416	0.444	
corr(u1,u2)=ρ			0.041			−0.748	
Wald test ($\rho = 0$, p-value)			0.526			0.052	
Robust score test (p-value)					0.464		
Overidentification test (p-value)			0.728†		0.353		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors, clustered on the student level, in parentheses.

Notes: SOEP 2002–2013, weighted. $^{\natural}$ = Deflated to base year 2007 and in hundreds of Euro. † p-value from a J overidentification test on an unweighted, twostep version of the IV Probit without cluster-robust standard errors; estimated with the weakiv package in Stata (Finlay et al., 2013).

another social transfer has been claimed in the previous year are less likely to forgo BAföG funding. Yet, the effect is not statistically significantly different from zero. Second, although neither having migration background nor parents' educational and financial situation affect the students' take up decision significantly, having an older sibling who has claimed BAföG before decreases the NTU by 20 percentage points. The latter suggests that support in managing the complex paperwork involved when claiming BAföG is beneficial.

Moreover, there is strong support for our hypothesis that non-take up differs between students socialized in East and those socialized in West Germany. On average, students with an East-German background are about 15 percentage points less likely to reject the money, ceteris paribus. We observe that this gap in non-take-up is stable and statistically significantly different from zero over the whole range of possible funding amounts (cf. figure 5).[20] We closer investigate the robustness of this finding in section 7.



(a) Predicted probabilities

(b) Contrasts of predicted probabilities

Figure 5:
Impact of socialization on non-take-up of BAföG by simulated benefits and by whether parents lived in East or West Germany in 1989

Notes: SOEP 2002–2013, weighted with individual weights. The spikes indicate 95% confidence intervals. Predicted probabilities were calculated from the Probit regression in table 2, column 1. All other variables were held at their observed values.

With respect to the importance of time-inconsistent preferences, we find a statistically significant interaction of impulsivity and impatience in the expected direction of self-commitment to avoid overspending. In table 3, we show the predicted probabilities of NTU for high and low levels of impulsivity and impatience, keeping all other variables at their observed values. The predicted probabilities of students who are high in impatience and low in impulsivity or vice versa do not differ significantly. Impatient students who

[20] The gap is also robust to introducing an interaction between East German background and parents' incomes to our model, although this results in a high degree of multicollinearity.

are very impulsive at the same time are, however, about 23 percentage points more likely to reject the same benefit amount than are impulsive but patient students. This difference is highly statistically significant. We find a symmetrical effect of about 20 percentage points for impatient students when we vary the level of impulsivity. The large double difference of about 23 percentage points (which represents the size of the interaction effect in terms of AMEs) is also statistically significantly different from zero ($p < 0.05$) and in line with the sign and significance we find for the interaction effect in terms of our Probit coefficients. To ensure that the effect is meaningful over the whole range of BAföG amounts, we calculated contrasts for every EUR 50 of the BAföG amount as shown in figure 6a. The difference in non-take-up between East and West German background is large and statistically different from zero at $p < 0.05$ over the whole range of the BAföG benefits as displayed in figure 6b. All in all, our results yield strong evidence for the hypothesis that students with self-control problems restrict their future funding sources as to avoid overspending. As expected, willingness to take risks is not associated with non-take-up.

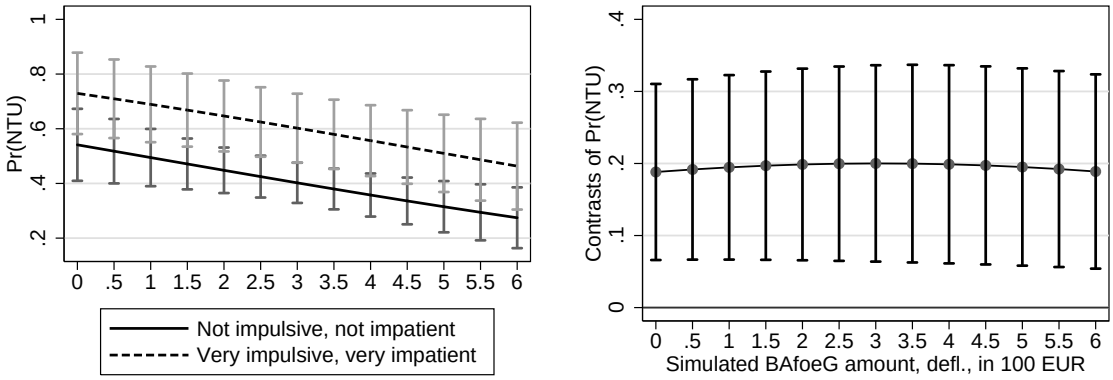
Table 3: Predicted probabilities for non-take-up of BAföG by different levels of the students' impulsivity and impatience

		Very impulsive		
		No	Yes	Difference
Very impatient	No	0.397***	0.366***	-0.032
		(0.037)	(0.058)	(0.064)
	Yes	0.396***	0.594***	0.199**
		(0.078)	(0.064)	(0.095)
	Difference	-0.002	0.229***	0.230**
		(0.077)	(0.083)	(0.116)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Unconditional, cluster-robust standard errors in parentheses.

Notes: SOEP 2002–2013, weighted. Predicted probabilities of the Probit in table 2, col. 1. All other variables were kept at their observed values.

The second and third columns in table 2 present the results from running instrumental variable regressions for the Probit (col. 2) and the linear probability model case (col. 3), using the individual maximum benefits amount and an indicator for whether the student is independently funded as instruments. As indicated by the Wald test of exogeneity and Wooldridge (1995)'s robust score test, we do not find evidence for potential endogeneity of the benefits amount, neither in the non-linear nor in the linear model. In line with this and against the background that our correlation in the errors (u_1, u_2) in the IV Probit is very low, our results are, by and large, unaffected by whether we account for the potential endogeneity of the benefits amount or not. As IV Probit and TSLS are also very similar,



(a) Predicted probabilities

(b) Contrasts of predicted probabilities

Figure 6:
Impact of impulsiveness and impatience on non-take-up of BAföG by the simulated benefit amount

Notes: SOEP 2002–2013, weighted with individual weights. The spikes indicate 95% confidence intervals. Predicted probabilities were calculated from the Probit regression in table 2, column 1. All other variables were held at their observed values.

the somewhat stronger distributional assumptions of the IV Probit do not harm our results. Reassuringly, the first stage coefficients and p-values reported at the bottom of the table indicate that both instruments are very strong—as does a Shea's Adjusted Partial R-squared of .80 from the first stage of the TSLS.[21] Because our model is overidentified, we can conditionally test the exogeneity assumption with an overidentification test. As reported at the bottom of table 2, we cannot reject the hypothesis that the additional instrument is exogenous.

We check whether our specification in column 1 is affected by self-selection in column 4, where we report results from our Heckman-type Probit sample selection model. Only few students dropped out of our sample because they had too much assets or income. Nevertheless, our hypothesis that the errors of regression and selection equation are not correlated is rejected at $p = 0.05$. The correlation of the errors (u_1, u_2) is moreover negative as is the highly statistically significant exclusion restriction, suggesting that students who completed vocational training before studying have a lower probability to remain in our sample of eligible. Although we find evidence that sample selection is an issue, the resulting AMEs, especially for the benefits level, are very similar to those from

[21] It is not straightforward how to test for weak instruments in pooled non-linear models with cluster-robust standard errors and weighted data because there is no clear cut-off for non-linear models to guide us when to reject the hypothesis of weak instruments. Yet, a Kleibergen-Paap Wald F statistic of 1376.11 from our weighted TSLS with cluster-robust standard errors greatly exceeds the Stock and Yogo (2005) critical values of F=19.93 for a relative bias of 10% and provides additional evidence that the instruments are relevant.

the straightforward Probit model, presumably because the number of selected cases is low: The predicted probability to turn down BAföG slightly increases to 44%, and the elasticity of the average non-take-up probability with respect to a 10% increase in the benefits slightly reduces to 4.1%. The impact of East German background, siblings' claiming experience, and debt aversion is somewhat more pronounced. All other conclusions we have drawn from the Probit model (column 1) remain valid.

Taken together, our results suggest that most students stay roughly within the thresholds used for assessment of BAföG eligibility and family insurance so that we find no evidence for endogeneity of the benefit amount if we restrict our sample to students eligible for funding after own incomes are deducted. Nevertheless, some students are likely to earn so much that they lose their complete eligibility and select themselves out of the sample. This sample-selection should be accounted for, so that the Heckprobit model results in our preferred specification.

We run separate analyses to investigate the effect of the duration of benefits as including this variable reduces our sample again.[22] As expected, the relationship between a high number of semesters and non-take-up is positive, but slightly decreasing as we consider only students in the eligible semester range (table 4): The more advanced the student is in her studies, the higher the probability that she does not take up the benefits because the period in which the claiming costs pay off is shorter.

7 Robustness checks

7.1 Different welfare preferences

The stable difference in NTU between students socialized in the East and in the West might be either a masked difference in scale effects or the "welfare trap", given that East and West Germans differ significantly in claiming other social benefits. Therefore, we add an interaction between our East German background variable and the social benefit dummy to our preferred model, the Heckprobit specification, and report results from the Probit as a benchmark. Table 12 in the appendix displays the full results. We again report predicted probabilities with their respective differences in table 5.

[22] The microsimulation accounts for the fact that only students in a certain range of semesters are eligible to receive BAföG. We keep observations with missing information on the year of enrollment in higher education in our sample used for the previous analyses if students report to claim BAföG, assuming that they should accordingly still fall into the eligible range of semesters. Inclusion of these observations does not affect our results.

Table 4: Effect of duration of BAföG benefit receipt on the probability, not to claim BAföG Pr($NTU = 1|\mathbf{X}$)

	(1) Probit		(2) Heckprobit	
	Coeff	AME	Coeff	AME
Simulated BAfoeG amount$^{\natural}$	−0.151***	−0.049***	−0.145**	−0.047**
	(0.058)	(0.018)	(0.058)	(0.018)
Female	−0.086	−0.028	−0.076	−0.025
	(0.147)	(0.048)	(0.142)	(0.046)
Migration background	−0.084	−0.027	−0.147	−0.047
	(0.217)	(0.069)	(0.209)	(0.067)
Academic year	0.376***	0.044***	0.342***	0.042***
	(0.116)	(0.016)	(0.112)	(0.015)
Academic year^2	−0.047***		−0.042***	
	(0.016)		(0.016)	
Living situation controls				
Student living in urban area	0.574***	0.183***	0.522***	0.169***
	(0.167)	(0.052)	(0.163)	(0.052)
Student living at parents' home	0.856***	0.277***	0.830***	0.273***
	(0.188)	(0.056)	(0.184)	(0.056)
Student lives in East Germany	0.282	0.090	0.304	0.097
	(0.243)	(0.077)	(0.240)	(0.075)
Parent and sibling controls				
Log parental gross labor income$^{\natural}$	−0.041	−0.013	−0.028	−0.009
	(0.056)	(0.018)	(0.054)	(0.018)
Parent(s) have college degree	−0.133	−0.043	−0.105	−0.034
	(0.163)	(0.053)	(0.155)	(0.050)
Parents received social transfers	−0.264	−0.085	−0.281	−0.091
	(0.213)	(0.067)	(0.207)	(0.066)
East German background	−0.465**	−0.151**	−0.528***	−0.174***
	(0.209)	(0.068)	(0.205)	(0.068)
Older sibling claimed BAfoeG	−0.663***	−0.205***	−0.700***	−0.220***
	(0.201)	(0.057)	(0.199)	(0.058)
Time-inconsistent preferences				
Willingness to take risks (std)	−0.052	−0.017	−0.048	−0.016
	(0.070)	(0.022)	(0.068)	(0.022)
Very impulsive	−0.066	0.027	−0.051	0.036
	(0.201)	(0.055)	(0.196)	(0.054)
Very impatient	0.031	0.063	−0.021	0.052
	(0.245)	(0.061)	(0.241)	(0.060)
Very impulsive × Very impatient	0.530		0.590*	
	(0.356)		(0.348)	
Exclusion restriction (1st stage)				
Vocational training completed			−0.903***	
			(0.203)	
Observations	944		998	
Baseline predicted probability	0.442		0.470	
corr(u1,u2)=ρ			−0.844	
Wald test ($\rho = 0$, p-value)			0.057	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors, clustered on the student level, in parentheses.

Notes: SOEP 2002–2013, weighted. $^{\natural}$ = Deflated to base year 2007 and in hundreds of Euro.

Table 5 highlights that the AME of the interaction effect equals -0.15 and is not statistically significant from zero (as are the coefficients of the interactions in table 12). Accordingly, having drawn upon other social transfers does not affect families with East and West German background differently.

Table 5: Predicted probabilities for non-take-up of BAföG by the students' East German background and whether parents received other social transfers last year

		Other social transfer		
		No	Yes	Difference
East German Background	No	0.501***	0.482***	-0.020
		(0.042)	(0.090)	(0.089)
	Yes	0.366***	0.196***	-0.170**
		(0.057)	(0.074)	(0.081)
	Difference	-0.135*	-0.286**	-0.150
		(0.069)	(0.117)	(0.120)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Unconditional, cluster-robust standard errors in parentheses.

Notes: SOEP 2002–2013, weighted. Predicted probabilities of the Heckprobit in table 12, col. 2. All other variables were kept at their observed values.

7.2 Parents' financial support

As discussed earlier, the official BAföG calculation uses parents second-last year's incomes, unless students request to use parents' last year's or current incomes. Our microsimulation model is, therefore, based on the assumption that students request an update to more recent incomes if these are lower. If parents' income grows very fast and if parents use the surplus to support their children financially, we might overestimate the students' needs and, accordingly, the importance of the level of BAföG benefits. This biases our results only if the factors of income growth are not controlled for by the socio-economic covariates in our model, and if the income growth is related to an disproportional increase of the direct transfers to the offspring.

We add an indicator for whether parents supported the student financially to columns 1 and 2 of table 6, which results in the loss of one observation due to item non-response. The indicator is not statistically significantly different from zero and does not affect the other coefficients much.

7.3 Different simulation quality

To rule out the possibility that our evidence of non-take-up is simply resulting from poorer data quality for some cases, we construct indicators for whether parents' income

Table 6: Robustness check: Parents' financial support does not impact on non-take-up of BAföG

	(1) Probit		(2) Heckprobit	
	Coeff	AME	Coeff	AME
Simulated BAfoeG amount$^{\natural}$	−0.128**	−0.041**	−0.127**	−0.041**
	(0.052)	(0.016)	(0.051)	(0.016)
Age (centered)	−0.006	−0.002	0.014	0.005
	(0.033)	(0.011)	(0.033)	(0.011)
Female	−0.087	−0.028	−0.072	−0.023
	(0.144)	(0.046)	(0.140)	(0.045)
Migration background	−0.094	−0.030	−0.170	−0.054
	(0.211)	(0.066)	(0.204)	(0.064)
Living situation controls				
Student living in urban area	0.620***	0.194***	0.575***	0.183***
	(0.164)	(0.049)	(0.161)	(0.049)
Student living at parents' home	0.908***	0.288***	0.909***	0.293***
	(0.206)	(0.059)	(0.205)	(0.060)
Student lives in East Germany	0.279	0.089	0.301	0.096
	(0.235)	(0.074)	(0.234)	(0.074)
Parent and sibling controls				
Log parental gross labor income$^{\natural}$	−0.037	−0.012	−0.019	−0.006
	(0.056)	(0.018)	(0.055)	(0.018)
Parent(s) have college degree	−0.128	−0.041	−0.109	−0.035
	(0.154)	(0.049)	(0.148)	(0.048)
Parents received social transfers	−0.268	−0.085	−0.273	−0.087
	(0.205)	(0.063)	(0.200)	(0.063)
East German background	−0.458**	−0.147**	−0.521***	−0.170***
	(0.204)	(0.065)	(0.201)	(0.065)
Older sibling claimed BAfoeG	−0.693***	−0.208***	−0.724***	−0.221***
	(0.191)	(0.053)	(0.190)	(0.053)
Parents' financial support last year	0.161	0.051	0.127	0.041
	(0.147)	(0.046)	(0.146)	(0.046)
Time-inconsistent preferences				
Willingness to take risks (std)	−0.103	−0.033	−0.100	−0.032
	(0.067)	(0.021)	(0.065)	(0.021)
Very impulsive	−0.099	0.032	−0.077	0.043
	(0.198)	(0.053)	(0.194)	(0.053)
Very impatient	−0.001	0.070	−0.056	0.058
	(0.237)	(0.059)	(0.233)	(0.058)
Very impulsive × Very impatient	0.693**		0.743**	
	(0.353)		(0.344)	
Exclusion restriction (1st stage)				
Vocational training completed			−0.708***	
			(0.235)	
Year controls	✓		✓	
Observations	985		1040	
Baseline predicted probability	0.416		0.443	
corr(u1,u2)=ρ			−0.753	
Wald test ($\rho = 0$, p-value)			0.039	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors, clustered on the student level, in parentheses.

Notes: SOEP, weighted. $^{\natural}$ = Deflated to base year 2007 and in hundreds of Euro.

is imputed by the SOEP and whether students, parents, or spouses/partners round their gross income to EUR 100. As shown in the first two columns of table 7, these indicators are not statistically significantly different from zero and provide no evidence that different simulation quality introduces bias to our estimates.

Columns three and four of table 7 investigate whether the estimates differ when we restrict our sample to those for whom we can differentiate between merit-based scholarship receipt and BAföG receipt, i.e., we limit the sample to those surveyed after 2006. Our point estimates are, overall, similar to those from the full sample. We find, however, no evidence for a significant sample selection bias—most probably because the number of cases with self-selection is too low.

7.4 Further robustness checks

We want to mention briefly that our results are also robust to several other robustness checks (results available upon request):

First, until August 2015, students who were only preliminarily accepted for their consecutive studies faced problems receiving BAföG without interruptions, e.g., when applying for a Master program before having completed the Bachelor's thesis. The number of students in our sample who are enrolled in consecutive programs is, however, very low. Excluding these cases does not affect our results.

Second, the introduction and abolition of tuition fees of up to EUR 500 per semester at several German universities in some federal states falls into our observation window. BAföG recipients were, generally, also obligated to pay the fees and their parents were expected to increase their financial support accordingly if possible. Evidence on whether the introduction of the fees had an effect is mixed (Hübner, 2012; Bruckmeier and Wigger, 2014). We construct an indicator based on the students' place of living in a certain year and merge information from federal amendments indicating which federal state introduced tuition fees in which year. The indicator is not statistically significantly different from zero and its inclusion does not affect our results.

Third, we investigate different specifications of our model. Adding further variables to our models in table 2 (student married, age squared, parents' relationship, student receives parental financial support, student has siblings, parents had debts last year, Big Five personality traits, desired age of economic independence as reported at age 17) neither increases model fit nor provides any indication of potential omitted variable bias, so that we report the most parsimonious models only. Moreover, using a broader measure for the parents' income, such as the parents' household net income, does not affect the results. Last, we find no indication of enough non-linearity in the data to justify higher order polynomials of the BAföG amount.

Table 7: Robustness check: Missing data and simulation quality does not impact on non-take-up of BAföG

	Full sample				After 2006			
	(1) Probit		(2) Heckprobit		(3) Probit		(4) Heckprobit	
	Coeff	AME	Coeff	AME	Coeff	AME	Coeff	AME
Simulated BAfoeG amount♮	−0.133**	−0.042**	−0.129**	−0.042**	−0.115*	−0.037*	−0.116*	−0.037*
	(0.054)	(0.017)	(0.053)	(0.016)	(0.067)	(0.021)	(0.067)	(0.021)
Age (centered)	−0.005	−0.002	0.016	0.005	0.007	0.002	0.020	0.006
	(0.034)	(0.011)	(0.033)	(0.011)	(0.045)	(0.014)	(0.048)	(0.015)
Female	−0.095	−0.030	−0.081	−0.026	−0.019	−0.006	0.006	0.002
	(0.145)	(0.046)	(0.140)	(0.045)	(0.180)	(0.057)	(0.179)	(0.057)
Migration background	−0.113	−0.036	−0.189	−0.060	−0.095	−0.030	−0.139	−0.044
	(0.209)	(0.066)	(0.203)	(0.064)	(0.253)	(0.079)	(0.245)	(0.076)
Living situation controls								
Student living in urban area	0.635***	0.198***	0.580***	0.184***	0.656***	0.200***	0.627***	0.193***
	(0.161)	(0.048)	(0.159)	(0.049)	(0.195)	(0.056)	(0.205)	(0.059)
Student living at parents' home	0.831***	0.266***	0.841***	0.273***	0.799***	0.254***	0.834***	0.267***
	(0.195)	(0.058)	(0.192)	(0.058)	(0.248)	(0.073)	(0.251)	(0.075)
Student lives in East Germany	0.313	0.100	0.330	0.105	0.576**	0.183**	0.595**	0.187**
	(0.234)	(0.074)	(0.232)	(0.073)	(0.278)	(0.085)	(0.281)	(0.084)
Parent and sibling controls								
Log parental gross labor income♮	−0.045	−0.014	−0.028	−0.009	−0.056	−0.018	−0.045	−0.014
	(0.056)	(0.018)	(0.055)	(0.018)	(0.080)	(0.025)	(0.081)	(0.026)
Parent(s) have college degree	−0.130	−0.042	−0.110	−0.036	−0.070	−0.022	−0.066	−0.021
	(0.154)	(0.049)	(0.148)	(0.048)	(0.193)	(0.061)	(0.190)	(0.060)
Parents received social transfers	−0.273	−0.086	−0.273	−0.087	−0.400	−0.123	−0.393	−0.122
	(0.203)	(0.063)	(0.197)	(0.062)	(0.267)	(0.079)	(0.265)	(0.079)
East German background	−0.471**	−0.151**	−0.537***	−0.175***	−0.560**	−0.175**	−0.597**	−0.188**
	(0.204)	(0.065)	(0.201)	(0.065)	(0.235)	(0.072)	(0.237)	(0.073)
Older sibling claimed BAfoeG	−0.689***	−0.207***	−0.727***	−0.222***	−0.646***	−0.192***	−0.683***	−0.204***
	(0.195)	(0.054)	(0.192)	(0.054)	(0.228)	(0.062)	(0.228)	(0.063)
Data-quality indicators								
Parents' income imputed	0.070	0.023	0.060	0.019				
	(0.059)	(0.019)	(0.058)	(0.019)				
Gross income rounded	0.088	0.028	0.110	0.035				
	(0.128)	(0.041)	(0.125)	(0.040)				
Time-inconsistent preferences								
Willingness to take risks (std)	−0.097	−0.031	−0.095	−0.031	−0.126	−0.040	−0.127	−0.040
	(0.068)	(0.022)	(0.066)	(0.021)	(0.079)	(0.025)	(0.078)	(0.025)
Very impulsive	−0.117	0.028	−0.092	0.039	−0.220	−0.002	−0.206	0.005
	(0.200)	(0.053)	(0.195)	(0.052)	(0.236)	(0.062)	(0.239)	(0.064)
Very impatient	−0.010	0.070	−0.067	0.056	0.058	0.099	0.022	0.093
	(0.241)	(0.059)	(0.235)	(0.058)	(0.277)	(0.073)	(0.274)	(0.072)
Very impulsive × Very impatient	0.720**		0.764**		0.784*		0.829**	
	(0.355)		(0.345)		(0.425)		(0.421)	
Exclusion restriction (1st stage)								
Vocational training completed			−0.723***				−0.848***	
			(0.227)				(0.308)	
Year controls	✓		✓					
Observations	986		1041		625		659	
Baseline predicted probability	0.417		0.444		0.401		0.422	
corr(u1,u2)=ρ			−0.789				−0.460	
Wald test ($\rho = 0$, p-value)			0.042				0.533	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors, clustered on the student level, in parentheses.

Notes: SOEP 2007–2013, weighted. ♮ = Deflated to base year 2007 and in hundreds of Euro.

8 Discussion

This paper investigates which percentage of eligible students do not take up the German student financial aid, BAföG, and provides insights into the explanatory factors of non-take-up. We explicitly account for endogeneity of the level of benefits and students selecting themselves out of the group of eligible.

Although the combination of a grant and zero interest loan is very lucrative and classical economics would expect students to claim the aid amounts, about two fifths of the students forgo funding. Students are more likely to claim the benefits if the expected duration of funding is high. Moreover, increasing the level of benefits by 10% reduces the probability of non-take-up by about 4.1% on average when sample selection is taken into account. The probability of non-take-up is, therefore, relatively inelastic with respect to the level of benefits, though our estimate is about one third higher than those found for non-take-up of social assistance in Germany (Anderson and Meyer, 1997; Riphahn, 2001). Our evidence of the existence of BAföG non-take-up and its rather low benefit-level elasticity provide a novel explanation why increasing the level of student financial aid cannot raise students' university enrollment substantially (Baumgartner and Steiner, 2005, 2006; Steiner and Wrohlich, 2012).

We test hypotheses on various factors related to non-take-up behavior. We find that students socialized in the former socialist East where people still have stronger preferences for high levels of social security and equality, are considerably less likely to forgo the benefits, irrespective of whether parents claimed other welfare benefits in the previous year. At the same time, students with siblings who already claimed the benefits and are, thus, acquainted with the formalities of claiming are more than 20 percentage points more likely to take up BAföG. Debt aversion, to the contrary, is strongly associated with higher probabilities of non-take-up.

Like most other studies investigating non-take-up of social benefits, we have to rely on survey data to draw upon information of both eligible and ineligible students and to be able to shed light on the reasons for non-take up. The use of survey data is, however, associated with well-known limitations such as measurement error or small sample sizes for specific subgroups.[23]

Furthermore, as survey data usually lacks direct measures of the reasons to reject social benefits, we have to base our analyses on proxy variables that generally yield conflicting expectations about the theoretical direction of the effects (Becker and Hauser, 2003, p. 149f) or do not allow to disentangle competing explanations. We carefully account for potential endogeneity arising from students' endogenous choices of their

[23] See Hernanz et al. (2004) for an extensive overview over (dis-)advantages of various data sources for the analysis of non-take-up.

incomes and do, therefore, implicitly incorporate unobserved differences in, e.g., abilities or motivation. Nevertheless, we cannot rule out that some degree of omitted variable bias remains. More specifically, further research is needed to assess whether other behavioral economics explanations for students' non-take-up of BAföG do also matter, for example procrastination, mental accounting, or framing effects (see Boatman et al. (2014) for an overview over the last two channels).

Due to our rather small sample size and the low within- and between-variation, we restrict our analyses to pooled cross-sections. To the best of our knowledge, sufficiently rich data sets allowing to account for unobserved heterogeneity between students in a panel-design are not yet available. Once appropriate data is available, rerunning our analyses in a longitudinal design is an interesting avenue for future research. In case this data included repeated measures of the real incomes and assets or allowed to merge external register data on income, future studies should also account for measurement error as done by, e.g., Hernandez and Pudney (2007).

Up to now, we can, nevertheless, conclude that a significant share of students does not claim the student financial aid available. Non-take-up is potentially detrimental to intergenerational educational mobility if these students prolong their time to degree, graduate with worse grades, or fail to graduate completely. As previous studies suggest (Triventi, 2014, e.g.,), dropping out without a degree is often a consequence of financial hardship or long working hours.

Our results suggest that take-up is not easily increased by simply raising the level of benefits. Against the background that we find strong evidence for debt aversion resulting from students' fear to spend the money they intended to save, a policy implication would be to provide only the grant component of BAföG as a default, instead of automatically embedding the loan into the BAföG scheme.

Furthermore, filing applications online, which will be possible as of autumn 2016, provides several starting points to facilitate the administrative processes and to decrease the opportunity costs of claiming BAföG. For example, information from students' previous applications or from parents' electronic income tax declaration could be prepopulated.

Finally, we are convinced that simplifying the overly complicated application forms for BAföG would not only cut red tape, but also decrease the number of students who are put off claiming and at risk of financial hardship.

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9 Appendix

These appendices outline briefly the complex calculation of the BAföG benefits, the rough set-up of our microsimulation model and the sensitivity of the NTU and beta error to necessary assumptions on our data. To reduce the complexity of our descriptions, the following sections refer to the BAföG calculation for a single student. If the student is married or lives in a registered partnership, the calculation is similar, but based on the spouse's or partner's income and living situation instead of on the parents'.

9.1 BAföG calculation

To illustrate the BAföG calculation, we draw upon a simple example, representing the standard case (see table 8). The example details the BAföG calculation for a single 24-year-old student in 2015 who is not living at her parents' home. The student has neither own earnings, nor assets. Her brother is in vocational training and earns EUR 6,000 per year. Their parents are married; the mother is not employed, but the father earned EUR 38,000 in 2013 and EUR 44,000 in 2015 as an employee in a close-by company. The father's travel distance each day amounts to 5 km for a single journey.

First, we identify the income considered relevant for the calculation of BAföG. The income relevant for BAföG is generally defined as the sum of all positive earnings according to § 2 sect. 1 and 2 of the Income Tax Act: incomes from agriculture and forestry, income from industrial or commercial activities, income from self-employment, employment income, income from investment of capital, rental income, and other income such as life annuities or income from private sales business. Further income as of § 21 sect. 2a and 3 BAföG (earnings taxable outside Germany) must be added; public-sponsored scholarships of up to EUR 300 (e.g., Deutschlandstipendium) are exempt from these deductions. In our example, the starting point is the sum of parents' gross incomes from employment in 2013, i.e., EUR 38,000.

To calculate the parents' incomes relevant for BAföG (§ 21 and § 24 BAföG), the mother's and father's gross positive earnings are reduced by a lump sum for income-related expenses[24], payed taxes such as income tax, church tax, solidarity surcharge, old age percentage reductions (§ 21 sect. 1 BAföG), and by flat-rate social security benefits (§ 21 sect. 2 BAföG). Some forms of grant-aided privately funded pension schemes are also be subtracted. In our example, the father's commuting expenses do not exceed the EUR 1,000 lump sum for income-related expenses, so that we reduce his gross income by EUR 1,000 only. We calculate allowances for social insurance payments, church tax, and

[24] In case the actual income-related expenses exceed the general lump sum amounts of currently EUR 1,000, the full amount of income-related expenses can be deduced. The same holds for the student.

Table 8: Exemplary BAföG calculation

Calculation of the parents' BAföG-relevant income		
Gross income from employment	EUR	38,000.00
./. Income-related tax deductions (lump sum)	EUR	1,000.00
./. Allowances for social insurance payments	EUR	7,881.00
./. Income tax (including church tax and solidarity surcharge)	EUR	3,214.72
= Parents' income relevant for BAföG	EUR	25,904.28
Monthly parents' income relevant for BAföG	EUR	2,158.69
Calculation of the sibling's BAföG-relevant income		
Vocational training pay (monthly)	EUR	500.00
./. Lump sum allowance (see Tz 21.1.32 BAföGVwV)	EUR	140.00
Sibling's income relevant for BAföG	EUR	360.00
Calculating parents' income relevant for BAföG including allowances		
Monthly parents' income relevant for BAföG	EUR	2,158.69
./. Basic allowance for the parents	EUR	1,605.00
./. Basic allowance for the sibling reduced by sibling's income	EUR	125.00
= Parents' income relevant for BAföG reduced by basic allowances	EUR	428.69
./. Additional allowance for parents (50 %) and sibling (5 %)	EUR	235.78
Parents' income relevant for BAföG including allowances	EUR	192.91
Calculating the BAföG amount		
Basic needs	EUR	373.00
+ Rent subsidy	EUR	224.00
= Sum of needs	EUR	597.00
./. Parents' income relevant for BAföG including allowances	EUR	192.91
= BAföG amount	EUR	404.09
BAföG amount (rounded)	EUR	404.00

Notes: Exemplary BAföG calculation for the standard case of a single, childless 24-year-old student, living not at her parents' place and having neither own earnings, nor assets.

the solidarity surcharge. After deducting all these components and dividing the sum by 12, we arrive at the parents' monthly "income relevant for BAföG", here equal to EUR 2,158.69. Note that the "income relevant for BAföG" is neither gross nor net income but a special measure used only for the BAföG calculation.

Only the parents' and student's incomes are considered in the calculation of the income relevant for BAföG. Nevertheless, incomes of step parents, children, and other dependents of the parents reduce parents' allowances for children who are not theoretically eligible for BAföG (§ 23 sect. 3 BAföG), see table 9. In our example, the student's brother is in vocational training and, therefore, ineligible to claim BAföG. Nevertheless, the parents can protect up to EUR 485 of their incomes to support their son financially. His training pay reduces the parents' maximum allowance, though: The family is allowed to protect a lump sum of monthly EUR 140 from the son's vocational training pay. The remaining EUR 360 are, however, considered as income relevant for BAföG and, therefore, deducted from the maximum parental allowance of EUR 485. All in all, parents can, thus, only deduct an allowance of EUR 125 from their income relevant for BAföG.

Parents can further protect monetary amounts from being means-tested, depending on their living situation. In the case considered here, both parents are married and cohabiting, so that they can protect another EUR 1,605 for their own use. After deducting both the allowance for parents' own use and for their son, the parents' income relevant for BAföG reduced by basic allowances amounts to EUR 428.69. From this amount, parents are, again, granted an additional allowance equal to half of the income relevant for BAföG plus another 5% for each dependent not theoretically eligible for BAföG. As the student's brother is ineligible for BAföG, the parents in our example are granted EUR 235.78 as an additional allowance for themselves and the brother.

Parents are expected to be able to use the remaining amount of EUR 192.91 to support their complete offspring financially. Therefore, the remaining parents' income relevant for BAföG including allowances is divided by the number of dependents formally eligible to receive BAföG. The parents in our example are expected to use the full amount of EUR 192.91 to support their daughter. If the brother had been eligible, the monetary amount of expected support would have dropped to EUR 96.46 as the parents' applicable income would have been divided by two.

While parents are allowed to protect their full assets—except the interest accruing from it which is part of the sum of positive earnings—, both the student's earnings *and* assets are subject to the means test.

The student's maximum earnings without deductions are calculated as follows (§ 21 and § 23 BAföG): Starting point of the calculation is the student's gross income for the respective year BAföG is claimed for. From this, EUR 1,000 of income-related expenses

Table 9: Basic allowances of incomes and assets between 2002 and 2015

Basic allowances of… (in EUR)		2010–2015	2008–2010	2002–2008
…parents' or spouse's / partner's income				
	cohabiting and married or in a registered same-sex partnership	1,605	1,555	1,440
	single parent, not cohabiting	1,070	1,040	520
	additional allowance for step-parent	535	520	480
	additional allowance for children and other dependents not eligible for BAföG	485	470	435
…own income				
	earned income	255	255	112-215
	married or in a registered same-sex partnership and spouse not eligible for BAföG	535	520	480
	with children / dependents not eligible for BAföG (each)	485	470	435
	orphan's pension	125	120	112
	case of hardship	205	205	205
…own assets (per year)				
	for the claimant	5,200	5,200	5,200
	for the spouse / partner	1,800	1,800	1,800
	for each child	1,800	1,800	1,800

Notes: Amounts are in euro and per month (if not indicated otherwise). *Source:* Own table based on Rothe and Blanke (2015).

are subtracted as a lump sum, unless higher factual expenses can be proven. Then, a certain percentage is deduced as a flat-rate amount. The percentage depends on whether the student is compulsorily insured as a student or as an employee in the retirement insurance and on the type of employment. The default is compulsory insurance as a student or as a student working in a job with compulsory insurance, resulting in a flat-rate percentage of 21.3%. Furthermore, to calculate monthly amounts, the remaining amount is divided by 12 months. Last, the respective exempt amounts, depending on the student's living situation (e.g., EUR 255, see table 9), are deducted. The maximum gross income to be earned without deductions is, therefore, EUR 4,884 a year or EUR 407 a month if the student is in a minor employment—other than that, the student loses his or her family insurance. With respect to own assets, students are expected to use every euro exceeding a cut-off of EUR 5,200 for their education. As the student in our example has neither own income nor assets, we can skip the means test of own incomes and assets.

To calculate the student's respective BAföG amount, we have to calculate the sum of needs first. The basic need amount equals EUR 373 and can be supplemented by additional amounts, depending on the student's living situation and age, see table 10. In our example, the student has her own flat and is, therefore, also eligible to a rent subsidy of EUR 224. Because she is childless and under age 25, she is still insured in her parents' non-contributory dependents' co-insurance and does not qualify for other additional amounts as of table 10. From the student's level of needs, we deduct the parents' and student's incomes relevant for BAföG including allowances and the student's assets above EUR 5,200. The resulting amount is the level of monthly benefits to be cashed. For the student in our example, we have to deduct only the parents' income measure and arrive at a rounded BAföG amount of EUR 404.

Table 10: Level of needs 2002–2015

Level of needs		2010–2015	2008–2010	2002–2008
Basic need				
	Students in higher education	373	366	333
Additional amounts				
	to cover living expenses if living at home	49	48	44
	to cover living expenses if not living at home	224	146	133
	health insurance	62	50/54	47
	care insurance	11	9/10	8
	first child (below age 10)	113	113	–
	further children (below age 10)	85	85	–

Notes: Amounts are in euro and per month. *Source:* Own table based on Rothe and Blanke (2015).

9.2 The microsimulation model

This section explains the basic features of our microsimulation model and details the most important assumptions made on the data.

Our microsimulation model takes three main steps to set up the analytic sample used for our analyses: First, we isolate the formally eligible students and their siblings. Second, we prepare our data for the means test. More specifically, we set up an income tax model, roughly following Schwarze (1995), to calculate the incomes relevant for BAföG from the respective gross income amounts. Third, we perform the means test by calculating the students' needs, subtracting the BAföG-relevant incomes, and accounting for the relevant allowances. The third step entails the procedure detailed in section 9.1.

As described previously, we determine the formal BAföG eligibility of all students in the SOEP 2002-2013, following § 2 et seq. BAföG. In other words, we have to assess whether students are formally eligible to participate in the means test. While we can easily assess whether students meet the age requirement and are enrolled at an eligible higher education institution,[25] we have to impose assumptions on the maximum funding period. Students can receive funding for their first degree and during the respective average period of studies (*Regelstudienzeit*). The average period of studies varies with the desired degree, the subject of studies, and the type of higher education institution. Lacking full information to construct individual-specific average period of studies, we calculate weighted averages of the the average period of studies at universities and universities of applied sciences, respectively, using data from the Hochschulrektorenkonferenz (2012, p. 14ff). Accordingly, we assume that students enrolled at universities of applied sciences are eligible to four and students enrolled at universities are eligible to five years of BAföG funding. These cut-offs are rather restrictive to prevent an artificial increase in our NTU.

We abstain from further differentiating the maximum period of studies by desired degree for two reasons: First, we lack information on desired degrees and can only observe achieved degrees. Second, we have to rely on annual data for the students' enrollment status, so that we could not model the slight differences between the maximum period of studies in different degrees anyway.

Moreover, funding is granted on two further specific conditions. First, students have to proof sufficient progress in their studies. This proof of progress is due after completion of the fourth semester or, when their higher education institution requires taking an intermediate examination before the third semester, after completion of the second semester. Second, to remain eligible, students must not change their field of studies after a certain number of semesters. Lacking both information on grades and

[25] We have to drop cases with missing information on the year of enrollment in higher education from our data.

institution-specific information about intermediate examinations, we cannot incorporate the progress requirement. Because results from the representative student survey of Middendorff et al. (2013, p. 312) show that insufficient progress is neither important in students' decisions to apply nor a relevant factor to explain why students are not awarded the benefits, we consider this shortcoming as negligible. Lacking information on the students' field of studies, we can neither incorporate harmful changes in subject of studies. Changes in subject of studies are, however, also no frequent reason for why students forgo BAföG funding (Middendorff et al., 2013, p. 312).

As detailed previously, the family can protect additional monetary amounts for every sibling formally eligible to receive BAföG. To assess how many siblings are formally eligible to receive BAföG, we merge information on siblings from all survey waves of the SOEP. As the juridical distinction between eligible and ineligible programs is very complex and is often subject to individual case-by-case decisions, we cannot take into account all details of § 2 sect. 1 BAföG with the data at hand. We proxy siblings' eligibility, using information on their degree(s) previously attained, the type of their current educational program, and whether they are enrolled as full- or part-time students.

To set up the income tax model, we restrict our sample to eligible students for whom we have enough information to calculate the students' BAföG amounts. We face missings from three main sources: First, data on the students' wealth were only collected in 2002, 2007, and 2012. Second, data on parents' old-age provisions were only collected in 2004, 2006, 2007, 2010, and 2012. Third, data on church taxes payed were only collected in 2003, 2007, and 2011. As students' assets rarely exceed the allowable thresholds, missing information on assets are of minor importance for the quality of our calculation. Missing information on parents' old-age provisions and church taxes payed are more important because they directly affect the respective incomes relevant for the BAföG calculation. We follow Bruckmeier and Wiemers (2012) and linearly interpolate the missing values from all three sources for gap years. We have to discard cases where we do not even have enough information to interpolate.

To compute the incomes relevant for BAföG, we have to calculate the individual sum of all positive earnings as explained in section 9.1. We compute the sum of all positive incomes for each individual in the household, where possible. Income components such as profits or losses from investment of capital and rental income are, however, only available on the household level. We assume that these income components reduce or increase the income of the household head. As the income of married spouses enters the means test as an aggregate amount anyway and as only few cases report profits and losses at all, this assumption is innocuous for 94% of our sample.

The BAföG calculation uses parents' second last year's incomes as a default. If subsequent incomes are lower, e.g., because of unemployment, students can request using more recent incomes instead (see § 24 sect. 3 BAföG). We account for the possibility to update incomes by assuming that rational students request using parents' recent incomes if these are lower. Therefore, to compute the BAföG amounts between the years 2002 and 2013, we have to compute income taxes for the years 2000 through 2013.

Furthermore, we have to take into account income-related tax deductions from the parents' and students' incomes. Usually, these are considered up to a lump sum of EUR 1,000, unless higher expenses are proven for, e.g., commuting, moving, or working from home. We have enough information to calculate the most important part of the income-related tax deductions, namely commuting expenses. To calculate commuting expenses, we exploit available information on the commuting distance (single journey), the days worked (based on the annual working hours and taking into account information on full or part-time employment), and the deductible amount per kilometer in the respective year. We deduct the lump sum of EUR 1,000, unless the commuting expenses exceed EUR 1,000. In the latter case, we deduct the full commuting expenses.

Apart from that, we calculate further allowances for social security payments, but also income taxes, church taxes, and solidarity surcharges according to the respective German laws in the respective year (§ sect. 2 BAföG and German tax law (EstG)). The remaining BAföG calculation proceeds as detailed in the previous section.

All in all, the assumptions we have to impose on our microsimulation tend to underestimate parents' and, to a less extent, students' possibilites to protect income from the means test. Therefore, we tend to overestimate parents' financial resources available to support their offspring. In other words, our specification is rather restrictive. Restrictive assumptions are generally associated with a higher beta error and a lower NTU (Frick and Groh-Samberg, 2007). We discuss in the next section how relaxing the rather restrictive assumptions affects both measures.

9.3 Reduction of beta error

The students' level of needs is straightforward to calculate once the students' place of living, age, and family situation are known. Assuming that the microsimulation model correctly calculates the students' needs, there are two potential explanations for a high beta error rate: First, students are incorrectly classified as ineligible. As previously mentioned, our model tends to overestimate true incomes relevant for BAföG because we cannot incorporate all special allowances with the SOEP data. Accordingly, we tend to underestimate the number of eligible students which increases the beta error. Second,

students are correctly classified as ineligible but their survey information on BAföG receipt is misleading.

The first case is plausible when the parents' or the students' incomes (as well as the students' own assets) exceed the respective thresholds only by a slight percentage. We study this possibility in models 1-4 of table 11. The first row contains the model used for our analyses as a benchmark. In model 1, for example, we consider students whose parents' relevant income or their own relevant income and assets exceed their needs by 5%. Assuming that students are classified as ineligible only because we overestimated their true incomes relevant for BAföG by up to 5%, we reduce our simulated incomes by the respective percentage and reclassify students from ineligible to eligible. Doing so makes our model less restrictive and decreases the beta error rate by 5.8% to 14.7%. The non-take-up rate is, however, very robust to this correction and decreases by 0.5% only. We report the sensitivity of beta error and NTU up to a correction of 20%. Although correcting incomes by 20% is a substantial reduction in BAföG-relevant incomes and makes our model far less restrictive, the non-take-up rate is only slightly affected. When compared to our benchmark model, the beta error rate decreases, however, by 20%.

In cases where the income relevant for BAföG exceeds the students' needs by far, but the student reports to have been funded, it seems more plausible that the information on benefit receipt is misleading. For example, in those cases where we cannot separate BAföG from merit-based scholarships, students can correctly report both positive student financial aid amounts and parents' incomes far beyond the respective BAföG thresholds. In models 5-8 of table 11, we investigate the sensitivity to reclassifying students from eligible to ineligible when the BAföG-relevant incomes are 10 times, 7.5 times, 5 times, and 2.5 times higher than the students' needs. As we observe less cases where the BAföG-relevant incomes exceed the students' needs by more than factor 10 than we observe cases where incomes exceed needs by only factor 2.5, model 5 has the least, model 8 the most impact on our beta error rate. The NTU is unaffected because we reclassify ineligible claimers to ineligible non-claimers, and both cases do not enter the NTU. Models 5-8 show that the beta error rate can be decreased to 9.9%, assuming that all cases with incomes exceeding needs by more than 2.5 times are in fact ineligible for BAföG.

Finally, models 9. - 12. combine both corrections. Reclassifying students as eligible if their (family's) BAföG-relevant incomes exceed their needs by up to 20% and as ineligible if their (family's) BAföG-relevant incomes exceed their needs by more than factor 2.5 leads to a decrease in the beta error rate by more than 50%. Nevertheless, the NTU is very robust even to these extensive corrections.

All in all, this analysis shows that the NTU is almost unaffected, although we allow for extreme and less realistic corrections of the incomes relevant for BAföG. As sensible

corrections do also not affect our multivariate results, we decided to present results from the uncorrected model only (model 0).

Table 11: Sensitivity of NTU and beta error

Model	Beta error rate (%)	Non-take-up rate (%)
0. Reference	15.6	39.5
Correction if relevant income exceeds needs by up to		
1. 5 %	14.7	39.3
2. 10 %	14.1	39.1
3. 15 %	13.2	38.8
4. 20 %	12.5	38.7
Correction if relevant income exceeds needs more than		
5. 10 times	12.5	39.5
6. 7.5 times	11.4	39.5
7. 5 times	11.2	39.5
8. 2.5 times	9.9	39.5
Mixed		
9. model no. 1 and no. 5	11.6	39.3
10. model no. 2 and no. 6	9.9	39.1
11. model no. 3 and no. 7	8.7	38.8
12. model no. 4 and no. 8	6.7	38.7

Notes: The reference model is the specification used in our main analyses.

9.4 Additional tables

Table 12: Robustness of East German background effect

	(1) Probit		(2) Heckprobit	
	Coeff	AME	Coeff	AME
Simulated BAfoeG amount$^{\natural}$	−0.138**	−0.044**	−0.134**	−0.043**
	(0.054)	(0.017)	(0.052)	(0.016)
Age (centered)	−0.007	−0.002	0.013	0.004
	(0.034)	(0.011)	(0.034)	(0.011)
Female	−0.110	−0.035	−0.093	−0.030
	(0.143)	(0.046)	(0.138)	(0.045)
Migration background	−0.115	−0.036	−0.188	−0.060
	(0.206)	(0.064)	(0.199)	(0.062)
Living situation controls				
Student living in urban area	0.605***	0.189***	0.561***	0.178***
	(0.162)	(0.049)	(0.160)	(0.049)
Student living at parents' home	0.839***	0.268***	0.853***	0.276***
	(0.194)	(0.058)	(0.191)	(0.057)
Student lives in East Germany	0.252	0.081	0.275	0.088
	(0.232)	(0.073)	(0.232)	(0.073)
Parent and sibling controls				
Log parental gross labor income$^{\natural}$	−0.030	−0.010	−0.013	−0.004
	(0.055)	(0.018)	(0.054)	(0.017)
Parent(s) have college degree	−0.127	−0.041	−0.108	−0.035
	(0.151)	(0.048)	(0.146)	(0.047)
Parents received social transfers	−0.043	−0.061	−0.058	−0.065
	(0.272)	(0.066)	(0.263)	(0.065)
East German background	−0.338	−0.139	−0.409*	−0.162*
	(0.212)	(0.065)	(0.210)	(0.066)
Older sibling claimed BAfoeG	−0.702***	−0.210***	−0.735***	−0.224***
	(0.194)	(0.053)	(0.192)	(0.054)
East Germany × Social transfer last year	−0.572		−0.546	
	(0.420)		(0.411)	
Time-inconsistent preferences				
Willingness to take risks (std)	−0.102	−0.032	−0.100	−0.032
	(0.068)	(0.021)	(0.066)	(0.021)
Very impulsive	−0.101	0.028	−0.080	0.039
	(0.197)	(0.052)	(0.193)	(0.052)
Very impatient	0.002	0.067	−0.053	0.055
	(0.236)	(0.058)	(0.232)	(0.057)
Interaction effects				
Very impulsive × Very impatient	0.655*		0.707**	
	(0.349)		(0.341)	
Exclusion restriction (1st stage)				
Vocational training completed			−0.681***	
			(0.231)	
Year controls	✓		✓	
Observations	986		1041	
Baseline predicted probability	0.417		0.444	
corr(u1,u2)=ρ			−0.750	
Wald test ($\rho = 0$)			0.047	
Joint sig. of East German (p-value)	0.028		0.019	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors, clustered on the student level, in parentheses.

Notes: SOEP 2002–2013, weighted. $^{\natural}$ = Deflated to base year 2007 and in hundreds of Euro.

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