To Grant or Not to Grant?

Lessons in Human Capital Investment from German Student Finance

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Abstract

How do human capital investments respond to student finance induced changes in cost? In 1983, Germany moved from a system offering means-tested student finance as a mix of a grant and a loan to exclusively a loan. Exploiting this unique setting, we find human capital investments of low-income students to be highly cost-sensitive. Loans were interest-free and income-contingent repayment plans effectively insured individuals against adverse labour market outcomes. Our event study results reveal that despite these favourable conditions, the reform reduced enrolment rates amongst funding eligible students substantially, with pupils re-allocating into apprenticeship training instead. The contraction in enrolment was particularly pronounced in teacher training, which was geared for a career in the public sector, and much less so in subjects associated with higher labour market returns. Furthermore, we find that funding eligible students became increasingly concerned with being financially independent and exploring different career options before making a final commitment. These results suggest that reform impacts were mainly driven by increased costs, but reinforced by heightened debt concerns. Finally, we also document that individual level responses to the policy added up to unintended consequences at the aggregate level. As a product of the reform, access to university was narrowed for low-income students of all abilities and the overall supply of teachers contracted during a time when pupil numbers were expanding.

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1 Introduction

The decision whether to enrol in higher education can have a substantial effect on an individual's life, ranging from career to health impacts (Lovenheim and Smith, 2023). Given these long-term implications, policymakers across the world have introduced student finance programs to ensure that those from budget-constrained households can also access higher education. These programs can either be offered as grants or loans—a choice that is often not discussed and whose implications are not fully understood (Dynarski et al., 2023). However, comprehensive understanding is imperative, as the implied incentives for funding-eligible students differ substantially. Whereas a grant actively reduces enrolment costs, a loan merely shifts them inter-temporally. Thus, the design of student finance policy likely has pronounced effects on post-secondary human capital investments.

In this paper, we explicitly analyse the effects of offering student finance as a grant or a loan on human capital investment. Specifically, we focus on three dimensions of adjustment: First, we examine the impacts on enrolment and subject choice. Second, we analyse how career motivations guide these impacts and how they themselves are shaped by changes in student finance policy. Third, we investigate how adjustments in individual behaviour translate into aggregate changes in access to university and the occupational structure.

We address these questions by leveraging novel survey data as well as a unique historical setting. In 1983, Germany reformed the composition of its student finance program—the *Bundesausbildungsförderungsgesetz* (BAföG), catering to those from less-affluent households—from a mix of a grant and a loan to exclusively a loan. This setting is interesting for several reasons: At the time, there were no tuition fees and student finance loans were interest-free. In addition, income-contingent repayment plans effectively insured debtors against adverse labour market outcomes. Thus, this was a setting in which higher education was comparably cheap and taking a loan was associated with relatively low downside risk, similar to many Central and Northern European countries nowadays. Furthermore, studying a national-level reform – instead of smaller programmes rolled out at only a few universities – also permits us to investigate the aggregate implications of providing student finance as a pure loan.

To estimate the reform impacts on human capital investment, we exploit funding eligibility rules for identification and apply a dynamic difference-in-differences (DiD) design, comparing post-secondary education trajectories of funding-eligible with those of ineligible high school graduates across graduation cohorts. The identifying assumption in this design is that the choices of those eligible for funding would have evolved in the same way as those of the funding-ineligible absent the reform. We provide evidence that the selection into high school graduation did not change around the reform time, making cohorts before and after the reform

comparable. In addition, the observed patterns cannot be explained by shifts in the relative attractiveness of university education compared to apprenticeships—which funding-eligible high school graduates chose more often following the reform.

Underlying our analysis is a rich and novel survey dataset, the DZHW School Leavers Panel [German: *Studienberechtigtenpanel*] (SLP), allowing us to trace out the educational trajectories of German high school graduates of the late 1970s until the early 1990s, something which has thus far not been possible using microdata. It captures the educational aspiration of high school leavers at graduation as well as their realised post-secondary choices in six-month increments over the following two years. A key feature of the data is that it also contains detailed questions on the motives underlying a respondent's educational and occupational choices, allowing us to analyse both changes in realised choices as well as the underlying preferences driving these.

Looking at realised choices at the extensive margin, we document that the decision to enrol in higher education was highly cost sensitive for students from less affluent backgrounds. The reform, shifting funding to a full-loan policy, reduced enrolment in university by 10.7 percentage points, which equates to around one sixth when evaluated at baseline, with students instead opting for alternatives such as apprenticeship training. This finding is particularly striking as loans were interest-free and effectively insured students against adverse labour market outcomes. At the intensive margin, we find a substantial response in terms of subject choice. The contraction in enrolment was particularly pronounced in teacher training, which was geared for a career in the public sector, and much less so in subjects associated with higher labour market returns. Those choosing apprenticeship training instead of enroling in higher education were more likely to take up relatively high-return white-collar apprenticeships (e.g. banking and insurance services) instead of apprenticeships promising relatively lower returns (e.g. education and social care).

Analysing the underlying career motivations in our event study framework, we first demonstrate that funding-eligible students became increasingly concerned with the cost of higher education. In particular, they became more likely to state that they didn't enrol because they could not afford to do so or because the degree would take too long. At the same time, they began to increasingly value the ability to explore other post-secondary options first before making a committed choice. These findings suggest that the enrolment response to the cost increase can broadly be rationalised in a simple human capital model. However, we also find that factors beyond a pure cost effect appeared to shape the observed effects. Specifically, funding-eligible students became increasingly concerned with financial (in)dependence after the reform shifted the system to a solely loan-based one. Overall, our results thus suggest that reform impacts were driven by increased cost, and reinforced by heightened concerns

with debt amongst low-income students.

In the last part of the paper, we illustrate that the impacts of student finance policy may also extend beyond the individual level. In particular, if many individuals adjust their choices in the same way, this may lead to aggregate—and likely unintended—changes in the occupational structure and selection into higher education. First, we document that access to university was narrowed for low-income students all along the grade distribution. While the effects were most pronounced for students at the bottom of the high school grade distribution, enrolment impacts were still in excess of 10% even in the top quartile. This implies that the reform screened out low-income students of all abilities. At the same time, there was no discernible reduction in short-run dropout rates, indicating that compliers, i.e. those who did not attend college because of the full-loan system, were not more likely to have otherwise dropped out. Thus, even if it had been the government's goal to reduce the number of university students, this reform did not necessarily result in a more efficient selection of students. Second, given our finding that potential teachers reacted particularly strongly to the cost increase of 1983, the reform substantially contributed towards the contraction in teacher supply over the 1980s. Yet, during the mid-1980s, demographic reports had already projected that from 1992 onwards there would be excess demand for teachers, calling for government action to increase the supply of teachers. Instead, the student finance reform had the opposite effect and indeed during the 1990s teacher-pupil ratios began to consistently increase.

Overall, our findings offer interesting lessons for post-secondary education and student finance policy. First of all, the sizeable responses both in terms of enrolment as well as subject choice illustrate the profound impact that changes in student finance policy can have on human capital investment. These findings are also relevant considering related policy choices, such as those concerning tuition fees. Furthermore, they highlight the importance of considering potential unintended consequences of student finance reforms.

This paper contributes to three strands of existing literature. First, our empirical results relate to the literature studying the impact of costs and benefits on post-secondary human capital investments. While one strand of the literature examines the role of (net) benefits in general (Attanasio and Kaufmann, 2014, 2017; Patnaik et al., 2022), for postgraduate studies (Berkes et al., 2022) or across majors (Arcidiacono et al., 2012; Wiswall and Zafar, 2015a,b; Reuben et al., 2017; Arcidiacono et al., 2020), our paper is more closely related to studies explicitly analysing the role of costs and debt both at the enrolment (Nielsen et al., 2010; Dearden et al., 2014; Hanushek et al., 2014; Solis, 2017; Card and Solis, 2022) as well as the subject choice margin (Field, 2009; Callender and Jackson, 2008; Patnaik, 2020; De Falco and Reichlin, 2023). In particular, we complement papers studying the introduction

of so-called "no-loans"-policies in the US, which converted funding from loans into grants or vice versa (Linsenmeier et al., 2006; Rothstein and Rouse, 2011; Hampole, 2024). We contribute to this literature in two ways. First, by studying a policy reform that was not limited to a specific set of universities, but implemented at the national level, we can look at more general implications as well as aggregate effects. Secondly, unlike previous papers, we can observe outcomes across all dimensions of a student's choice set, allowing us to study both the extensive and intensive higher education responses as well as the alternative paths of students not enroling in higher education.

Second, we contribute towards the literature exploring the broader impacts of student finance policies, both at an individual as well as an aggregate level (Deming and Dynarski, 2010; Black et al., 2023). This literature has focused on a variety of margins, namely labour market outcomes (Minicozzi, 2005; Chapman, 2016; Daniels Jr. and Smythe, 2019), selection into university (Ichino et al., 2024), degree completion rates (Arendt, 2013; Bettinger et al., 2019), default risk (Ionescu and Simpson, 2016) or entrepreneurship (Morazzoni, 2023). Of particular relevance to our paper is of course the literature evaluating reforms in the German student finance scheme BAföG (Lauer, 2002; Baumgartner and Steiner, 2004; Steiner and Wrohlich, 2008; Engelhardt and Lörz, 2021). We contribute to this literature by documenting that changes to student finance policies can have unintended consequences with aggregate implications. In our particular case, we document that access to university was narrowed for less-affluent students all along the high school grade distribution. Furthermore, changing incentives lead to a reduction of the supply of teachers, a policy outcome that was not optimal from the planner's perspective at the time.

Third, we link the growing literature on the importance of preferences and beliefs in shaping human capital investment, in particular for students from low income backgrounds (McGuigan et al., 2016; Boneva and Rauh, 2019; Belfield et al., 2020; Lergetporer and Woessmann, 2023; Boneva et al., 2022), to the literature studying how public policy can shape such preferences and beliefs. One strand of the latter literature is concerned with the lasting effect of entire political systems (Alesina and Fuchs-Schündeln, 2007; Peisakhin, 2010; Grosfeld and Zhuravskaya, 2015; Becker et al., 2016; Campa and Serafinelli, 2019). Most related to our paper, Azmat and Kaufmann (2024) study how a change from socialism to capitalism affects economic preferences associated with higher education choices. A second strand of this literature investigates the effects of particular policies on norms and attitudes (Bastian, 2020; Bau, 2021; Farre et al., 2023; Arold, 2024; Fontenay and González, 2024; Mikkelsen and Peter, 2024)—none of which directly look at higher education choices. We contribute to and combine both literatures by studying the importance of career motivations and financial motives, such as concerns with debt, in driving educational choices and how

they themselves are shaped by changing policy incentives.

The rest of our paper is structured as follows. Section 2 explains the reforms and their historic context, Section 3 discusses our data set, and presents descriptive evidence on pre-reform post-secondary human capital investment patterns as well as our empirical strategy. We present results on individual choices in Section 4 and investigate the mechanisms underlying these responses in Section 5. Finally, we consider aggregate-level implications of the reforms in Section 6 before Section 7 concludes.

2 Historical Context

2.1 The German Post-Secondary Education System

The German education system is grounded in an early-age tracking approach. After four years of schooling (at around age ten) children are allocated to one of three tracks. The first two tracks, compulsory and middle school, prepare pupils for vocational training. In order to be able to attend university, pupils must instead obtain a university entry qualification (*Hochschulreife*, we refer to this as a high school degree). Such a qualification can be obtained in the academic track of general secondary education (*Gymnasium* or *Gesamtschule*).[1] Upon graduation from the academic track, individuals can then choose either paid apprenticeship training or unpaid further study —the key margin of adjustment we investigate in this paper (see Figure 1 for an overview).

Apprenticeship training is a highly regulated and standardized system in Germany. It typically lasts three years and is comprised of a mix between on-the-job and classroom-based training. Apprentices are paid a wage which is determined as part of collective bargaining negotiations. Upon completion, they are then fully qualified to enter the workforce. The alternative is higher education, either taught at universities or universities of applied sciences (*Fachhochschule*, we also refer to these as applied universities). Applied universities are smaller institutions specialised in subjects directly applicable to the labour market, such as engineering, and entry requirements are typically lower. As such, they fall somewhere between apprenticeship training and regular university education in terms of status and pay (Berlingieri et al., 2022).[2]

[1] Note that it is also possible to first complete the vocational tracks and then high school. For a more detailed exposition of this issue and the German education system more generally, see Dustmann et al. (2017).

[2] In general, the post-compulsory education system is characterised by quite a bit of flexibility. Some students decide to complete an apprenticeship training before starting their higher education. In 1983, 13% of German first-year students had a completed apprenticeship training before enroling, about half of those before graduating from high school (Franzmann, 2006, Table B3.10).

Depending on their high school leaving certificate, some pupils would only be eligible to study certain subjects at university (*fachgebundene Hochschulreife*) or only study at applied universities (*Fachhochschulreife*) (see Helbig and Nikolai, 2015, for an overview). In 1980, 20% of all pupils leaving school graduated with a high school degree, 77% of which were qualified to study at both regular and applied universities (Bundesamt, 1982b, p. 51ff).[3] Figure B.1 plots the evolution of the share of school-leavers with a high school degree between 1967 and 1990, showing a general increase in this share over time.[4] However, there are no systematic changes around the 1983 student finance reform, suggesting that it did not affect the decision to graduate from high school.

The costs of higher education. During our period of interest there were no tuition fees but students had to cover their own living costs. In 1982, the mean monthly student income was DM 876 (Schnitzer et al., 1983, p. 79) which amounts to around EUR 819 at 2015 prices or one third of the mean gross income at the time.[5] Monthly student expenses were DM 820 on average in 1982 (EUR 767 at 2015 prices), with 30% spent on rent, 26% spent on food, and 15% spent on travel (Schnitzer et al., 1983, p. 141ff). In 1980, the mean time for obtaining a higher education degree was 5.4 years across all subjects (not weighted by student numbers), ranging from 3.9 years for Economics and Social Sciences to 7.4 years for Medicine (Lundgreen, 2008).[6][7] Note that overall this student finance set-up is similar to many central and northern European countries nowadays which charge no to very little tuition fees in higher education and provide universal or need-based student aid schemes to cover living expenses (see Figure B.2 in the Appendix for an overview of student finance across Europe).

2.2 Student Finance in the 1970s-1990s

When Willy Brandt became chancellor in 1969, he had campaigned on a platform of democratisation and participation. Higher education policy was a cornerstone of this agenda. Brandt's first government address bears testimony to this - he stated that Germany "must not become a society of wasted talent" and instead "educational planning needs to strongly contribute

[3] Among these, 89% obtained their high school degree at a general school.

[4] There is a dip in the share graduating with a high school degree in 1979. Politicians at the time attributed this to the 1979 graduating cohort starting school with a short school year in 1966 (Landtag Nordrhein-Westfalen, 1980) Note that we do not have the 1979 graduating cohort in our data.

[5] Source: Sozialgesetzbuch (SGB) Sechstes Buch (VI) - Gesetzliche Rentenversicherung - (Artikel 1 des Gesetzes v. 18. Dezember 1989, BGBl. I S. 2261, 1990 I S. 1337)

[6] Data taken from GESIS Datenarchiv, Köln. histat. Studiennummer 8202, version 1.0.0

[7] The dropout rate in 1980 was around 21% (Griesbach et al., 1992).

towards realising social democracy".[8] To that end, the government aimed at paying special attention to education, research and innovation. In particular, the government was concerned with the assessment that equal opportunities had not remotely been realised yet (Brandt, 1969).

The resulting changes in educational policy were drastic and included, among other things, expanding the tertiary education sector as well as reducing access barriers to it. To achieve the latter, Germany introduced a generous student finance scheme – the *Bundesausbildungsförderungsgesetz* (BAföG) – in 1971. At its core was a legal entitlement to student finance, with eligibility determined by parental and own income.[9] The introduction of BAföG was a success and, in 1972, 41% of all students received BAföG student finance (Bundesregierung, 1973). Initially, none of the received funding needed to be paid back. This was changed in 1974 when part of the funding became an interest-free loan. Regardless, more than 60% of BAföG funding was paid as a grant, i.e. students did not have to repay this portion (Bundesamt, 1982a).[10]

However, in 1982 Helmut Kohl became the new chancellor of a liberal-conservative coalition government. Kohl had been elected against the backdrop Germany's first post-war economic downturn, unemployment was high, and so was government debt. Kohl had accordingly built his agenda around a theme of "less state, more market; less collective burden, more individual achievement".[11] One of the key measures was "respite for social policy" which was supposed to return welfare policy on a solid financial basis.[12] Concerning BAföG, the new government agreed on a dramatic change: student finance would become a full interest-free loan, i.e. students would need to repay the entire amount of BAföG they had received (CDU/CSU/F.D.P.-Koalition, 1982). The new regulations became effective from the start of the academic year 1983 onward (Bundesregierung, 1983). As illustrated by Figure 2, from 1983 onwards there was a marked contraction in the number of university students receiving student finance. Accordingly, the reform was met with substantial public backlash and to this

[8]German original: "[Wir] dürfen keine Gesellschaft der verkümmerten Talente werden" (Brandt, 1969, p. 10); and "Die Bildungsplanung muss entscheidend dazu beitragen, die soziale Demokratie zu verwirklichen" (Brandt, 1969, p. 18).

[9]This contrasted with the previous student finance scheme, the Honnef Scheme, which did not constitute a legal right to student finance. Instead, students were selected on need and achievement (Stephany, 1967). In the 1960s, around 15% of students received finance under the umbrella of the Honnef Scheme (Stephany, 1967, p. 36). Appendix A.3 gives a more detailed explanation of how funding eligibility and amounts were determined.

[10]Specifically, the first DM 70-150 were paid as a loan, and any entitlement above that was paid as a grant. This was DM 70 (100, 130) for students living with their parents in 1974 (1976, 1977), and DM 80 (130, 150) for students living on their own. Source: Bundesregierung (1978), p. 15.

[11]German original: "Weg von mehr Staat, hin zu mehr Markt; weg von kollektiven Lasten, hin zur persönlichen Leistung" (Kohl, 1982).

[12]Original German: "eine Atempause in der Sozialpolitik" (Kohl, 1982).

day, interest groups such as the "Berlin Initiative against full-loan BAföG" are campaigning for those impacted by these reforms under the Kohl government.[13] To contextualise the extent of the reform, we next provide further details about funding amounts, the debt burden and its repayment.

Funding Amounts. In 1982, the average monthly funding amount was DM 510 or EUR 477 at 2015 prices (Bundesregierung, 1983, p. 18). This compared to the average bargained wage for apprentices of DM 569 equalling EUR 532 (Beicht, 2011). Annualised average funding amounted to 19% of the average annual (full-time) income level, which stood at DM 32,198 (≈EUR 30,110).[14] Recall that average expenditure across all students – not just those in receipt of funding – was DM 820 (EUR 767) with rent and food expenditures accounting for over half (Schnitzer et al., 1983, p. 139). Assuming a funding period of four years, a student in receipt of the average amount would therefore receive a total of around DM 24,500 (≈EUR 23,000).[15] If instead in receipt of the sustenance amount, this would result in a total of around DM 32,400 (≈EUR 30,300).

Increase in Cost and Debt Burden. Following the 1983 reform, the entire funding amount needed to be repaid. For the average student, this implied that debt (and therefore cost) more than tripled, up from DM 7,200 pre-reform (Bundesregierung, 1986, p. 20). The increase was thus equivalent to just over half of average annual (full-time) income in 1983.[16]

Repayment of Loans. Under both the part-loan-part-grant system and the full loan system, loans were interest-free and not indexed to inflation, i.e. students only had to pay back the borrowed amount. The default repayment plan began 5 years after (expected) graduation, with monthly payments structured to clear the loan in 20 years and a minimum payment of DM 120 per month.[17] Students could opt for larger repayment instalments to reduce their repayable total. Top performers (top 30% of graduates) and those graduating early qualified for reduced repayment.[18] The system also accommodated varying financial situations post-graduation. For those with lower incomes, considering factors like marital

[13] *Berliner Inititiative gegen BAföG Volldahgrlehensregelung*

[14] Source: Sozialgesetzbuch (SGB) Sechstes Buch (VI) - Gesetzliche Rentenversicherung - (Artikel 1 des Gesetzes v. 18. Dezember 1989, BGBl. I S. 2261, 1990 I S. 1337)

[15] This precise amount varies between DM 24,480 and DM 24,864 depending on whether one assumes the average amount to be fixed in the base year or uses the realised average amounts for years 1982-1986.

[16] DM 33,293; Source: Source: Sozialgesetzbuch (SGB) Sechstes Buch (VI) - Gesetzliche Rentenversicherung - (Artikel 1 des Gesetzes v. 18. Dezember 1989, BGBl. I S. 2261, 1990 I S. 1337)

[17] The period had been 3 years post graduation prior to 1983.

[18] A student receiving the average amount for four years could reduce their outstanding balance to DM 13,750 in this manner (Bundesregierung, 1986, p. 20).

status and dependent children, monthly payments could be reduced or exempted. Furthermore, low-income recipients caring for young children benefited from automatic deductions in their repayable amount. Thus, this approach effectively insured recipients against poor labour market outcomes and non-working times due to childcare responsibilities. It ensured financial support during higher education while protecting students from excessive repayment burdens based on their circumstances after graduation.[19] In 1988, 57.5% of all debtors were repaying their loans in quarterly instalments, whilst 20.4% opted for early repayment and 22.1% qualified for an exemption. Out of 1.42 million debtors registered in 1989, around 2/3 had fully settled their outstanding balances, with the remainder still repaying (Bundesregierung, 1989, p. 17).

Relative Amount of Debt. For a student in receipt of the average amount for four years, the extra debt burden was around DM 17,000 (≈EUR 15,900). In order to contextualise the amount, two factors must be considered. First of all, whilst of course more costly than a grant, the loan came with very favourable conditions. Most importantly, it did not accrue interest. Against the backdrop of inflation rates above three percent in the early 1980s, this would have led to a significantly diminished net present value. Students were also able to reduce the repayable amounts by graduating early or through exceptional academic performance. On the other hand, students were also insured against adverse labour market outcomes. All these conditions were well-publicised at the time. For the cohort of 1986 high school graduates our data contains questions asking whether students knew about the conditions of the loan. Whilst over 70% of funding eligible respondents said they were aware of the possibility to reduce repayable amounts as well as income-contingent repayment (71% and 72%, respectively), 82% said they were aware that loans were interest-free.[20]

Secondly, in most cases both expected average lifetime earnings and the average lifetime college earnings premium should be far in excess of this amount of debt. Those graduating high school in 1983 would have been at the peak of their earnings potential at the start of the 2010s. Based on the sample period 2011-2013, Piopiunik et al. (2017) document that those with a higher education degree earned life-time incomes which were EUR 387,000 higher than those with an apprenticeship did.[21] Even if the college premium was likely smaller when correcting for selection bias and narrower still for those on the margin between apprenticeship training and higher education, this cross-sectional evidence suggests that expected returns nevertheless ought to have been in excess of ≈EUR 23,000 for most of those graduating from the academic track of high school.

[19] See Catherine et al. (2024) for a discussion of the impacts of income-driven student loan repayment plans.
[20] Source: own calculations, DZHW SLP.
[21] Not including those with a *Meister* certificate.

3 Data and Empirical Strategy

3.1 Data

To analyse the 1983 funding reform, we make use of a rich and novel survey dataset, the DZHW School Leavers Panel [German: *Studienberechtigtenpanel*] (SLP). Every two to three years, a representative sample of pupils from that year's high school graduation cohort is surveyed. A particular advantage of this dataset is that it allows us to observe high school graduates of the late 1970s until the early 1990s, something which has thus far not been possible using other micro-data such as the German Socio-Economic Panel (SOEP), which had its first iteration in 1984 . Prior studies in the German context have been limited to the late 1980s or the period post reunification. The first iteration of the SLP was conducted in 1976 and since then, 18 cohorts of school leavers have been surveyed. We focus on the high school graduating cohorts of 1976, 1978, 1980, 1983 and 1986 to ensure comparability of the survey questionnaires.

A second advantage of the SLP data is its detailed level of information on both stated and revealed higher education preferences. Two survey waves are carried out for each cohort of high school leavers.[22] The first wave primarily captures realised post-secondary choices six months after graduation. Yet, it also surveys the career expectations and aspirations that high school leavers had held immediately at graduation. The second wave is then carried out two years after high school graduation. It retrospectively captures the realised post-secondary decisions at six-month intervals, and can be used to contrast and compare to previous educational aspirations. Individuals are tracked regardless of whether they embark upon an academic or non-academic educational/professional path. Effectively the data allows us to trace out individuals post-school trajectories in six-month intervals until two years post high school graduation. Furthermore, individuals are also asked about the underlying reasons for their educational choices, for example what role financial concerns played.

In addition to the career aspirations and human capital investment decisions, the data set also contains information on background characteristics. Of particular importance to our study are information on parental occupation and education, which we use to determine the eligibility for student finance. Furthermore, the data comprise information on the high school biography of graduates, such as the school-leaving grade, the type of school and the type of higher education entrance qualification obtained, allowing us to examine heterogeneity in student finance reform impacts.

[22] In some cohorts, students were also surveyed a third time (four years later), allowing longer tracking of post-secondary trajectories. In order to make cohorts comparable, we focus on the trajectory length which we can trace for all cohorts in our sample, which is two years.

3.1.1 Sample Selection

For our analysis, we restrict the sample to individuals who obtained their high school leaving certificate in West Germany between the ages of 18 and 23.[23] We also require students to have graduated with a grade better than or equal to 4, which is the technical pass-mark (1 being the best and 6 the worst grade achievable). Yet, in our main specification we do not restrict the type of school leaving certificate obtained, i.e. we do include students who obtained *Fachhochschulreife* and could thus not access all higher education options. We do so because we assume that these students are those closest to the margin between university education and apprenticeship training and hence hold a highly relevant pool of outcomes. We do not exclude men who are observed in military or community service in the first semester after leaving school, as these individuals exit mandatory service in our observation window.[24] Our results are robust to using samples excluding those initially in service after high school or those who obtained a *Fachhochschulreife*, as we demonstrate in Appendix B. Table 1 outlines key descriptive statistics in our sample across different school leaving cohorts. Reassuringly, key demographics, such as gender and age, as well as important determinants of higher education choice, such as parental education and the high school grade, appear balanced across cohorts, indicating that cohorts are comparable in dimensions other than the applicable student finance scheme.

The SLP (like any alternative data source) does not permit us to directly observe eligibility to the student finance scheme BAföG for all individuals across all cohorts. We cannot compute eligibility directly from the background characteristics either as it would require detailed household finance information which are not surveyed. Specifically, eligibility to the student finance scheme is determined by a complicated procedure based on parental income, own income and wealth as well as the number of siblings in education (see Appendix A.3). Given that we do not observe this information, we instead draw upon observations in our sample for which we directly observe survey questions on eligibility status and impute eligibility for the remaining observations based on household characteristics. Appendix A.4 explains our two-step procedure in greater detail. Table 2 gives an overview of eligibility across cohorts. The table shows little variation, indicating that cohorts are largely comparable over time in terms of eligibility. Overall, funding eligibility is also strongly correlated with parental higher education, with ineligible students being around five times as likely to have at least

[23] We focus on West Germany, as East German students only became eligible for BAföG from 1st January 1991 and are only included in our data from survey wave 1990 onwards.

[24] The bulk of individuals observed in military or community service in the first semester post-school are observed in other activities in the two years after school and are thus picked up by our key outcome variable. See A.2 for details on the length of military service and Appendix Table 4 for the career progression of initially conscripted individuals.

one parent with completed higher education than eligible students.[25]

3.2 Stylized Facts

Before proceeding to our empirical analysis, we document high school graduates post-secondary educational choices in the pre-reform period. Using data from the school graduation cohort of 1980, we document stylized facts concerning three margins: (1) Who enrols in university? (2) Which subjects do students choose? (3) Which concerns motivate these choices?

3.2.1 Who enrols in university?

To capture the decision to enrol in university, we examine whether a high school graduate was observed as a university student or an apprentice (the immediate outside option) at least once over the two years post high school graduation.[26] Amongst the 1980 cohort university is the most popular choice, with 64% choosing this option and 32% ever taking up an apprenticeship. The remainder of students choose neither option.[27] Figure 3a further illustrates that university enrolment is positively correlated with high school graduation grades, with the enrolment probability at lowest grade decile being about half that at the very top. For apprenticeships we instead see the mirror image.

This trend is similar across different demographic groups. Looking at potential first-generation students, Figure B.3a illustrates that conditional on having at least one parent with completed higher education, high school leavers are considerably more likely to enrol in university themselves. It is even more striking that this is true at any point of the grade distribution. However, this gap is smaller at the top of the grade distribution, indicating a more positive selection on high school grades of first-generation students. Figure B.3b confirms that those from college-educated parental backgrounds are conversely also less likely to undertake an apprenticeship. Overall, this suggests that post-secondary education choices are highly persistent across generations, even controlling for observed ability. Consistent with findings from Heineck and Riphahn (2009), Figure B.4 further illustrates that conditional on obtaining a high school graduation certificate, parental education has a considerably larger impact on enrolment rates than parental income. In 1980, the average enrolment shares of funding eligible and ineligible students were virtually identical, with 64% and 63%,

[25] See also Appendix A.4. As a robustness exercise, we also estimate results using a parental higher education dummy as the treatment group variable.

[26] Whilst not mutually exclusive, it is unlikely that individuals are observed both as an apprentices as well as enroled over our observation window. Fewer than four percent of our sample are observed in both options for at least one sub-period over the time period in question.

[27] The remainder is observed in casual employment, home production, unemployment or in the military and community service (beyond the mandatory conscription period).

respectively. Finally, Figure B.5a shows that there were hardly any differences between men and women regarding both the overall likelihood to enrol in university and the shape of the grade gradient.

Overall, these findings demonstrate that in the pre-reform period university enrolment was the predominant post-secondary choice for high school graduates. The enrolment probability was an increasing function of high school graduation grades, but considerably lower for those whose parents had not completed higher education themselves.

3.2.2 Which subjects do students choose?

We focus our study of the subject choice margin on two subgroups, namely subjects offering relatively higher labour market returns and those training individuals to become teachers. To define the former group, we focus on the 25 most popular subjects chosen by students enroled in university in the pre-treatment cohorts. This goes without loss of generality as almost all enrolment occurs in these subjects. Table 6 summarizes these subjects, with the most popular ones being Business and Economics, Law and Mechanical Engineering. Next, we draw upon work by Piopiunik et al. (2017), who calculate subject-specific lifetime income levels relative to completing an apprenticeship.[28] We classify a subject as high return if the relative lifetime income advantage falls above the average for university educated workers. This leaves us with 12 subjects being defined as high return (see Table 6 for details).

For the second subgroup we exploit a particular feature of the German (higher) education system. As opposed to countries like the UK, the teaching profession is highly regulated in Germany. In order to become a teacher, one must complete specific teacher training (*Lehramt*) which consists of a university degree in teaching as well as further on-the-job training (*Referendariat*). Those in teacher training take teaching-specific as well as modules in a subject. This feature allows us to specifically identify those training to become teachers, a choice which offers a clear career path into the public sector but limited financial upside. For the purpose of our analysis, we classify those training to be a teacher in a high return subject (e.g. Chemistry or Biology) as enroled in teacher training only.

Figure 3b illustrates the probability to be enroled in a high returns subject or teacher training along the grade distribution, unconditional on enrolment. In the pre-reform period, the unconditional likelihood to be enroled in a high return subject was 34% and 13% for teacher training. Amongst those enroling in university, over 70% of individuals chose one

[28] Calculations refer to average lifetime earnings and are based on the Microcensus for years 2011-2013. Those graduating high school in 1983 would have been at the peak of their earnings potential at the start of the 2010s, so these returns appear a good gauge for these cohorts. We assume that relative returns across subjects have evolved steadily over time.

of these subject groups.[29] Differentiating this along the high school grade distribution, as can be seen in Figure 3b, the share of those in teacher training was largely constant, while high-return subjects were more often chosen by students at the upper end of the grade distribution. There are very interesting heterogeneities by gender, as Figure B.5b illustrates. In particular, women are around three times as likely to train as teachers than men.

Overall, these findings illustrate that the two subgroups of subjects covered roughly three quarters of all those enroling in university in the pre-reform period. Whereas university enrolment in high return subjects was an increasing function of high school graduation grades, this was not the case for teacher training.

3.2.3 Which concerns motivate these choices?

We next turn to the motivations and concerns underlying these post-secondary education choices. To explore these, we draw upon a distinctive feature of our dataset which is its rich battery of survey questions on the motives shaping high school graduates' post-secondary education path. This allows us to compare the relative importance of different motivations for students choosing different post-secondary human capital investments. For the purpose of this exercise, we pool the pre-reform high school graduation cohorts 1976, 1978 and 1980.

We examine motives for post-secondary educational choice along three dimensions: (sunk) costs, altruistic considerations, and individual gains. Table 3 shows the share of students and non-students in columns (1) and (2) who reported that a given concern was important or very important for their educational choice. Note that answers are not mutually exclusive and, hence, shares do not add up to one. With respect to (sunk) cost motives, non-students assigned on average greater importance to timely financial independence as well as the ability to explore before making a final/long-term commitment to a career path. Since a university education came with greater sunk costs, both in terms of time and money, this is precisely in line with expectations. Secondly, while university students were more assured and committed to their career path, earning money during an apprenticeship or work would have allowed individuals a lower commitment due to smaller (perceived) sunk cost.

Looking at the choice of subject at university, columns (3) and (4) of Table 3 show the share of those finding a particular concern important among those who chose a high-return subject and those who opted for teacher training, respectively. Cost considerations did not seem to be an important driver between different subject choices. This is in line with the fact that there were no tuition fees that may have varied across subjects. However, those in teacher training assigned larger importance to altruistic considerations, which is in line with expectations. On the flipside, those opting for high return subjects placed greater relative

[29] Conditional on being enroled the likelihood was 54% and 20%, for high returns and teaching, respectively.

importance on private returns, such as better income and job prospects as well as higher social status.

3.3 Take-Aways

Overall, these stylized facts provide us with a better understanding of the baseline environment into which the Kohl reform was introduced. Post-secondary human capital investments of high-school graduates predominantly came in the form of university enrolment and high return subjects. There also was considerable heterogeneity in subject choices across gender as well as strong inter-generational persistence of higher education attendance. Personal career motivations also appeared to play a role in selection into different post-secondary tracks. For instance, individuals less concerned with the monetary and non-monetary sunk costs of higher education selected into university. At the intensive margin, those choosing high return subjects were more often motivated by future income, job and status prospects than those training to become teachers, who were instead motivated by public value concerns, such as the ability to help others. Equipped with these stylized facts we now proceed to our empirical analysis.

3.4 Empirical Strategy

To study the 1983 reform of German student finance, we draw upon a dynamic difference-in-differences (DiD) design, comparing the outcomes of funding-eligible (treatment) and ineligible (control) students across high school graduation cohorts. We choose this flexible design to capture potential dynamic treatment effects, allowing us to fully understand the adjustment process. Note that we do not have a staggered setting here where treatment is introduced at different points in time, allowing us to abstract from concerns regarding forbidden comparisons which have recently been pointed out (for an overview, see Roth et al., 2023). Thus, we estimate the following dynamic two-way fixed-effects specification:

$$D_{icg} = \gamma_c + \gamma_g + \sum_{\substack{c=1976 \\ c \neq 1980}}^{1986} \delta_c * T_g + X'_{icg} * \beta + \varepsilon_{icg}, \tag{1}$$

where D_{icg} refers to the outcome variables of interest of high school graduate i of graduating cohort c and eligibility group g, such as whether we observe this individual enroled in university at any point over the two years after high-school graduation. γ_c and γ_g are cohort and group fixed effects, respectively. δ_c are our main parameters of interest and they capture the how the outcomes of the treatment group of funding-eligible students differ from those

of the control group of ineligible students in each graduation cohort c where the cohort of 1980, just before the first reform, serves as the reference cohort. X'_{icg} is a vector of control variables. Following the descriptive analysis in Section 3.2, we include the standardized high school graduation grade as this is a strong predictor of choices, as well as gender. We further include the federal state where the student graduated from high school and the regional unemployment in the graduation year to capture systematic differences in the outside option of apprenticeship training. ε_{icg} is the idiosyncratic error, clustered at the school-cohort level.

3.5 Common Trends and the Supply of Post-Secondary Education Options

The key identifying assumption in this design is that of common trends. It requires that, absent the student finance reform trends in post-secondary education, choices would have been the same in the funding-eligible and ineligible group, conditional on our set of controls. Three main threats arise.

First, there might be general trends in social mobility which might affect funding-eligible students' decisions but not those of ineligible students. Yet, this seems unlikely with regards to university enrolment in the context of the 1983 student finance reform. The political debate at the time was concerned with the state budget and neither equal opportunities nor (dis-)incentivising higher education more broadly. In addition, recall from Section 3.1.1 that, conditional on graduating from high school, parental income was not a strong determinant of university enrolment pre-reform. Thus, systematic changes in this relationship—and consequently with eligibility—are unlikely to have occurred at the same time as the reform. However, the likelihood to graduate from high school in the first place might have changed systematically between our treatment and control group around the time of the reform. This would affect the composition of our sample of high school graduates. Recall from Section 2 that there was a general increase in the share of school leavers graduating with a high school degree, but no changes in this trend around the reform. This indicates that the student finance reform did not impact the likelihood to graduate from high school. Furthermore, any systematic differences in enrolment driven by changing high school graduation patterns across treatment groups would come to light in the analysis of the pre-trends specified in equation 1. In addition, we provide evidence in Table 1 that the composition of our sample did not change in terms of observable characteristics over the period of interest, reassuring us that the effects we estimate are not driven by changes in sample composition. Our findings are in line with Heineck and Riphahn (2009) who show that the gap in high school graduation by parental income remained stable for German birth cohorts born after WWII to 1999, and

with Dodin et al. (2024) who show that, for the birth cohorts 1980-1996—slightly after our sample period—increases in high school graduation rates were uniformly distributed across the parental income distribution.

A further factor which might play a role is rising unemployment. During the early 1980s recession, the unemployment rate increased from 3.8% in 1980 to 9.1% in 1983.[30] It is a priori unclear whether higher unemployment rates would incentivize university enrolment (relative to apprenticeship take-up). On the one hand, greater uncertainty about post-university employment prospects may encourage students to take the apprenticeship route, which offers a more immediately tangible employment perspective. This may be especially the case for less affluent and first-generation students, as they might be lacking information about job prospects following a university degree. Furthermore, it may be the case that funding-eligible students were more so affected because they graduated from high school in regions with higher unemployment rates. To account for this, our main empirical specification controls for the state-level unemployment rate at graduation. However, the adverse labour market impacts of graduating into a recession are in fact far less pronounced and persistent for college graduates (von Wachter, 2020), so there ought to be positive incentives to enrol during a recession. Secondly, research regarding the Great Recession has shown that enrolment actually increased following rises in unemployment, and in particular so for students from non-traditional and less-affluent backgrounds (Barr and Turner, 2013; Brown and Hoxby, 2015). So if funding-eligible students were in fact impacted relatively more than eligible individuals by the 1980s recession, this would imply that our estimates constitute a lower bound.

Finally, there may be changes in the relative attractiveness of the two post-secondary education options—apprenticeship training and university education—which affect funding-eligible students differentially to the funding-ineligible. Specifically, the labour market conditions might have been such that apprenticeship training became more attractive in comparison to university education. This would likely affect our treatment group of eligible students more as they were more often first-generation students, and thus the advice they received on post-secondary education in their immediate network was likely very different to funding-ineligible students. Likewise, an increase in university places, especially if that entailed lower moving or commuting distance, might affect funding-eligible students more.

To investigate such supply-driven factors, Figure B.6 illustrates the supply of both university options and places for apprenticeship training over time. During the period we study in this paper the supply of both was rather stable. Part (a) shows the share of districts

[30]Source: *Arbeitslosigkeit im Zeitverlauf: Entwicklung der Arbeitslosenquote, Bundesagentur für Arbeit*, July 2024

with a university from 1945 to 1990 in West Germany. As can be seen, the large expansion of universities happened in the early and mid-1970s, indicating that the supply of higher education options was largely stable over the period we analyse. Turning to Part (b) which shows the supply and demand of apprenticeship options from the mid-1970s to 2000, it can be seen that the supply of apprenticeship places was rather stable over the 1980s. After 1983, the demand for such training slightly exceeded its supply, suggesting that a reduced likelihood to enrol in university after the 1983 reform might be a lower bound of the reform effect in absence of a scarce supply of apprenticeship options, even so if not to a large extent. From the second half of the 1980s onwards, supply clearly exceeded demand until the end of the 1990s, indicating that high school graduates were likely not constrained in their post-secondary education choice.

These patterns are reassuring for our analysis. Given the largely stable supply of both post-secondary education options, university and apprenticeship, it is unlikely that supply-based factors affected high school graduates' post-secondary education choices to a large extent during the period we study. First, changes in university availability which are likely to push students into higher education (see e.g. Boelmann, 2024) are unlikely to affect the students we consider. Second, the supply of apprenticeship places is sufficiently large such that high school graduates are in fact able to react to the reform in question by choosing apprenticeship training instead of higher education. Finally, Figure B.7 shows that in the years immediately leading up to the reform as well as during the implementation period, real bargained wages for apprentices remained stable. Similarly, looking at the evolution of the relative returns of university education vs. apprenticeship training in Germany across this time period, Dustmann et al. (2009) find no clear trend in the wage differential. Overall, this indicates that changes in the relative returns to the two options are unlikely to be the reason for differences in university enrolment between funding-eligible and ineligible students over time.

3.6 Further Identifying Assumptions

We further need to assume that there are no spillovers which change the outcomes of the untreated high school graduates, whether it is ineligible students in the same cohort or all students in cohorts prior to the reform. Crucially, no cohort in our sample is exposed to two different student loan policies. For example, the last observation we have for those graduating in 1980 is in 1982, prior to the reform in 1983. Furthermore, with treatment being based on parental income, no ineligible student can simply opt into treatment.

Finally, we also assume that there are no anticipation effects which means that high school

students do not strategically change their graduation time because of anticipated changes in student finance. In practice, this requires that no students who were due to graduate in 1983 did so earlier in order to avoid the reform. Whilst deferring entry into university by a year or two is conceivable, graduating high school early by the same margin is logistically very difficult if not impossible, due to bureaucratic constraints.

4 Results - Individual Level

We investigate impacts on individual post-secondary educational choices along two margins: university enrolment and university subject choice. We further investigate what high school graduates who opt out of university after the reforms do instead by analysing apprenticeship take-up and occupational choice.

4.1 University Enrolment

Starting with the decision to enrol in university, Figure 4 plots the estimates of δ_c of equation 1 with corresponding 95% confidence intervals for university enrolment as the outcome. The x-axis represents the different high school graduating cohorts, starting in 1976 and ending in 1986. Two key points emerge from this figure. First, the pre-reform estimates of Figure 4 provide evidence that both funding-eligible and ineligible high school graduates exhibited similar time trends in university enrolment ahead of the reform, lending credibility to the common time trend assumption discussed in Section 3.5. Second, looking at the post-reform estimates shows that the reform, shifting funding to a full-loan policy, substantially reduced enrolment in university. By 1986, the reduction in enrolment amongst eligible students was 10.7 percentage points. Given the baseline probability to enrol in university in 1980 of 64%, these are large effects, equating to a reduction by around one sixth at baseline. These results are robust to excluding those who do not hold a general school leaving certificate or those initially in military or community service (see Figure B.8).

What alternative paths do these students take? Figure 4b illustrates that treated students became more likely to take up an apprenticeship, whilst at the same time alternative options such as casual or permanent work and remaining in military or community service beyond the mandatory period also became more prevalent (see Appendix Figure B.9).

Next, we examine effect heterogeneities along the high school grade distribution in Figure 5, where we estimate equation 1 separately for the group of high school graduates in the first to fourth quartile of the grade distribution, respectively. The results are depicted in Parts (a) (lowest) to (d) (highest). The figures illustrate that there are only minor differences across

high school grade quartiles in terms of absolute reform effects. Recall that baseline enrolment rates were an increasing function of high school grades (see Figure 3a). This implies that there is a gradient in reform impacts by grade if evaluated at baseline, even if absolute effects show only limited variation. Nevertheless, we still find a reduction of around 10% in the highest quartile if evaluated at baseline. This is surprising if one assumes that high school grades are informative about ability and there are complementarities in ability and higher education. In this case, we would expect that there are more marginal students at the bottom quartile of the grade distribution than at the top, meaning that for more students at the bottom increased costs render university education too expensive in a simple cost-benefit consideration. Instead, we see that cost considerations seem to meaningfully impact lower-income students at any high school grade and by extension ability. We will explore this result further in Section 5 when we discuss the underlying mechanisms. There was very limited effect heterogeneity by gender, albeit women appeared to react sooner than men (see Figure B.10).

4.2 University Subject Choice

Turning next to the intensive margin of subject choice, we draw upon the two broad categories defined in Section 3.2.2. Figure 6 plots the estimates from equation 1, not conditioning on being enroled in university, with ever studying a high-return subject in Part (a) as the outcome and being in teacher training in Part (b). Consistent with the overall reduction in the probability to enrol, we find that the unconditional probabilities to enrol decline following the reform. However, whereas teaching accounted for 20% of all enrolment in 1980, the reduction in its enrolment equates to around one quarter of the overall enrolment effect. This means that teacher training was disproportionately affected by the negative enrolment impacts. The opposite is true for high return subjects, which accounted for over 50% of baseline enrolment, yet only just over 1/3 of the enrolment contraction. This pattern also becomes apparent when we instead run our regressions conditional on being enroled, with the likelihood to enrol in a high returns subject increasing and that for teacher training contracting (Figure B.11). Very few students in our sample change subjects across enrolment, which is reflected by the fact that results are robust to using subject at first matriculation as the outcome variable instead (see Figure B.12 and Figure B.13). Overall, these results illustrate that the contraction in enrolment disproportionately affected teacher training, rather than high return subjects.

What type of students were dissuaded from teacher training? Figure B.14 depicts event study results, when we estimate equation 1 separately for the group of high school graduates in the first to fourth quartile of the grade distribution. As can be seen, there were virtually no reform impacts at the very top as well as the very bottom of the high school grade distribution.

Instead, it appears that the reform dissuaded enrolment in teacher training amongst those in the middle of the grade distribution.

4.3 Occupational Choice of Apprentices

Above, we documented that high school leavers shifted into apprenticeship training as a result of the 1983 reform. What types of occupations did they choose in lieu of university education? To assess this, we classify the apprenticeship groups that we observe in our data into blue-collar (e.g. construction and technical occupations), low-return white collar (e.g. education and social care) and high-return white collar (e.g. banking and insurance services). Figure 7 shows the estimates of δ_c in equation 1 for these three types of occupations as the respective outcome, not conditioning on apprenticeship take-up.

Consistent with the positive impact on apprenticeship take-up following the 1983 reform, we find increases in the unconditional likelihood to take-up high-return white-collar and blue-collar apprenticeships, in particular so for the former group of courses. This suggests that individuals no longer enroling predominantly chose these courses, which at baseline had accounted for just over half of all apprenticeship courses taken (52%). This is further reinforced when we examine event study results conditional on taking up an apprenticeship (Figure B.15). More specifically, these results suggest that the majority of high school graduates who chose apprenticeships instead of university following the 1983 reform chose white-collar occupations with high returns.[31]

Overall, three main findings emerge from our analysis: First, the 1983 reform shifting student finance to a solely loan-based system strongly decreased the likelihood of funding-eligible high school graduates to enrol in university education. Second, whilst effects were more pronounced for students with lower high school graduation grades, the reform nonetheless reduced enrolment of low-income students all along the grade distribution. Third, the reduction in enrolment was particularly pronounced in teacher training and less so in high-returns subjects. Those opting for apprenticeship training in response to the reform predominantly chose high-return white-collar as well as blue-collar occupations. In the next section, we aim to further disentangle the underlying drivers of these effects.

[31] We cannot rule out crowding-out of those who always chose apprenticeship training out of white-collar high-return occupations to blue-collar occupations, i.e. all compliers to the 1983 reform opt for white-collar high-return occupations and crowd out the never-takers of university education who, in turn, opt for blue-collar occupations. However, given that these occupations are associated with very different skills and jobs tasks, it is more likely that for some compliers to the 1983 reform blue-collar jobs are more appealing, such as becoming an electrician instead of an engineer. Note that blue-collar occupations are not necessarily relatively lower paid, especially if one attains further training as "master" (*Meister*) and opens up a business.

5 Mechanisms

In order to understand what factors may have driven these responses, we use our event study design to analyse how the 1983 reform impacted the career aspirations and motivations of funding-eligible students. In particular, we draw upon two types of survey questions contained in our data. First of all, students not enroling in university could select from a list of potential reasons for which they did not enrol. Secondly, we once again make use of the survey questions regarding career motivations already discussed in Section 3.2.3. We group our analysis into concerns with (sunk) costs and those with financial dependence and debt.

5.1 Concerns with (Sunk) Costs

Within the framework of a simple human capital model (e.g. Becker (1962); Rosen (1976)), high school graduates compare the returns of education against its cost, acquiring higher education as long as the net benefits are positive. In Appendix A.5 we further formalize this using a simple life-cycle model of human capital investment. Within such a framework, the returns—higher income in the most basic model—vary with innate ability such that more able high school graduates will receive higher returns. The costs, on the other hand, are comprised of the opportunity cost of forgone wages while studying as well as direct associated with higher education, such as tuition fees. In the simple model, a student finance grant can be thought of as as reduction in the costs of higher education, while a loan-based student finance scheme solves liquidity constraints which might otherwise make studying infeasible for low-income students. The elimination of the partial grant is thus captured as an increase in the cost and hence lowers the likelihood to pursue more education. Intuitively, this will tip the balance in this simple cost-benefit analysis for some students and shift them out of university.

In order to directly evaluate the impact of increasing costs, we first of all investigate students' stated reasons for why they did not enrol in university. Using our event study approach, we evaluate whether cost considerations became more prominent amongst the treated group after the 1983 student finance reform. Figure 8 illustrates that following the reform, the likelihood to not enrol because study duration was perceived as too long increased by one quarter at baseline values. Even more striking is the increase in the likelihood to not enrol because one could not afford to so, which doubled relative to baseline, illustrating the importance of concerns with the costs associated with higher education.

The effects of these concerns might be particularly strong when students are unsure about how well studying at university suits them, for example because of uncertainty about the likelihood to succeed or about the consumption value of university. In this case, trying out

university is more costly after the reform because of higher sunk costs. To investigate whether this is a concern for high school graduates, we exploit a question asking individuals at high school graduation whether they ever want to enrol in university and if so when. Figure 9a illustrates that following the 1983 reform, treated students became considerably more likely ($\sim 1/3$ at baseline) to state that they only wanted to enrol in university after trying something else first. In other words, the cost-increasing reform increased the desire to defer and explore other options. This is further reinforced by Figure 9b, which instead uses the likelihood to assign high importance to the ability to explore different career options before making a final commitment as the outcome variable—showing a similar pattern. By extension, this increased desire to explore other options first also led to an increase in the likelihood of not enroling in university over the two years following high school graduation, despite stating that one wanted to do so upon leaving school (see Figure B.16). Taken together, these patterns suggest that the increase in cost following the 1983 reform led to increasing concern with the now higher (perceived) sunk cost of university enrolment amongst treated students.

Overall, the results in this section suggest that following the cost-increasing reform of 1983, lower-income students became increasingly concerned with both the direct as well as the perceived sunk costs of university enrolment. This increased their desire to explore other options first and materialised in lower enrolment rates. This appears in particular intuitive against the backdrop of Section 3.2.3: In Table 3, we documented that in the pre-reform period non-students had been more than twice as likely to list exploration value as an important concern. Following the increase in the importance of this concern in the aftermath of the reform, it is thus intuitive that funding eligible students would have re-allocated out of university. In addition, these results can also help explain why negative enrolment impacts affected higher return subjects disproportionately less, as they offered higher net returns, leaving less scope for higher costs to tip the cost-benefit trade-off in favour of not enroling in higher education.[32]

5.2 Concerns with Financial Dependence and Debt

Yet, the policy did not simply increase costs for funding eligible students, but it did so by introducing a more sizeable debt component. Previous research has shown that concerns over debt—on top of the cost-benefit considerations outlined above—play a role in decision making, in particular for lower-income individuals (Callender and Jackson, 2008). For example, Caetano et al. (2011) find that labelling a contract as a loan decreases the probability of it

[32]In Appendix A.5 we further discuss how potential uncertainty regarding higher education returns may have contributed to the observed trends. Because we cannot directly test for them, they are not included in this discussion in the main body.

being chosen over a financially equivalent contract by 8%.

In order to evaluate the impact of the increased debt burden, we draw upon the survey questions described above, particularly those concerned with financial independence as the opposite of having debt. Based on our event study approach, Figure 10a illustrates that by 1986, the likelihood to list timely financial independence as an important concern had increased by 20% at baseline. Moreover, treated students became 50% more likely (at baseline) to say that they had not enroled because they did not want to be financially dependent (see Figure 10b). Recall that in Table 3, we documented that in the pre-reform period non-students had been more than three times as likely to list financial independence as an important concern. With this concern being assigned greater importance by treated students following the reform, it is intuitive that this channel would contribute to the negative enrolment impact.

Concerns with debt may also help us understand why we find treatment effects of more than 10% all along the high school grade distribution. Human capital investment models mostly assume complementarities between ability and education, increasing the returns of higher education for more able high school graduates, thus making them more likely to enrol in university. Typically, we think that school grades are a good proxy for ability, suggesting we should only find small impacts at the top of the grade distribution. However, if concerns with debt do not correlate with ability in the same way as returns, their presence may explain why we find sizeable enrolment impacts across the entire grade distribution. To evaluate this hypothesis, we estimate the reform effects on concerns with financial independence separately for the group of high school graduates in the first to fourth quartile of the grade distribution. Figure B.17 illustrates that reform impacts were most pronounced in the top half of the grade distribution. This heightened concern with debt amongst higher achieving students can help us rationalise the fact that we see substantial contraction in enrolment even amongst high achieving high school graduates.

We further formalize these results using a simple life-cycle model of human capital investment in Appendix A.5. Overall, they suggest that the sizeable reform impacts on enrolment and subject choice were driven by increased concerns with (sunk) costs. This explains why eligible high school leavers became more interested in exploring other options first. However, our results also suggest that concerns with debt in particular reinforced these effects and can help us understand why we find impacts for students all along the high school grade distribution.

6 Results - Aggregate Level

Thus far we have documented that post-secondary human capital investments of lower-income students appear to be highly cost sensitive, both along the enrolment as well as the subject choice margin. Yet, the consequences of these policy impacts may also extend beyond the individual level. In particular, if many individuals adjust their choices in the same way, this may lead to aggregate changes which may not have been intended by policy makers. In the next section we examine two examples of such aggregate changes that occurred in the aftermath of the 1983 student finance reform in Germany—narrowed access to university for low-income students all along the high school grade distribution and an occupational re-shuffle away from teaching.

6.1 Access to University for Low-Income Students

In Figure 5 we documented that reform impacts were largest in the lowest and least pronounced in the top quartile of the high school grade distribution. Nevertheless, the enrolment reduction in the latter group was in excess of 10% at baseline. The implication is that access to university was narrowed for low-income students all along the grade distribution and by extension of all abilities. A similar finding applies to first-generation students. Recall that funding-ineligible students were around five times as likely to have at least one parent with completed higher education. Re-estimating equation 1 and defining treatment at the parental education rather than funding eligibility level, Figure B.20 illustrates that following the reform, enrolment amongst first-generation students contracted. At the same time, they became more concerned with financial (in)dependence. Thus, the reform also narrowed access to university for first-generation students. Recent research from the United States has argued that the relatively narrower admissions policies of selective private colleges have significant implications for the inter-generational persistence of privilege and the diversity of society's leaders (Chetty et al., 2023). Viewed through this lens, narrowed university access for potential first-generation students and those from less-affluent households may have had a similar effect in Germany.

Furthermore, assuming that high school grades are more generally informative about ability and that there are complementarities between ability and the returns of higher education, this policy may have contributed to the potential misallocation of talent. While, unfortunately, our data do not allow us to speak directly to the individual optimality of these changes in enrolment behaviour, we try to examine this by looking at dropout behaviour as a likely symptom of previous misallocation into university. One concern with the original student finance scheme (before 1983) could have been that it was overly generous and set distorted incentives. Students may have been enticed to enrol to access student finance, later

dropping out. This may have been more so the case for those from less-affluent backgrounds, as they may have been less well prepared for higher education (see for example Carneiro and Heckman (2002)). If this was the case, we would expect the 1983 reform to lead to a reduction in dropout behaviour by changing selection into higher education. However, Figure B.18 illustrates that at least across the first two years following high school graduation—the time frame which we can observe—this wasn't the case and on average the reform had no significant impact on dropout behaviour. This was the case all along the high school graduation grade distribution (see Figure B.19).

Overall, the reform thus narrowed access for low-income and first-generation students, even conditional on high school graduation grades. At the same time, there was no discernible reduction in short-run dropout rates, indicating that compliers, i.e. those who did not attend college because of the fully loan-based system, were not more likely to have otherwise dropped out. Thus, even if it had been the government's goal to reduce the number of college students, this reform did not necessarily result in a more efficient selection of students.

6.2 Impact on Supply of Teachers

Between the school graduation cohorts of 1980 and 1983, aggregate data show that the share of those in teacher training collapsed from 19.7 to 7.2% (Bölling, 1987). Our results demonstrate that at least part of this contraction occurred due to the 1983 student finance reform. Yet, was this optimal from the planner's perspective? On the one hand, this aggregate reduction must be viewed against rising unemployment rates amongst teachers at the time. Consequently, reducing the supply of teachers may appear desirable.[33] Between 1980 and 1983, the number of trained teachers that had registered as unemployed increased from 8,983 to 25,956 (or 1.6% and 4.4%, see Bölling (1987)). Yet, this was still lower than the overall unemployment rate, which over the same period was almost double that of trained teachers, casting doubt on the notion that teacher training should have been particularly discouraged relative to other options. In addition, while the 1980s had also been a time of falling pupil numbers (see Figure 11a), already during the mid-1980s, demographic reports had projected that from 1992 onwards there would be excess demand for teachers (Budde and Klemm, 1986; Tessaring, 1988). Given that teacher training took around seven to eight years, the post-1983 teacher cohorts would have entered the labour force in the early 1990s. Thus, it would have been optimal to increase enrolment in teacher training at that time.

[33]Note that there is no immediate reason why funding-eligible and ineligible students would have been differently impacted by this increase in unemployment. In 1980, 19% and 21% of ineligible and eligible university students (12% and 13% unconditional likelihood, respectively) were enroled in teacher training. So, whereas the increase in unemployment may have contributed to an overall downward trend in teacher training, it should not contaminate the reform impacts.

Why did individuals not see the shortage of teachers—and hence good labour market prospects of teachers—coming when making their post-secondary education decisions in the 1980s? The market for teachers may be best captured by a Cobweb market model, in which there is a time lag between supply and demand decisions (Ezekiel, 1938). Because demand and thus prices are only revealed after supply has been determined, suppliers use previous prices to inform their decision. In our case, high school leavers interested in teacher training would have used the labour market outcomes for current teachers in 1983 to decide on enrolment. Therefore, the government could have contributed to breaking the cycle of the Cobweb market. Instead, their student finance policy incentivized human capital investments in such a way that the opposite effect materialised. This lead to a reduced supply of teachers at a time when student numbers were growing and teacher-pupil ratios began to increase substantially (see Figure 11b).

7 Discussion and Conclusion

This paper analyses the relative effects of offering student finance as a grant or a loan, exploiting the 1983 reform of the German student finance scheme, the *Bundesausbildungsförderungsgesetz* (BAföG). The reform moved student finance towards a scheme solely based on an (interest-free) loan, having been offered as a mix of a grant and a loan beforehand. This unique historical setting allows us to study how the crucial "grant vs. loan" policy decision affects individual post-secondary human capital investments as well as their aggregate knock-on effects on the occupational structure and access to university.

To estimate the reform impacts on human capital investment, we apply a dynamic difference-in-differences (DiD) design, comparing post-secondary education trajectories of funding-eligible with those of ineligible high school graduates across graduation cohorts. Underlying our analysis is a rich and novel survey dataset, the DZHW School Leavers Panel [German: *Studienberechtigtenpanel*] (SLP), allowing us to trace out the educational trajectories of German high school graduates of the late 1970s until the early 1990s, something which has thus far not been possible using microdata. A key feature of the data is that it contains detailed questions on the motivations underlying a respondent's educational and occupational choices, allowing us to analyse how they guide these impacts and how they themselves are shaped by changes in student finance policy.

We document three main findings. First, looking at realised post-secondary education choices at the extensive margin, we show that the decision to enrol in higher education was highly cost sensitive for students from less affluent backgrounds. The reform, shifting funding to a full-loan policy, reduced enrolment in university by 10.7 percentage points, which equates

to around one sixth when evaluated at baseline, with students instead opting for alternatives such as apprenticeship training. This finding is particularly striking as loans were interest-free and income-contingent repayment plans effectively insured debtors against adverse labour market outcomes. On the intensive margin, we find a substantial response in terms of subject choice. Our estimates show that the contraction in enrolment was particularly pronounced in teacher training, which was geared for a career in the public sector, and much less so in subjects associated with higher labour market returns. Those choosing apprenticeship training instead of enroling in higher education were more likely to take up relatively high-return white-collar apprenticeships (e.g. banking and insurance services) instead of apprenticeships promising relatively lower returns (e.g. education and social care).

Second, analysing the motives underlying these adjustments on the extensive and intensive margin, we find that funding-eligible students became increasingly concerned with being financially independent and exploring different career options before making a final commitment. Overall, our results suggest that reform impacts were driven by increased costs, in particular perceived sunk costs, but reinforced by increased concerns with debt amongst low-income students.

Third, we show substantial and likely unintended aggregate consequences of the student finance reform along two dimensions: First of all, we document that access to university was narrowed for low-income students all along the grade distribution and by extension of all abilities. At the same time, there was no discernible reduction in short-run dropout rates, indicating that the reform likely did not result in a more efficient selection of students. On the contrary, it narrowed access for children from less affluent households all along the high school grade distribution. Secondly, given our finding that potential teachers reacted particularly strongly to the cost increase, the reform substantially contributed towards the contraction in teacher supply over the 1980s—whereas an upcoming teacher shortage was projected from the mid-1980s which would have called for policies incentivising enrolment in teacher training.

Overall, our findings offer interesting lessons for post-secondary education and student finance policy, as well as related policy choices, such as those concerning tuition fees. Our results show that these policy choices matter substantially—for the selection of students and the types of degrees chosen—calling for careful consideration of the incentive schemes associated with each policy choice. First of all, the sizeable response both in terms of enrolment as well as subject choice illustrates the profound impact that changes in student finance can have on human capital accumulation. This is particularly true in light of potential unintended consequences of student finance reforms. However, our results also offer interesting perspectives for further exploration. First, an intuitive next step would be to explore the labour market

impacts of student-finance induced changes in post-secondary human capital investments, by linking the DZHW School Leavers Panel [German: *Studienberechtigtenpanel*] (SLP) to administrative labour market data—which is not yet possible. Furthermore, future research ought to evaluate the student finance reform carried out in 1990, which reversed the 1983 reform and reinstated a 50% grant portion. Because of German reunification and the changing nature of high school cohort composition this is a challenging task. Nevertheless, it would be highly interesting to explore whether cost responses are symmetric or whether reference-dependence may play a role.

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8 Figures

Figure 1: The German Education System

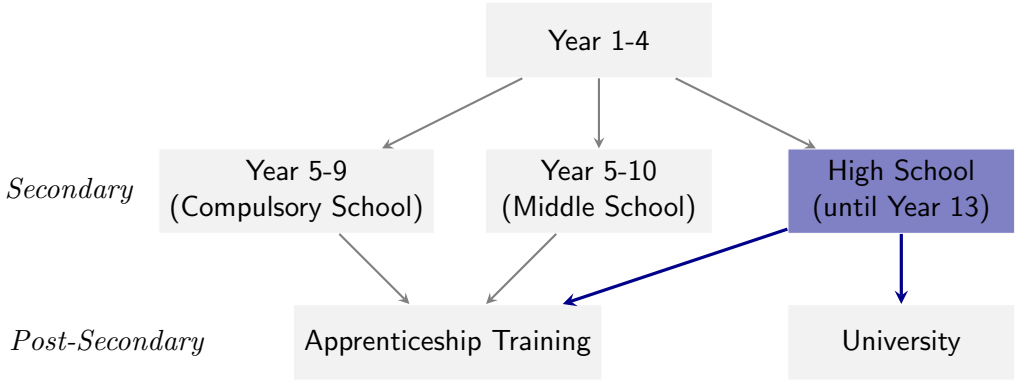
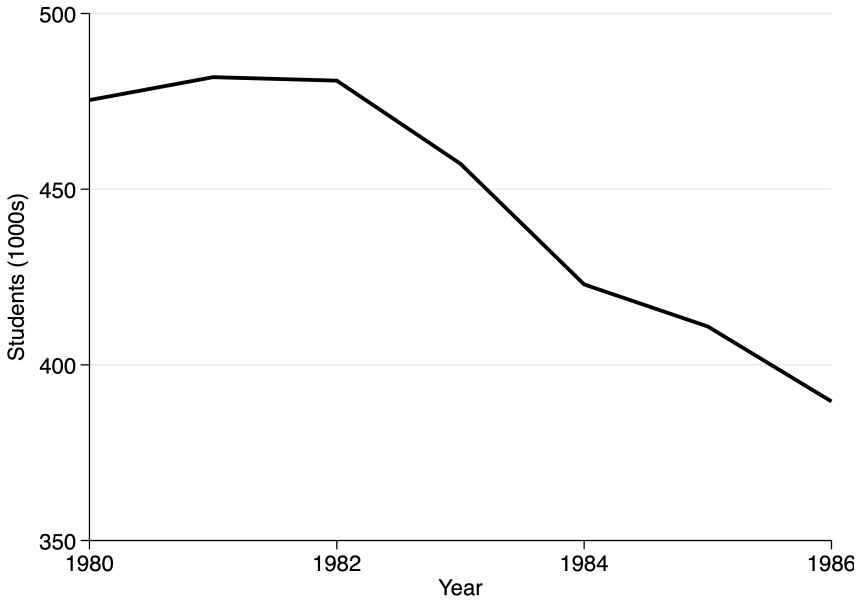
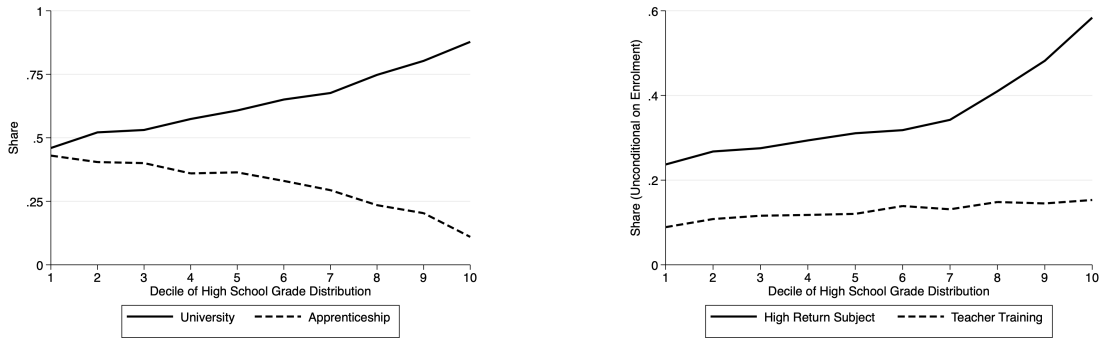


Figure 2: Number of Funded University Students



Note: The Figure shows the number of funded university students in any year. Source: own calculations based on government report *Bildung und Kultur - Ausbildungsförderung nach dem Bundesausbildungsförderungsgesetz*, 1986.

Figure 3: Choices along the Grade Distribution (1980)

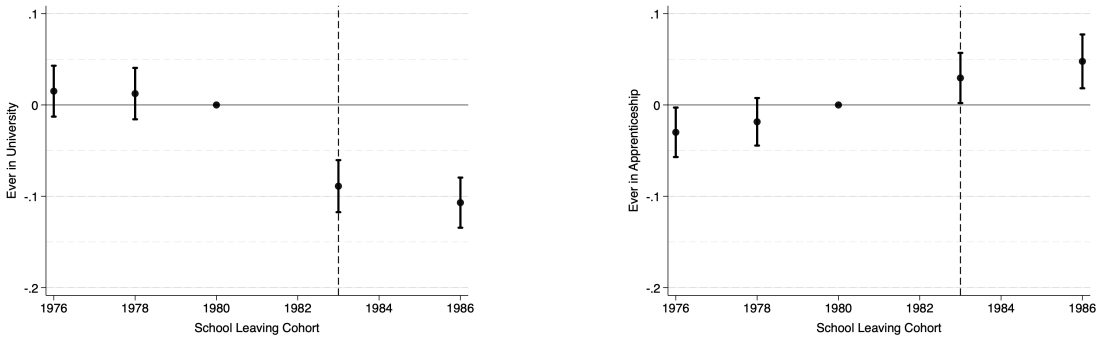


(a) Post-Secondary Choices

(b) University Subject Choice

Note: The left-hand panel illustrates realised post-secondary education outcomes along the high school grade distribution. The right-hand panel shows the probability of being enroled in a subject group, unconditional on enrolment. Results are based on the 1980 high school leaver cohort. Source: DZHW SLP.

Figure 4: Event Study - University Enrolment and Apprenticeship Training

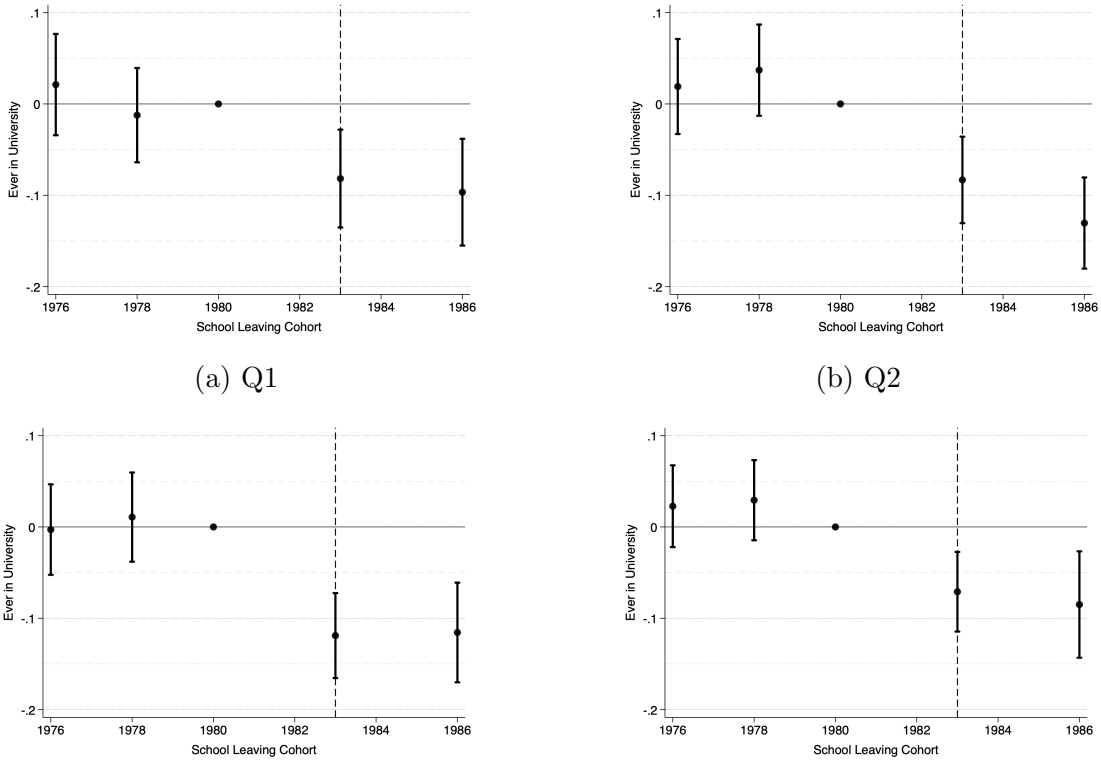


(a) University

(b) Apprenticeship Training

Note: The above figures depict the event study coefficients based on the main specification. University Enrolment and Apprenticeship are dummy variables switched on if an individual is observed in that activity at least once over the two years following high school graduation. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure 5: University Enrolment - Heterogeneity by Grade Quartile



(a) Q1

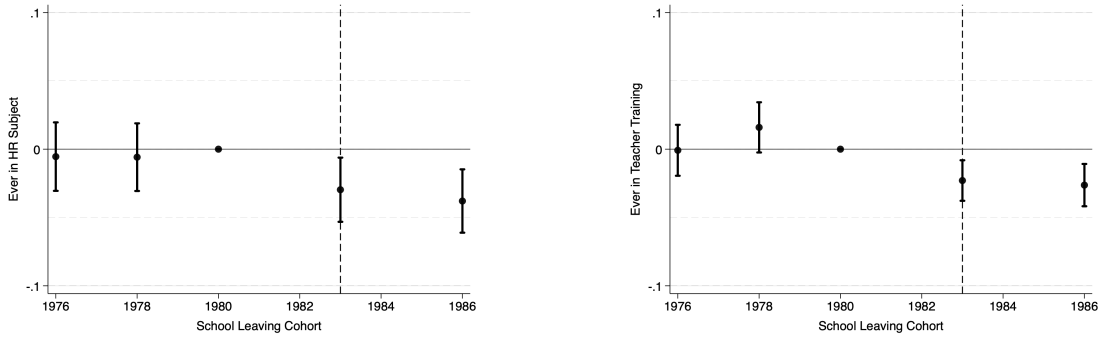
(b) Q2

(c) Q3

(d) Q4

Note: The above figures depict the event study coefficients based on the main specification, separately by quartile ranges of the high school grade distribution. University Enrolment is a dummy variable switched on if an individual is observed as a student at least once over the two years following high school graduation. Regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure 6: Event Study - Subject Choice Margin

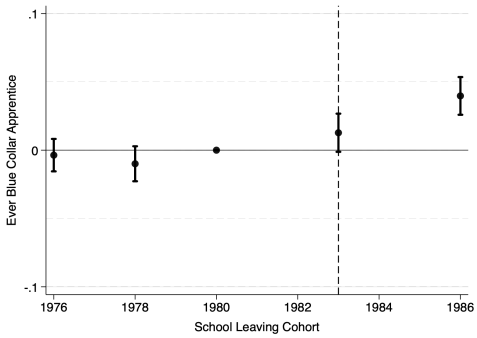


(a) Ever High Return Subjects

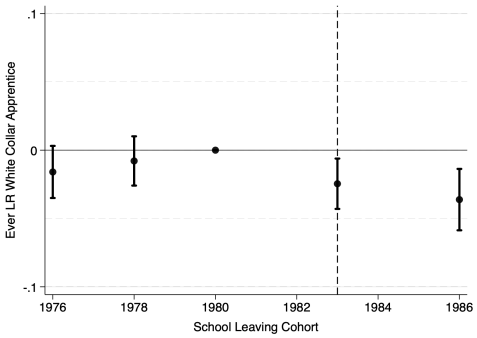
(b) Ever Teacher Training

Note: The above figures depict the event study coefficients based on the main specification. Dummies are switched on if the individual is ever enroled in the respective subject at least once over the two years following high school graduation. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

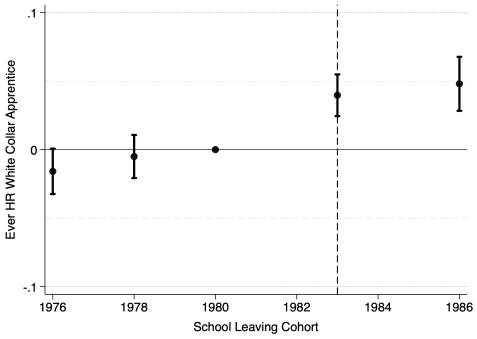
Figure 7: Apprenticeship Choice



(a) Blue Collar



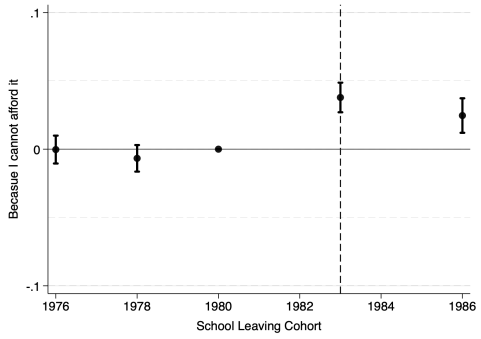
(b) White Collar - Low Return



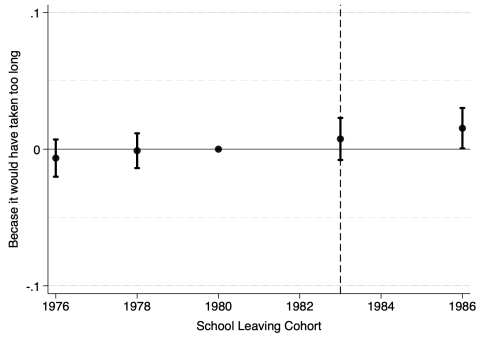
(c) White Collar - High Return

Note: The above figures depict the event study coefficients based on the main specification. Dummies are switched on if the individual is observed in the apprenticeship course group at least once over the two years following high school graduation. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure 8: Event Study - Reasons for Not Enroling



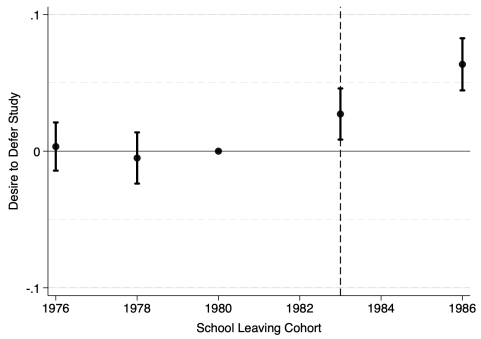
(a) Cannot Afford to Study



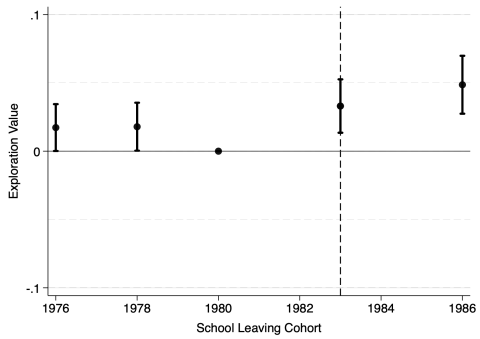
(b) University Takes Too Long

Note: The above figures depict the event study coefficients based on the main specification. The outcome dummies are switched on if an individual listed the particular item as one of the reasons for which they did not enrol in university. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure 9: Event Study - Deferring University and Exploring other Options



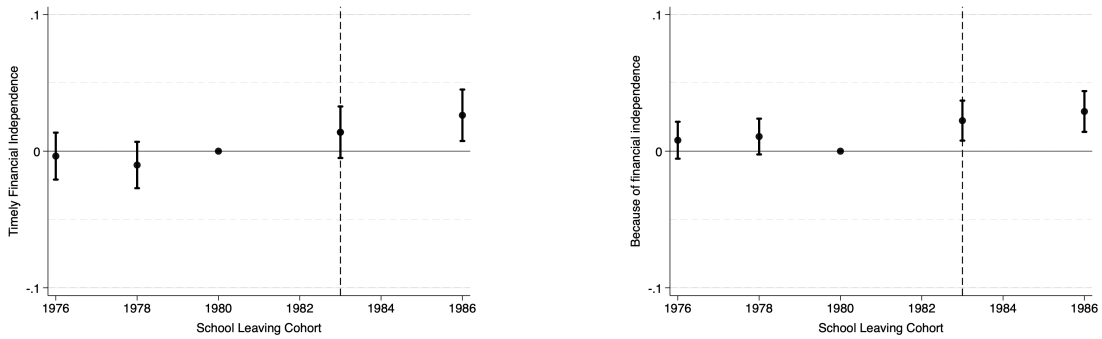
(a) Desire to Defer



(b) Importance of Exploration Value

Note: The above figures depict the event study coefficients based on the main specification. In the left-hand panel, the outcome variable is a dummy which is switched on if an individual reported that they want to enrol but only after pursuing another activity first, such as an apprenticeship. In the right-hand panel, the outcome dummy is switched on if an individual stated that the ability to explore career options before making a final commitment was very important to them. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

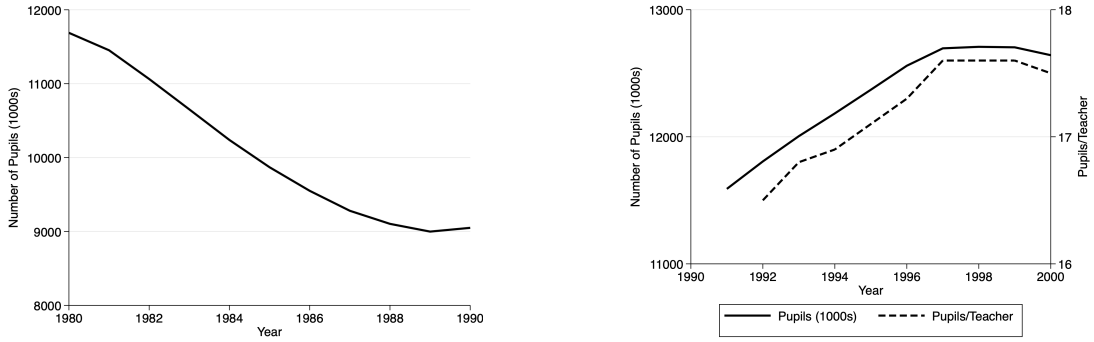
Figure 10: Event Study - Reasons for not Enroling



(a) Importance of Financial Independence (b) Do not want to be financially dependent

Note: The above figures depict the event study coefficients based on the main specification. The left-hand panel uses an outcome dummy which is switched on if an individual stated that timely financial independence was an important concern to them. The right-hand panel uses an outcome dummy which is switched on if an individual listed the particular item as one of the reasons for which they did not enrol in university. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure 11: Number of Pupils and Teachers in Germany



(a) 1980s

(b) 1990s

Note: The above figures depict the evolution of number of pupils and the number pupils per teacher. The left-hand panel refers to the period before 1990. The right-hand panel refers to the 1990s. We present the evidence in two panels as there is a jump of around 25% between 1990 and 1991 following reunification. Source: *Schüler, Klassen, Lehrer und Absolventen der Schulen - 1992 bis 2001, Statistische Veröffentlichungen der Kultusministerkonferenz*, October 2002

9 Tables

Table 1: Sample Descriptive Statistics

	1976	1978	1980	1983	1986
Female	0.49	0.44	0.45	0.44	0.49
Parents with HE	0.20	0.21	0.20	0.19	0.22
Graduation Grade	2.64	2.56	2.47	2.55	2.49
Age at Graduation	19.44	19.39	19.61	19.68	19.64
Regular *Hochschulreife*	0.84	0.86	0.86	0.79	0.84
N	9,949	12,185	11,942	13,552	11,037

Note: The above table refers to descriptive statistics for our analysis sample, which comprises individuals who obtained their school leaving certificate in West Germany between the ages of 18 and 23. We do not exclude those who are observed in military or community service in the first semester after leaving school. The parental higher education dummy is switched on if one or both parents have such a qualification. Source: DZHW SLP.

Table 2: Eligibility Across Cohorts

	1976	1978	1980	1983	1986
Share	0.50	0.51	0.49	0.49	0.46

Note: The table illustrates the estimated shares of student-aid-eligible pupils across cohorts. Predictions are based on probabilities estimated using a Probit model, which are then converted into dummy variables. Details of the estimation can be found in Appendix A.4. Source: DZHW SLP.

Table 3: Motives for Post-Secondary Choices

	Post-Secondary Education		University Subject	
	Students	Never Enroled	High Returns	Teaching
Timely Financial Independence	0.08	0.26	0.10	0.07
Exploration Before Commitment	0.10	0.22	0.08	0.10
Higher Social Status	0.14	0.13	0.21	0.07
Better Income and Job Prospects	0.21	0.30	0.31	0.10
Helping Others	0.36	0.27	0.28	0.48
Social Engagement	0.23	0.16	0.16	0.31

Note: The table illustrates the share of high school graduates who listed a certain factor as important to very important in their (post-secondary education) career choice. The first two columns differentiate according to observed enrolment. The right-hand columns then further show results for students enroled in high return subjects and those in teacher training. We pool the pre-reform cohorts of 1976, 178 and 1980. Source: DZHW SLP.

A Appendix

A.1 University Openings

For data on universities, we follow the method by Boelmann (2022), drawing on the German Statistical Yearbooks from 1953 to 1990 (German Federal Statistical Office, 1953). They take part of the data from Kamhöfer et al. (2019) who digitised the total student numbers, and add data on female students. For 1975, they augment the dataset by information from a different publication by the German Statistical Office (German Federal Statistical Office, 1977). In addition, for the state of Saarland, student numbers from 1952 to 1963 are only contained in the Statistical Handbook for this state (Statistisches Amt des Saarlandes, 1952), which they add to the main university data.

Based on when they first observe students in a given university, they infer the year the university was first open for teaching. Histories of all universities are cross-checked to make sure that they capture the year in which the university opened for students. Universities are assigned to districts based on their current (or last) address, which is mainly taken from the HRK which provide a list of all current members on their homepage *hochschulkompass.de* (obtained on 11 January 2018). In case a university has two campuses, a university is assigned to each district based on when the respective campus was opened.

A.2 Military and Community Service

Between 1956 and 2011 Germany had conscription, i.e. military service, for male citizens. Draft age depended on the schooling track completed by an individual. This study focuses on those with a high school degree, who would have been drafted upon graduation (around the age of 19 or 20). Mandatory service was 15 months until 1990, when it was reduced to 12 months. However, individuals could decide to stay longer should they wish to do so. Before being drafted, individuals had to undergo a medical exam at which point they may have been screened out due to their physical condition, in which case they did not need to complete military service. However, if not screened out one could also object on "moral grounds" in which case one had to complete community service instead. For the 1970 birth cohort, around 40% of men completed mandatory military service, around 35% did not complete any service and the remainder completed community service (for details, see Puhani and Sterrenberg (2021)). One caveat we must make is that we cannot distinguish between military and community service in our data. However, we can of course see when individuals leave their service and how this changes across cohorts (see also Appendix Table 4).

Furthermore, we also examine whether the "Herr Lehmann" story may have affected our

results. Named after the novel by Sven Regener, it describes the phenomenon of young men migrating to West Berlin as this would allow them to avoid conscription. If there are trends in the prevalence of this behaviour across time or treatment groups, this could impact our results. To gauge what role this effect may play, we examine the share of individuals who did not complete high school in West Berlin, but subsequently moved there. Across all cohorts, the share of these individuals is around one percent or less. Furthermore, our results are robust to excluding these observations from our analysis.

A.3 Computation of Funding Eligibility and Amounts

To determine BAföG eligibility, three components are assessed (cf. *Bundesausbildungsförderungsgesetz*). First, the government set a basic sustenance amount deemed necessary for students (*Grundbedarf* according to § 13.), which was higher for students not living with their parents and students with children of their own. This basic sustenance amount was then compared to the student's own income and savings (second component), and their parents' income (third component). Income here comprised all taxable income from which contributions to social security and income tax were deducted. From this net amount, an allowance was deducted. The allowance was higher for parental than for student income (*Freibetrag* according to § 23 and § 25). Students were expected to contribute everything above the allowance to their sustenance, parents were expected to contribute half of the amount above their allowance (less if they supported further children). If students had savings above a certain allowance, they were also expected to contribute those (*Freibetrag* according to § 29). Thus, the overall amount a student was eligible for was the difference between the basic sustenance amount and their own as well as their parents' contributions. Basic sustenance amounts as well as allowances were regularly updated by the government to make sure they aligned with changes in prices. Figure B.20 illustrates that over our period of study, they increased nominally but remained stable in real terms.

A.4 Funding Eligibility

To create a proxy for funding eligibility, we employ a two-step procedure. In the first step, we draw upon the survey cohorts 1983 and 1986. In the wake of the *Bundesausbildungsförderungsgesetz* (BAföG) reform, all students were asked questions concerning their funding (in)eligibility as well as application status or outcome. Using these questions we can sharply define eligibility as well as ineligibility. Out of this sub-sample of students, 47% are eligible for funding. Using this sample, we then estimate a Probit regression of binary eligibility on a set of household characteristics and their interactions (father's and

mother's education, father's occupation and federal state of high school graduation). We then use the regression results to predict eligibility for observations in the remaining cohorts. In the training sub-sample, the predictive accuracy is around 70%, with the majority of misclassification being actually eligible students being classified as ineligible.

In the second step, we draw upon survey questions asked in all cohorts (but crucially not filled out by all individuals) concerning *Bundesausbildungsförderungsgesetz* (BAföG) receipt and alternative funding sources. The groups of individuals missing and not missing this information appear balanced in terms of household characteristics. For those individuals where we do observe these questions, we use them to populate the eligibility proxy instead of the prediction from the first step. Based on this final proxy variable, on average 49% of every cohort is eligible for funding (see Table 2). Across all cohorts, eligible students appear sufficiently balanced in terms of father's occupation and parental higher education shares (see Table 5). It is very intuitive that eligible students are more likely to have a father who is an employed worker (rather than self-employed or a public servant) than ineligible high school graduates (63% compared to 49% average annual share). Similarly, funding ineligible students are about five times as likely to have at least one parent with completed higher education (34% versus 7% across all cohorts). As a robustness exercise, we also estimate our main specification with the treatment variable defined according to parental higher education.

A.5 A Simple Model of Human Capital Investment

For illustrative purposes, consider a simple, two-period life-cycle model not dissimilar to that used by Rothstein and Rouse (2011). Funding-eligible high school graduates make post-secondary education investments in the first period (e.g. university or apprenticeship training), and work in the second. They derive lifetime utility, which is governed by the following function:

$$U(c_1, c_2) = u^1(c_1) + \frac{1}{(1+\delta)} u^2(c_2) \tag{2}$$

where $u^t(c_t)$ is utility in period t, which is a function of consumption in that period. δ is a discount factor. When maximising utility, individuals face the following budget constraint:

$$c_1 + \frac{1}{(1+r)} c_2 \leq y_1(PS) + \frac{1}{(1+r)} y_2(PS) - L(PS) \tag{3}$$

where r indicates the interest rate and incomes $y_t(PS)$ are a function of post-secondary education choice $PS = \{A, HE\}$, i.e. either apprenticeship or higher education. Specifically, the period incomes are as follows:

$$y_1(A) = y \tag{4}$$

$$y_2(A) = y^A \tag{5}$$

$$y_1(HE) = l + g \tag{6}$$

$$y_2(HE) = y^{HE} \tag{7}$$

In other words, in period one, apprentices earn a wage y whereas university students receive a funding package comprised of a loan l and a grant g. In the second period, university graduates earn a wage y^{HE} and apprentices y^A. In addition, university students face a debt burden of amount $L(HE) = l$, and by contrast $L(A) = 0$. Students only enrol if the return premium in period 2 income exceeds the extra cost of university. The presence of the student finance scheme ensures that the budget constraint does not bind for prospective students.[34]

In order to capture the 1983 reform, $L(HE)$ becomes $L'(HE) = (l + g)$, i.e. the portion that was previously a non-repayable grant now enters the loan portion. Following this increase in study cost, the life-cycle utility gain from university no longer exceeds the cost burden for some students, and they opt for apprenticeships instead.

Yet, to rationalise why the enrolment response is very pronounced, and even so amongst students in the top quartile of the high school graduation grade distribution, we introduce concern with debt into the utility function. Specifically, Equation 2 becomes:

$$U(c_1, L, c_2) = u^1(c_1, L) + \frac{1}{(1+\delta)} u^2(c_2) \tag{8}$$

Any non-zero debt-holding L has a negative impact on utility, and this impact is uncorrelated with ability. Under Equation 8 the pure cost response to the 1983 reform is amplified by concerns with debt, and in particular so for students of all abilities.

To rationalize why enrolment in high returns subjects responds to a lesser extent than that in teacher training, one can primarily draw on the former offering on average higher returns. Yet, why would those in teacher training not simply switch into high returns subjects and still enrol? In Section 3.2.3 we documented that in the pre-reform period, those in teacher training were on average much less concerned with pecuniary factors than those in high-return subjects. Therefore, they might have greater uncertainty about the returns to

[34]Conditional on their (perceived) returns being sufficiently high enough.

enroling in a high-return subject. On the other hand, teacher salaries were well-publicised and hence subject to much less uncertainty. The same was true for apprenticeship wages, which were a by-product of collective bargaining negotiations. When faced with the increase in cost and debt burden, this uncertainty about potentially better returns in other subjects would thus reinforce the already more pronounced enrolment effect for teacher training.

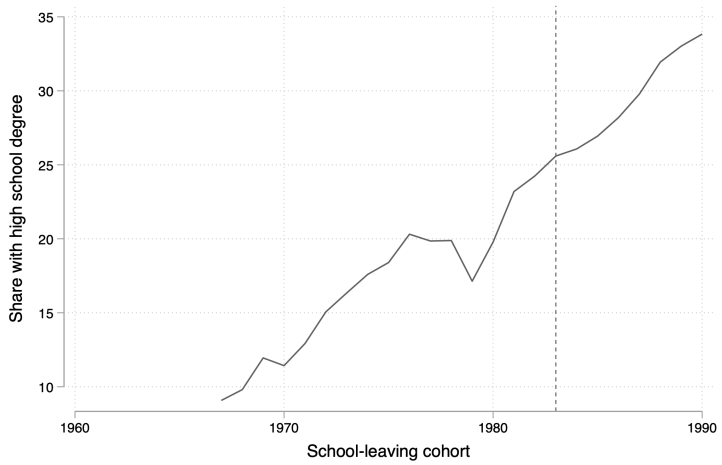
One reading of our findings may also allow for a more substantive role of uncertainty regarding higher education returns. Recall that in Section 5 we documented that upon the reform, funding-eligible students increasingly wanted to defer university enrolment until after further exploration of other options. This suggests that a simple cost-benefit analysis did not lead them to a straightforward conclusion. If it did, they would simply state that they no longer had a desire to enrol. In the presence of return uncertainty, a rise in perceived sunk costs may instead yield the observed result. Within our model, this could be captured by modifying the Equation 7 in the following way:

$$y_2(U) = \Phi(y^H) \tag{9}$$

where Φ captures uncertainty about returns to higher education, which in turn are uncorrelated with ability. For instance, it may be that students from less affluent backgrounds do not have family members who can give them information about the exact size of these returns. This channel may also help us rationalize the observed effects.

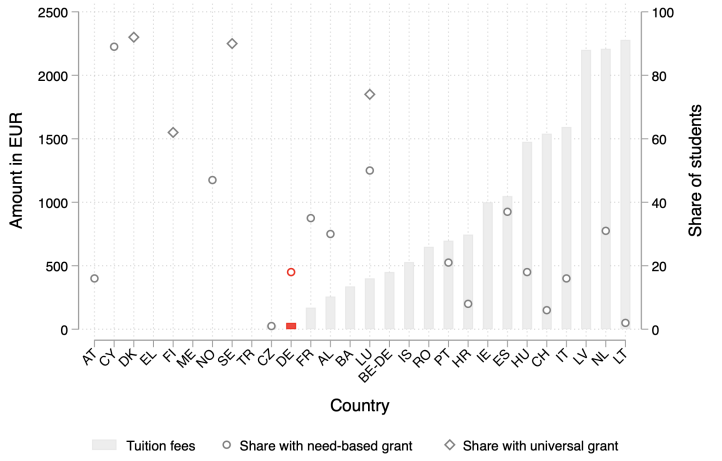
B Additional Figures

Figure B.1: Share of School Leavers with High School Degree Over Time



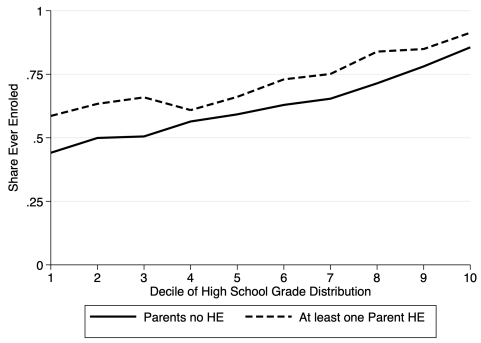
Note: The figure shows the share of school leavers in the school-leaving cohort 1967-1990 graduating with a high school degree (both *Allgemeine Hochschulreife* and *Fachhochschulreife*). The dashed vertical lines indicate the student aid reform in 1983. Source: German Statistical Office's report "Bildung im Zahlenspiegel 1992".

Figure B.2: Student Finance Across Europe – 2022/23

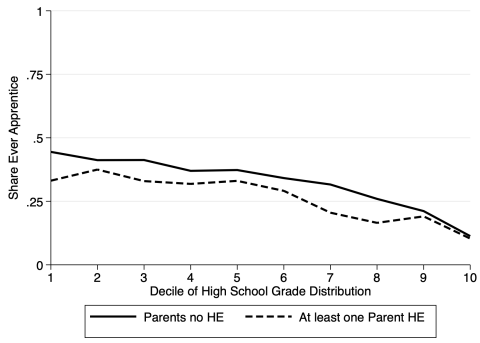


Note: The figure shows student finance regimes across European countries for full-time home students in their first cycle in the academic year 2022/23. The grey bars depict the most common annual fee in EUR. The circles represent the share of students who are need-based grant holders; the diamonds those who are universal grant holders. Source: Eurydice.

Figure B.3: Choices along the Grade Distribution (1980) - By Parental Education



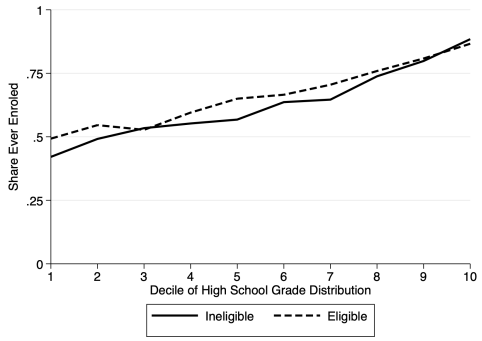
(a) University Enrolment



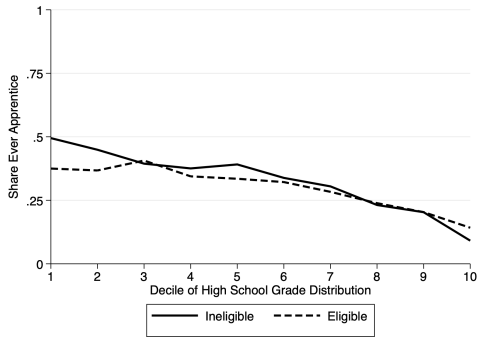
(b) Apprenticeship Training

Note: The figure illustrates post-secondary choices along the high school grade distribution and by parental education. We distinguish between those where at least one parent has completed higher education and those where this is not the case. Results are based on the 1980 high school leaver cohort. Source: DZHW SLP.

Figure B.4: Choices along the Grade Distribution (1980) - By Funding Eligibility



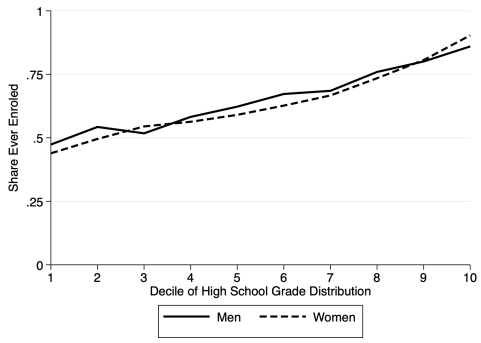
(a) University Enrolment



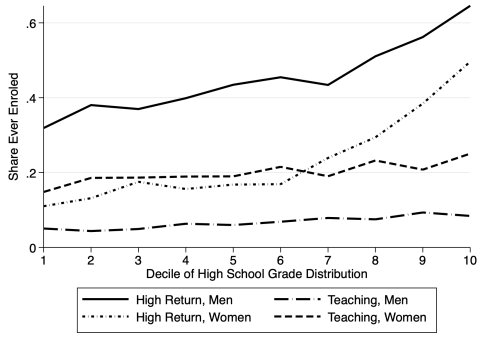
(b) Apprenticeship Training

Note: The figure illustrates post-secondary choices along the high school grade distribution and by funding eligibility. Results are based on the 1980 high school leaver cohort. Source: DZHW SLP.

Figure B.5: Choices along the Grade Distribution (1980) - By Gender



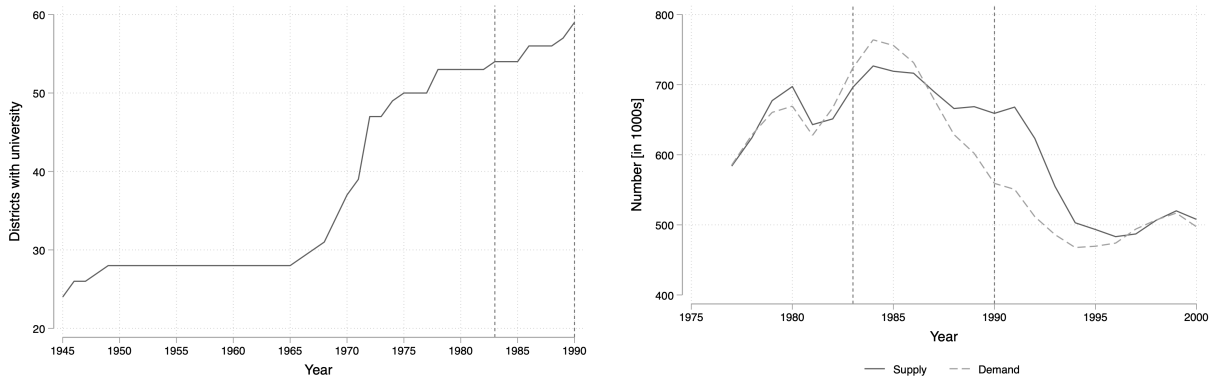
(a) University Enrolment



(b) Apprenticeship Training

Note: The figure illustrates post-secondary choices along the high school grade distribution and by gender. The right-hand panel shows the probability of being enroled in a subject group, unconditional on enrolment. Results are based on the 1980 high school leaver cohort. Source: DZHW SLP.

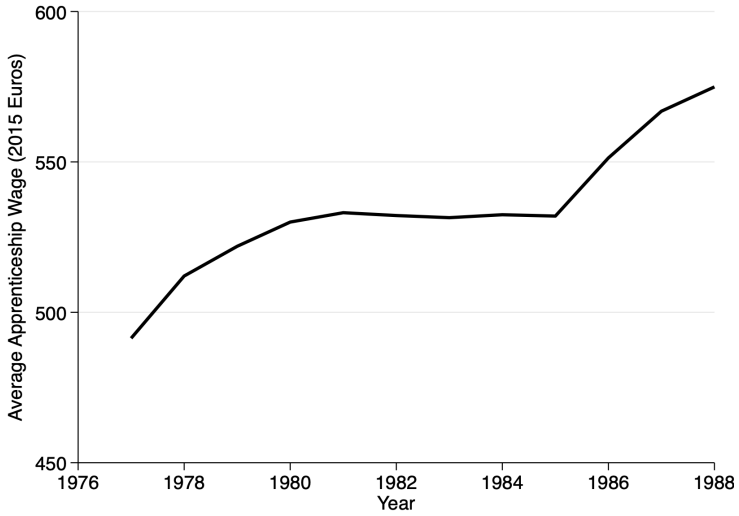
Figure B.6: Supply of Post-Secondary Education Options



(a) Share of German Districts with a University (b) Supply and Demand of Apprenticeships

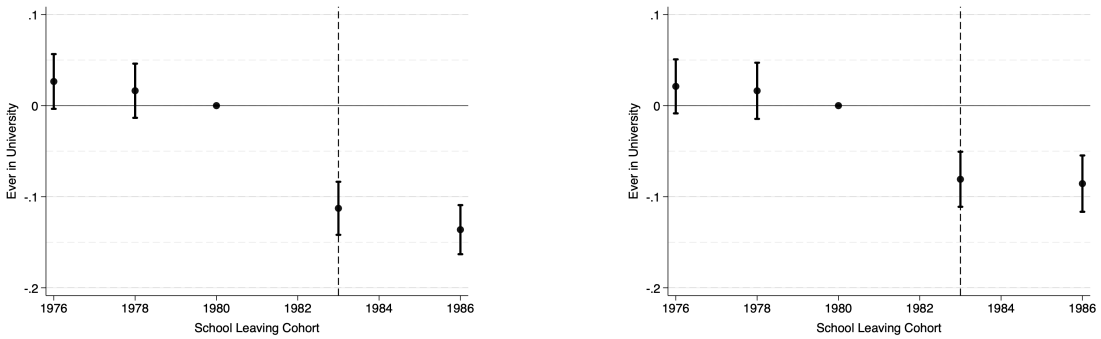
Note: The figure illustrates the share of districts with a university over time. Details on calculation steps can be found in the Appendix. Panel (b) illustrates the supply and demand of apprenticeship places. Source: own calculations based on German Statistical Yearbooks 1953 to 1990 (German Federal Statistical Office, 1953) and *Berufsbildungsbericht* 1979-1999.

Figure B.7: Average Bargained Wage for Apprentices (Real)



Note: The above figure depicts the evolution of the average bargained wage for apprentices in 2015 Euros. Source: own calculations based on Beicht (2011).

Figure B.8: Event Study - University Enrolment with Restricted Samples

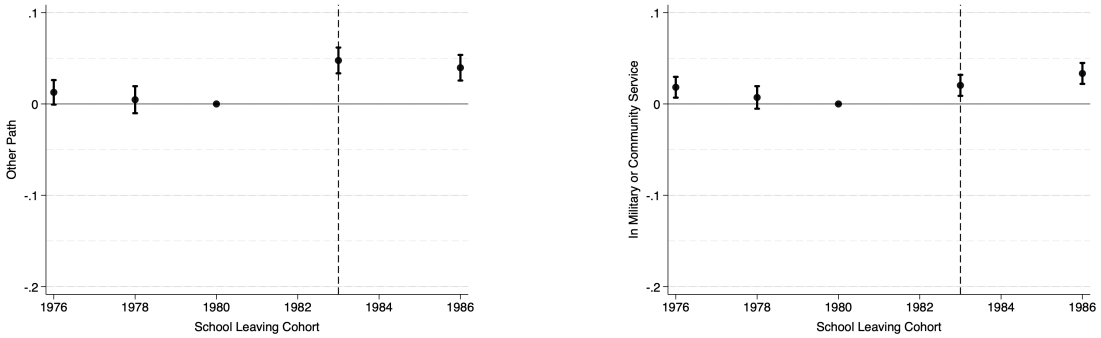


(a) Regular *Hochschulreife*

(b) Not Initially in Service

Note: The above figures depict the event study coefficients based on the main specification, but restricted samples. The left-hand panel excludes those who did not graduate with a general high school certificate. The right-hand panel excludes those initially in military service. University Enrolment is a dummy variable switched on if an individual is observed enroled at least once over the two years following high school graduation. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

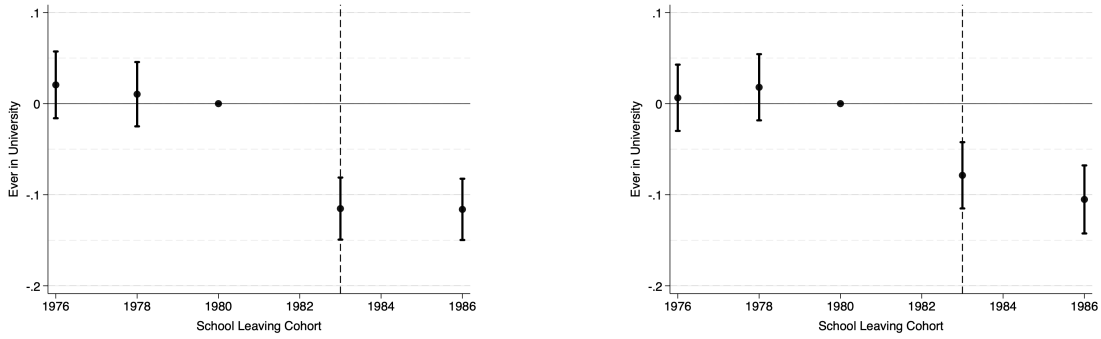
Figure B.9: Event Study - Other Post-Secondary Paths



(a) Never Enroled or in an Apprenticeship (b) In Service Beyond Mandatory Period

Note: The above figures depict the event study coefficients based on the main specification. The left-hand panel captures impacts on an outcome dummy that is switched on if an individual is never observed in university or an apprenticeship. Other options include work, unemployment, home production and military or community service. The right-hand panel captures an outcome dummy which is switched on if an individual is still in military or community service 24 months after high school graduation, i.e. beyond the mandatory service period. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

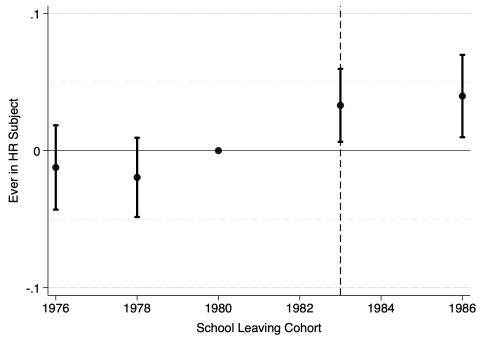
Figure B.10: University Enrolment - Heterogeneity by Gender



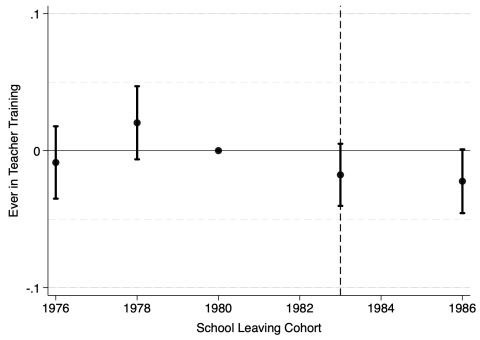
(a) Women (b) Men

Note: The above figures depict the event study coefficients based on the main specification, separately by gender. University Enrolment is a dummy variable switched on if an individual is observed as a student at least once over the two years following high school graduation. Regressions control for regional unemployment in the year of *Abitur*, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.11: Event Study - Subject Choice, Conditional on Enrolment



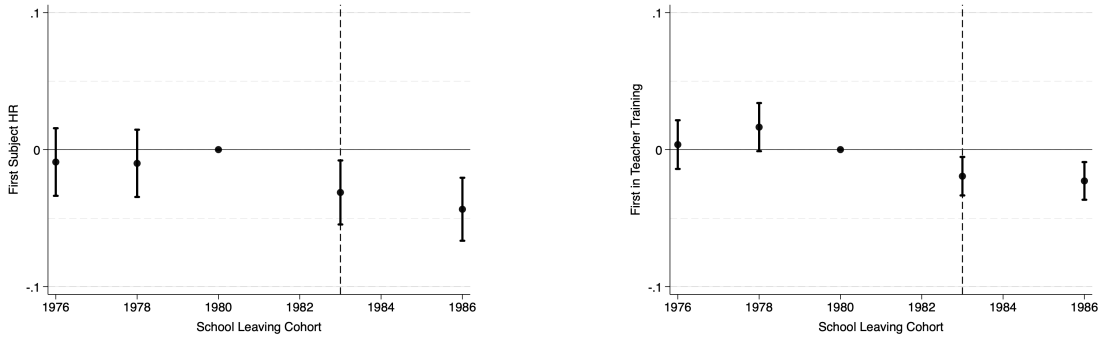
(a) High Return Subjects



(b) Teacher Training

Note: The above figures depict the event study coefficients based on the main specification. The sample is restricted to individuals observed in university at least once across the two years post graduation. Dummies are switched on if the individual is enroled in the respective subject group. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.12: Event Study - Subject Choice at First Matriculation

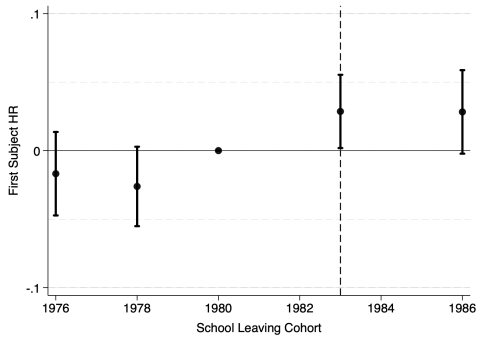


(a) Ever High Return Subjects

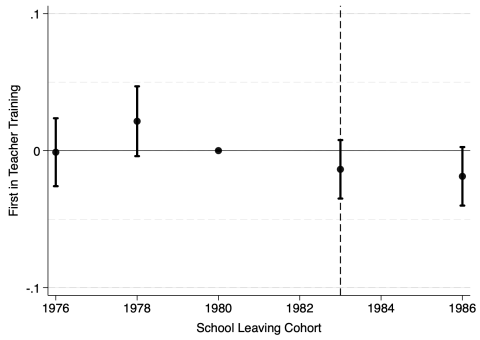
(b) Ever Teacher Training

Note: The above figures depict the event study coefficients based on the main specification. Dummies are switched on if the individual is enroled in the respective subject at first matriculation. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.13: Event Study - Subject Choice at First Matriculation, Conditional on Enrolment



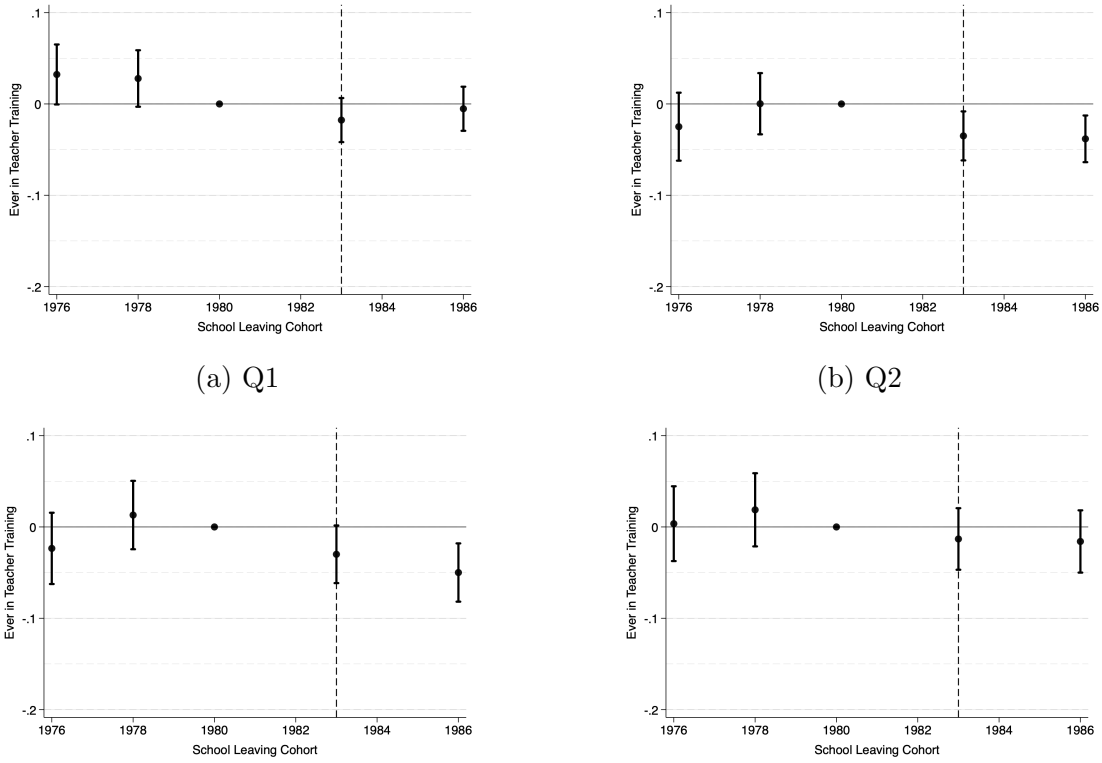
(a) High Returns Subject



(b) Teacher Training

Note: The above figures depict the event study coefficients based on the main specification. The sample is restricted to individuals observed in university at least once across the two years post graduation. Dummies are switched on if the individual is enroled in the respective subject at first matriculation. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.14: Teacher Training - Heterogeneity by Grade Quartile



(a) Q1

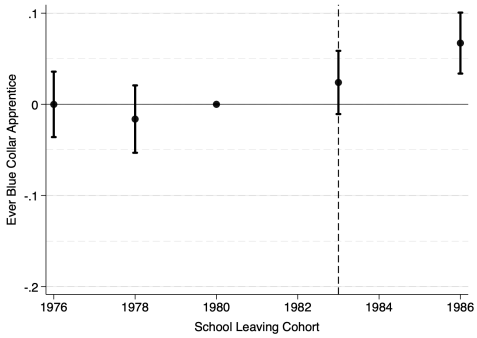
(b) Q2

(c) Q3

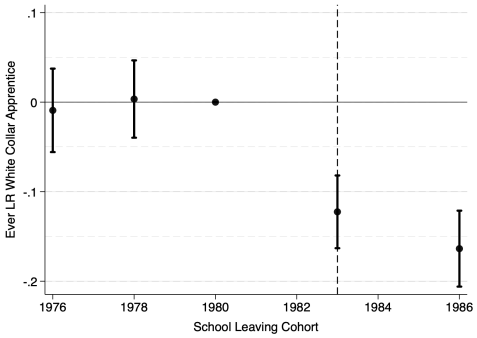
(d) Q4

Note: The above figures depict the event study coefficients based on the main specification, separately by quartile ranges of the high school grade distribution. Teacher Training is a dummy variable switched on if an individual is observed as a student in teacher training at least once over the two years following high school graduation. Regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

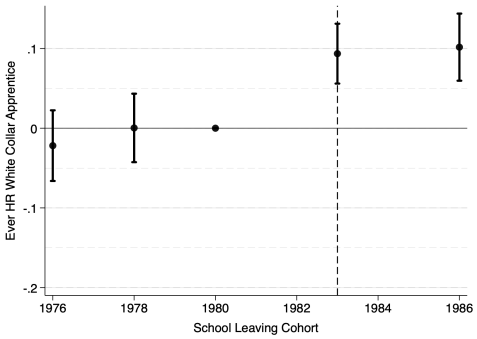
Figure B.15: Apprenticeship Choice, Conditional on Take-up



(a) Blue Collar



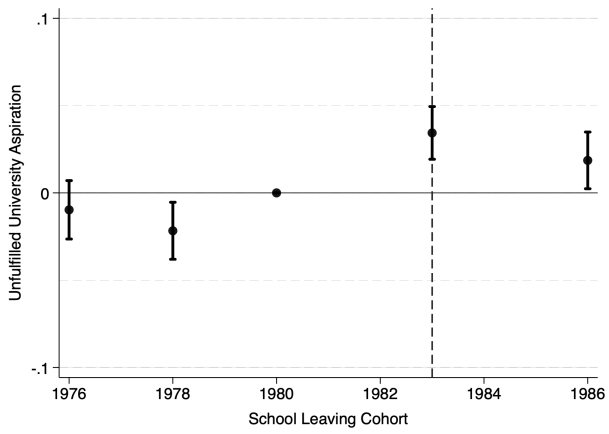
(b) White Collar - Low Return



(c) White Collar - High Return

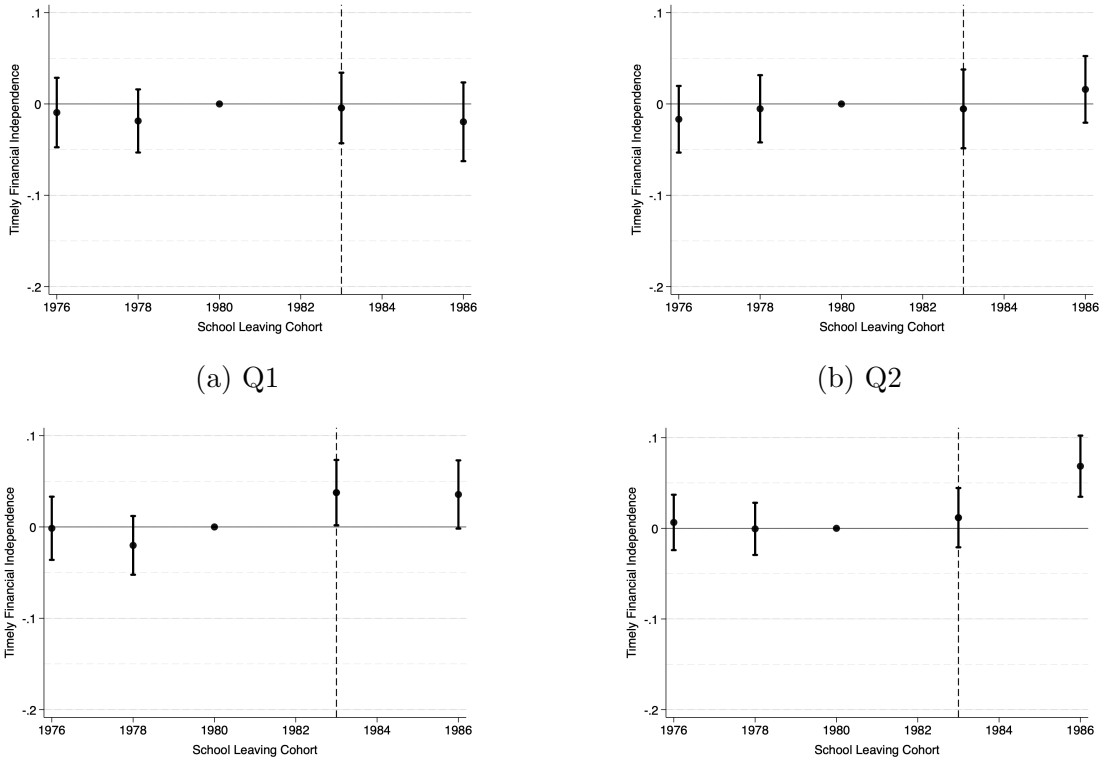
Note: The above figures depict the event study coefficients based on the main specification. The sample is restricted to individuals observed in apprenticeship training at least once across the two years post graduation. Dummies are switched on if the individual is enroled in the respective apprenticeship course group. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.16: Not Enroled Despite Desire



Note: The above figure depicts the event study coefficients based on the main specification. The outcome variable is a dummy which is switched on if an individual stated at high school graduation that they wanted to go to university, but did not end up enroling over the first two years post graduation. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.17: Concern with Financial Independence - Heterogeneity by Grade Quartile



(a) Q1

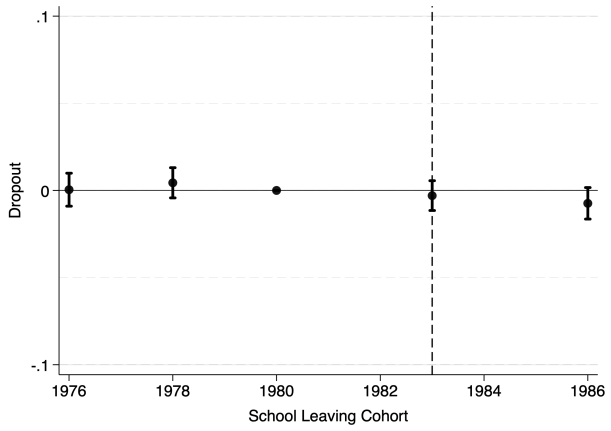
(b) Q2

(c) Q3

(d) Q4

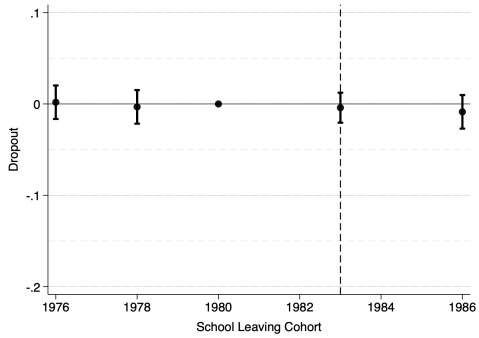
Note: The above figures depict the event study coefficients based on the main specification, separately by quartile ranges of the high school grade distribution. The outcome dummy is switched on if an individual stated that timely financial independence was an important concern when making post-secondary education decisions. Regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.18: Event Study - Dropout Prevalence

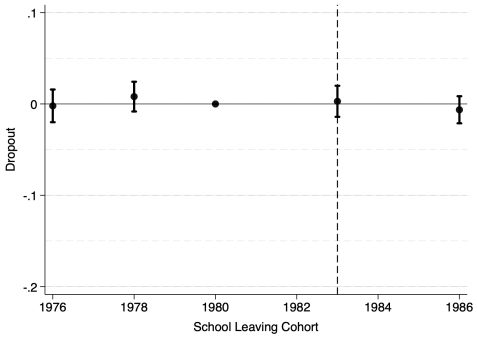


Note: The above figures depict the event study coefficients based on the main specification. The dropout dummy is switched on if over the two years post high school graduation, an individual is observed unenroled, having previously been enroled. Regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

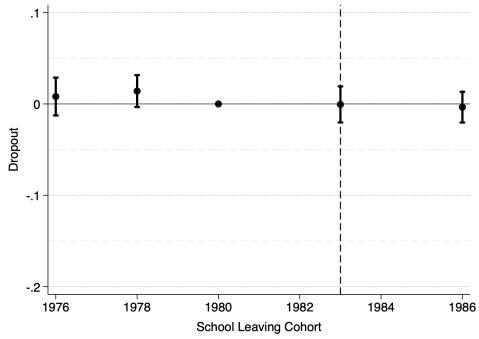
Figure B.19: University Dropout - Heterogeneity by Grade Quartile



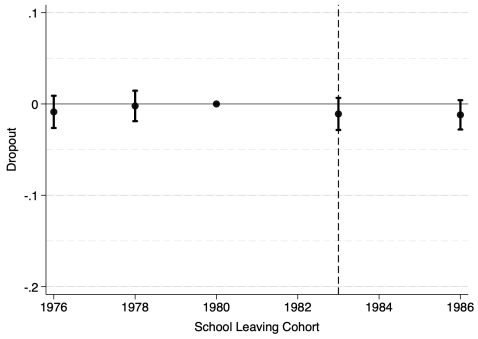
(a) Q1



(b) Q2



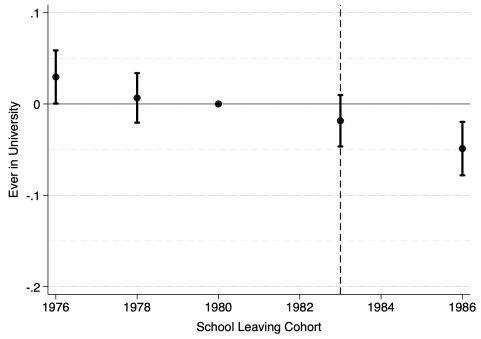
(c) Q3



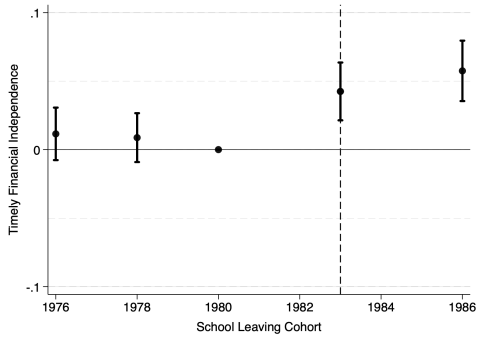
(d) Q4

Note: The above figures depict the event study coefficients based on the main specification, separately by quartile ranges of the high school grade distribution. The dropout dummy is switched on if over the two years post high school graduation, an individual is observed unenroled, having previously been enroled. Regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.20: Event Study - Treatment According to Parental Education



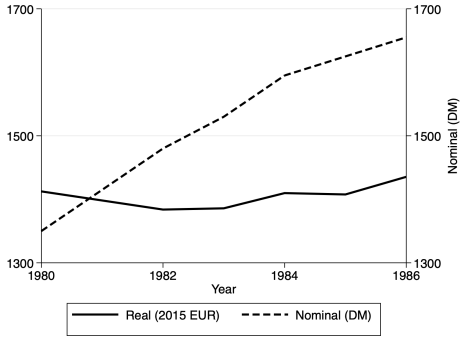
(a) University Enrolment



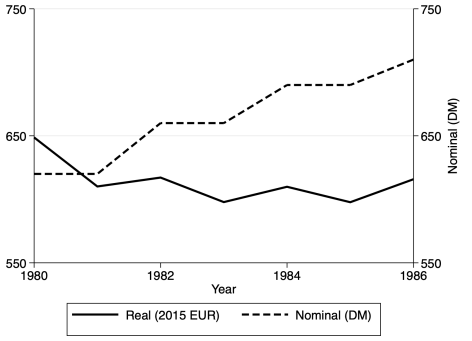
(b) Concern with Financial (In)Dependence

Note: The above figures depict the event study coefficients based on a specification using parental education as the treatment variable. University Enrolment is a dummy variable switched on if an individual is observed as a student at least once over the two years following high school graduation. The right-hand panel uses an outcome dummy which is switched on if an individual stated that timely financial independence was an important concern when making post-secondary education decisions. All regressions control for regional unemployment in the year of *Abitur*, gender, federal state of *Abitur* and standardized high school graduation grade. Standard Errors are clustered at the school-cohort level. Source: DZHW SLP.

Figure B.21: Student Finance - Allowance and Sustenance Amounts



(a) Income Allowance



(b) Sustenance Amounts

Note: The Figure illustrates the evolution of the income allowance and sustenance levels, both in nominal (DM) and real (2015 Euros) terms. The allowance level data point for 1981 is missing as it was not contained in the reports. Source: own calculations based on government reports, *Unterrichtungen durch die Bundesregierung nach § 35 des Bundesausbildungsförderungsgesetzes.*

C Additional Tables

Table 4: Progression from Military/Community Service

	1976	1978	1980	1983	1986
12 Months	0.94	0.92	0.95	0.94	1.00
18 Months	0.25	0.31	0.33	0.32	0.37
24 Months	0.11	0.17	0.18	0.09	0.11

Notes: The above table focuses on those in military or community service six months after high school graduation. It shows the share still in service at 6 month incremental intervals post graduation. Individuals can choose to prolong their service beyond the mandatory period. Source: DZHW SLP.

Table 5: Parental Background of Eligible Students

	1976	1978	1980	1983	1986
Father's Occupation					
Self-Employed	0.21	0.20	0.18	0.19	0.19
Employee	0.62	0.61	0.65	0.65	0.63
Civil Servant	0.17	0.18	0.15	0.15	0.18
At Least One Parent HE	0.06	0.06	0.04	0.07	0.10

Notes: The table shows the composition of the group of high school graduates which our proxy classifies as funding eligible. Source: DZHW SLP.

Table 6: Top 25 Subjects

	Enrolment Share	High Return Subject
Business and Economics	0.090	1
Law	0.076	1
Mechanical Engineering	0.070	1
Medicine	0.067	1
Electrical Engineering	0.054	1
Mathematics	0.048	1
Sociology	0.047	0
Chemistry	0.042	1
German Studies	0.041	0
Theology and Religious Education	0.039	0
Biology	0.039	1
Computer Science	0.032	1
Pedagogy	0.032	0
Physics and Astronomy	0.028	1
Civil Engineering	0.024	1
English and American Studies	0.024	0
Architecture	0.023	0
Music and Musicology	0.021	0
Romance Studies	0.019	0
History	0.017	0
Land Economy	0.017	0
Sport and Physical Education	0.016	0
Geography	0.016	0
Psychology	0.015	0
Pharmacy	0.014	1
Top 25 Total	0.92	12

Notes: The table above illustrates the shares of subjects chosen by enroled students, calculated across the pre-reform period and amongst enroled students only (i.e. likelihoods are conditional on enrolment). The right-hand column further indicates whether a subject offers relatively high lifetime income compared to the average for university graduates. Source: DZHW SLP.