The Effects of the Introduction of Tuition on College Enrollment in Germany:

Results from a Natural Experiment

With Special Reference to Students from Low Parental Education Backgrounds

by

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To my parents

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ABSTRACT

Many wealthy countries outside of the US have traditionally provided public higher education free of charge to students. However, due to growing enrollments, fiscal pressures and political objections to increased public spending, an international trend to introduce tuition has emerged. Whereas tuition is a controversial policy issue in many wealthy counties outside of the US, relatively little is known about how the introduction of moderate tuition affects college enrollment in these countries. Methodological challenges, such as a lack of valid comparison groups, often limit the validity of the existing estimates. It is also unclear whether the effects found in the US apply to other institutional contexts and how the introduction of tuition affects the enrollment decisions of students from low socioeconomic backgrounds. This dissertation is able to address these methodological challenges by using a natural experiment design. In 2006, six German states introduced tuition in the moderate amount of €1,000 per year, while the other ten states did not. Students in the states without tuition can therefore be used as a comparison group.

Using a differences- in-difference analysis, I find no evidence that the introduction of moderate tuition affects college enrollment in Germany in general. While high school graduates from college-educated family backgrounds are not affected by moderate tuition, their peers whose parents do not have a college degree are sensitive to tuition, even when the tuition level is minimal compared to international levels. After tuition was introduced, the enrollment probability of high school graduates from low parental education backgrounds dropped by six percentage points (from a baseline of 42%) relative to students from high parental education backgrounds in tuition-states and relative to the change in the enrollment gap by parental education in non-tuition-states. Implications for empirical research, theoretical perspectives on college enrollment, and tuition policy are discussed.

Chapter 1

Introduction

Many wealthy countries outside of the United States (US) have traditionally provided public higher education free of charge to students. However, due to growing enrollments, fiscal pressures and political objections to increased public spending for higher education, an international trend to break with this long-standing tradition has emerged. The United Kingdom introduced tuition in 1998 and Austria and Germany followed suit during the last decade.[1] Furthermore, most of the Organisation of Economic Cooperation and Development (OECD) countries that still offer tuition-free public higher education, such as Brazil[2], Denmark, France, Ireland, Mexico and the Czech Republic, are considering introducing tuition (Marcucci & Usher, 2014). The introduction of tuition is a controversial education policy issue. In many OECD countries there is heated debate among policy makers and researchers about whether and to what degree the imposition of tuition, especially moderate levels of tuition, discourages college enrollment, particularly among low-income students. I define moderate tuition as tuition that costs about 10% of students' annual living expenses.[3] Furthermore, plans in Germany and England to introduce or increase tuition have led to the largest student protests since the 1960s. The issue of imposing tuition has, therefore, been called one of the most hotly debated issues in international education policy in recent years (OECD, 2012; Wilkins, Shams & Huisman, 2012).

In the US, a large body of literature documents that increases in tuition levels negatively affect college enrollment, in particular for students from low-income backgrounds (e.g. Heller,

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1 As will be explained in more detail below, by the end of 2014, all German states subsequently abolished tuition. Austria also abolished tuition. In both countries there are political debates about reintroducing tuition.
2 Brazil is not member of the OECD but one of five countries that the OECD lists as a key partner and a potential new member.
3 In Germany, moderate tuition, for example, amounts to about €1,000 per year. Annual living expenses were calculated from Isserstedt, Middendorf , Kandulla, Borchert & Leszczensky (2010).

1997; Hemelt & Marcotte, 2011; Kane, 1994; Leslie & Brinkman, 1987; McPherson & Shapiro, 1991). A $100 increase in tuition per year at four-year institutions results (on average) in an enrollment decline of 0.4 to 0.5 percentage points (Heller, 1997; Kane, 1994). Yet, while we know a great deal about the effects of tuition increases from high tuition levels, (e.g. the average annual tuition of $6,000 in the US) (OECD, 2012), we know very little about how the introduction of moderate tuition, and tuition in general, affects college enrollment in OECD countries outside of North America. Furthermore, we know very little about how tuition affects the enrollment decisions of students from low parental education and parental-income backgrounds. It is also unclear whether the effects found in the US apply to the European institutional contexts which differ, for example, in terms of the higher education systems and the returns of a college degree and many other aspects.

Prior Research

A number of studies from the UK and the Netherlands have examined how moderate tuition affects enrollment decisions in Europe (Canton & de Jong, 2005; Galindo-Rueda, Marcenaro-Gutierrez, Vignoles, 2004). These studies found that tuition has no or only a very small effect on enrollment. Yet an important limitation of the studies is that they examined tuition effects by comparing enrollment rates before and after tuition reforms and did not have comparison groups that were not affected by changes in tuition. These studies found that enrollments remained stable after tuition was introduced in the UK and after tuition was increased slightly in the Netherlands. However, enrollments were trending upward in the UK and the Netherlands prior to the reform of the tuition policies. This positive enrollment trend might have masked the potentially negative effect of tuition. Due to the lack of appropriate comparison groups it is not clear whether enrollment rates would have grown in the UK or the Netherlands had tuition not been introduced or increased. To get closer to a causal effect of tuition, it is therefore important to consider the general trends in enrollment by using a comparison group that was not affected by new tuition policies (Dynarski, 2002; Long, 2007).

Another methodological challenge in estimating tuition effects on enrollments is taking into account the actual tuition amounts individual prospective students face, given that the

amounts often vary by student achievement, social background, institutional type, and a host of other factors. Given that data on the individual tuition costs of prospective students is often unavailable, studies frequently use the mean increase in tuition costs in a state as a measure for tuition increases. Yet as Long (2007) notes, studying changes in mean tuition costs misrepresents the price increases students with different characteristics face and therefore might lead to distorted estimates.

This dissertation is able to address these important methodological challenges in estimating the effects of tuition by using a natural experiment design. In 2006, six German states introduced tuition in the moderate amount of €1,000 (US$ 1,350) per year for all public higher education, while the other ten states did not. Students in the states without tuition can therefore be used as a comparison group for students in states experiencing the imposition of tuition, thereby allowing me to distinguish any general trend in enrollment from the effect of the newly introduced tuition. Furthermore, I am able to estimate the effects of individual tuition costs and do not need to rely on changes in mean tuition costs because tuition in Germany was set at €1,000 per year regardless of institutional selectivity and student characteristics.[4]

Relevance of Research on Tuition Effects in the European Context

Further empirical evidence about the effects of introducing moderate tuition and about tuition effects outside of the US is important for several reasons. First, moderate tuition is the norm in OECD countries, and we know very little about its effects. As illustrated in Figure 1, average tuition in OECD countries is set at about $1,650 annually; it is thus only one-quarter of the average tuition in the US.[5] In 2011, tuition levels ranged from $1,000 in Germany to $4,700 in the United Kingdom (UK) in 2011. Six OECD countries did not charge tuition for public undergraduate education in that year.

 US$ (PPP converted)

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[4] Tuition varies slightly for some students and institutions. These exceptions will be discussed below.
[5] The OECD average was calculated based on data from table B 5.1 in OECD (2012).
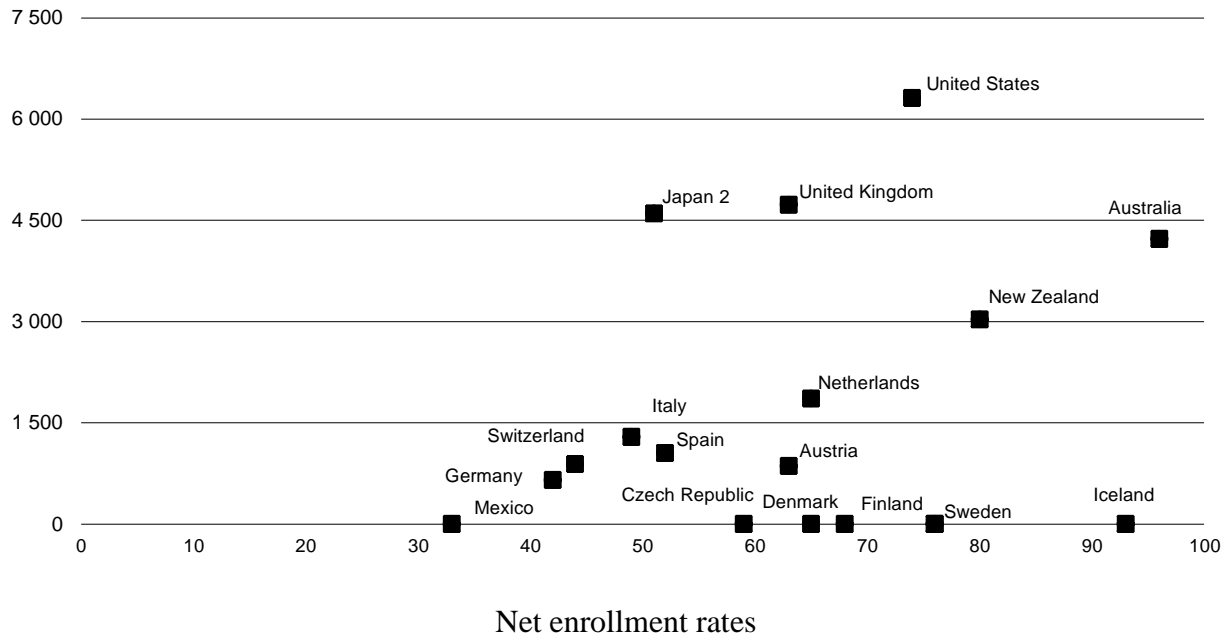
Figure 1. Average annual tuition in US$ (PPP converted) and net enrollment rates in OECD countries in 2011

Source: OECD (2012) calculated based on data from table B 5.1. Note: Tuition averages are calculated for full-time national students enrolled in public institutions. Net enrollment rates are calculated as the sum of the age-group-specific proportions of first-time enrollment to tertiary education in a country.

Second, policymakers in most OECD countries that currently offer free public higher education – such as Austria, Argentina, Brazil, Denmark, France, Ireland, Mexico and the Czech Republic – are considering introducing moderate tuition in various forms, (Marcucci & Usher, 2014) but they lack reliable information from outside the US on which to base their decisions.

Tuition was abolished in Germany by 2014 because the conservative parties (CDU and FDP) supporting tuition lost the majority of the seats in most state legislatures. This does not mean, however, that tuition is off the table in Germany in the future. In 2012, the federal minister of education already asserted that tuition has been abolished for ideological reasons and that she expects tuition to be re-introduced in five years, in large part because of a need for reducing state debt (HAZ, 2012). In line with this view, a debate about re-introducing tuition emerged, almost immediately after tuition was abolished. The head of the German Association of the Presidents of Higher Education Institutions (HRK) and a number of prominent researchers and education

think tanks demanded the re-introduction of tuition (Preuß & Osel, 2014). While policy makers currently do not support tuition publicly, off the record many policy makers from across the political spectrum express their support for tuition, albeit possibly charged in a deferred payment scheme (Lehmann, 2014, personal communication).

The decision of whether or not to introduce tuition is important for countries which currently offer free higher education because it has significant implications for the future of their higher education systems. On the one hand, the decision not to charge tuition threatens the funding base for their higher education system. In many countries where higher education is offered free of charge, the higher education system is underfunded (Marcucci, 2013; OECD, 2012). This underfunding often leads to problems in teaching quality and to capacity shortages; as a result some qualified applicants are not accepted into higher education (Marcucci, 2013). Given the political obstacles to allocating additional public funds to higher education, policy makers increasingly view the introduction of tuition as necessary for improving teaching quality and for expanding participation in higher education.

On the other hand, some of the OECD countries that do not charge tuition suffer from relatively low enrollment rates and high social inequalities in college participation, despite offering higher education free of charge (see Figure 1). If tuition significantly discourages enrollment, the introduction of tuition may aggravate the key problems of low enrollment and high social inequalities in participation. Improved empirical evidence about the effects of introducing moderate tuition is thus needed to support policy makers in making informed decisions about how much, if any, college participation is lost for charging tuition and whether students from underrepresented groups require additional support.

Theoretical Perspectives on the Enrollment Effects of Tuition

In addition to being important from a policy perspective, the enrollment effects of moderate tuition are also interesting from a theoretical standpoint given that prominent theoretical perspectives, such as rational choice theories, norm-based theories, and behavioral

economics, suggest diverging hypotheses regarding the extent and the mechanisms through which tuition affects enrollment decisions.

Rational choice theories, such as human capital theory (Becker, 1962; 1993) and sociological rational choice theory (Breen & Goldthorpe, 1997; Erikson & Jonsson, 1996) suggest that moderate tuition charges only discourage college enrollment in Germany in a minimal way. Rational choice theories argue that high school graduates, in their central tendencies, make rational educational decisions that maximize the adolescents' expected monetary and non-monetary net benefits over their lifetimes. Given the German context, rational choice theory suggests that the introduction of moderate tuition only discourages enrollment in a minimal way because high school graduates have sufficient loan money available and receive monetary and non-monetary benefits from a college degree that outweigh the costs of a college degree by a large margin. Tuition only increases costs by a small margin, so only a small margin on students should be affected by it. Furthermore, rational choice theory suggests that students from low parental education backgrounds might be negatively affected by tuition to a small extent because this student group is expected to receive less monetary and non-monetary benefits from a college degree and to face higher costs and risks given that these students have fewer economic, cultural and informational resources.

Norm-based theories (Callender 2003; Hesketh, 1999; Marcucci, 2013) and theories taking a psychological perspective, such as behavioral economics (Kahnemann & Tversky, 1979), suggest that even moderate tuition may discourage college enrollment to a substantial degree, particularly among students from low parental education and – income backgrounds. These theories challenge the assumption that students react rationally to the imposition of tuition and only give up college enrollment if they are credit constrained or the expected monetary or non-monetary net benefits from a college degree are valued less than the tuition costs. Norm-based theories suggest that high school graduates react strongly to tuition because they have internalized a norm that one should not pay for higher education and that one should not take on debt for a college degree. Behavioral economics, in contrast, suggests that high school graduates, in particular those from low parental education and low income backgrounds, might be deterred even by moderate tuition charges because of cognitive biases. Due to cognitive biases, such as

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hyperbolic discounting or the zero-price effect, high school graduates are expected to systematically underestimate the long-term net benefits they receive from a college degree and to overvalue the monetary and non-monetary costs of paying a new fee that they consider as unfair. As a consequence, norm-based theories and behavioral economics theories suggest that high school graduates are unwilling to pay tuition even though doing so would allow them to receive higher net benefits over their lifetime.

Research Questions

This dissertation aims to expand the empirical evidence about the enrollment effects of tuition in Germany by studying the following research questions:

1. How does the introduction of moderate tuition in the amount of € 1,000 per year affect college enrollment in Germany?

2. Does the effect of tuition vary by whether the students' parents have a college degree?

3. Does the introduction of tuition lead students to postpone college enrollment or to give up their enrollment plans?

Methodology

This dissertation uses representative, longitudinal data on high school graduates in Germany between the years 1999 and 2008 collected by German Center for Higher Education and Science Research (DZHW). Two approaches are used to estimate the effect of tuition on college enrollment: (a) a difference-in-differences analysis based on cross-sectional, individual-level enrollment data that was pooled over time and (b) a pre-post analysis based on individual-level longitudinal data about students from the high school graduating cohort of 2005.

In the difference-in-differences approach, I examine whether enrollment probabilities in higher education decreased in states that introduced tuition (tuition-states) relative to states that did not (non-tuition states) after the tuition policy was introduced in 2005. The identifying assumption is that any differential change in probability of enrollment between the two state

groups can be attributed to the introduction of tuition. As will be explained below, this assumption is supported by the fact that enrollment probabilities developed very similarly in tuition and non-tuition states prior to the introduction of tuition, thereby allowing attribution of any probability changes in the policy change. To account for possibly confounding effects a number of state and individual-level characteristics are accounted for, and several robustness and falsification tests are also conducted.

In the pre-post analysis, I examine whether high school graduates who had planned to enroll in higher education were more likely to give up their enrollment plans when they lived in a state where tuition was announced compared to students who lived in non-tuition states. Students who graduated from high school in 2005 were initially surveyed about their enrollment intentions in December of 2004 and they did not know that tuition would be introduced, and surveyed a year later, after the tuition policy had been announced. In the pre-post analysis I estimate whether the probability that high school graduates follow through on their enrollment intentions is lower among students in tuition-states than in non-tuition-states, conditional on having had enrollment intentions prior to the announcement of the tuition policy. The identifying assumption is that differences in the probability that high school graduates follow through with their enrollment plans between the state groups are due to the introduction of tuition.

The advantage of using two analytic approaches, that is, examining changes in states over time and in individuals over time, is that they make different identifying assumptions. Thus, the conclusions regarding the effect of tuition are bolstered if both approaches lead to similar results. The difference-in-difference approach identifies the effect of tuition by comparing the enrollment probabilities of students from tuition and non-tuition states. One validity threat is that the graduating cohorts might differ over time because of unobserved characteristics that cannot be controlled for, or because of slight sampling differences. The pre-post analysis addresses this concern because it examines the enrollment intentions of the same individuals over time, meaning that cohort differences are not a concern. Similarly, the pre-post analysis examines the effect of tuition by comparing the probability that high school graduates will follow through on their enrollment plans in tuition and non-tuition states. A validity threat is that enrollment rates between tuition and non-tuition states might differ in general. The difference-in-difference

approach addresses this concern because it allows me to demonstrate that enrollment rates followed a similar pattern in tuition and non-tuition states in the six years prior to the introduction of tuition.

Four prior studies have analyzed the effects of tuition in Germany based on this natural experiment. Hübner (2012) and Bruckmeier and Wigger (2014) studied the effect of tuition on registration for higher education. While Hübner found a decline in registration of 2.7 percentage points relative to non-tuition states, Bruckmeier and Wigger conclude that there is no evidence for a negative effect of tuition on registration behavior when state fixed effects are included and a number of state characteristics, such as the number of Abitur graduates, are held constant.

Helbig et al. (2012) and Quast et al. (2012) studied the effects on enrollment intentions and found no significant effect. While these are interesting findings, the outcomes used are distal proxies for actual enrollment. Many high school graduates in Germany formally register for higher education with no intention of studying – instead they wish to take advantages of the side benefits offered to students in Germany, such as reduced-cost transportation and health care. As Hübner (2012) cautions, the disproportionate decline in registration rates he found might be due to the fact that these "pseudo-students" stopped registering. Similarly, enrollment intentions are a weak proxy for actual enrollment, especially when the goal is to estimate the effects of tuition, because it is conceivable that tuition affects the financial ability to enroll while it leaves the intention to enroll unaffected. Thus, we know very little about whether and to what degree moderate tuition affects actual enrollment behavior in Germany. To my knowledge, this is the first study to examine the effects of tuition on *actual* college enrollment in Germany and to examine in detail the effects of this policy change on the enrollment of students from low parental education backgrounds.

This study contributes to the existing literature in three additional ways. First, by using a natural experiment design, this study addresses some of the key methodological challenges in estimating the enrollment effects of tuition, such as the need for a valid comparison group and information on individual level tuition costs. Second, it expands on the scarce knowledge about the effects of moderate tuition on enrollment behavior. Third, the study contributes to our understanding of the effects of tuition outside the US context.

I find no evidence that the introduction of moderate tuition affects enrollment behavior of high school graduates in Germany in general. Instead, the effect of moderate tuition depends on students' parental education background. While high school graduates from college-educated family backgrounds are not affected by moderate tuition, their peers whose parents do not have a college degree are sensitive to tuition, even when the tuition level is minimal compared to international levels. After tuition was introduced, the enrollment probability of high school graduates from low parental education backgrounds dropped by six percentage points (from a baseline of 42%) relative to students from high parental education backgrounds in tuition-states and to the change in the enrollment gap by parental education in non-tuition-states. This means that the probability of college enrollment drops by 14% (6/42) among Abitur graduates from low parental education backgrounds when tuition is charged.

This dissertation is structured as follows: Chapter 2 describes the German system of higher education and tuition policy in order to provide background information about the German context. Following this, Chapter 3 presents three different theoretical perspectives that speak to the effects of tuition on enrollment behavior and deducts the hypotheses they suggest regarding tuition effects. Chapter 4 reviews the empirical literature about tuition effects in Germany and internationally. Chapter 5 describes the details of the tuition policy in Germany. Chapter 6 describes the data while Chapter 7 presents the estimation strategy. I then present the overall results, the results for subgroups and the robustness of the findings in Chapter 8. The article concludes with a discussion of the findings and their implications for tuition policy and theory (Chapter 9).

<center>**Chapter 2**</center>

<center>**Higher Education, College Financing and Financial Aid in Germany**</center>

In order to situate the findings from Germany and to assess the degree to which they might be indicative for higher education in other countries, background information about higher education in Germany is necessary. This chapter will provide information about the German higher education system, including its structure, admission rules, enrollment rates, and social inequalities in enrollment. Because it is the main alternative to postsecondary education in Germany, the system of vocational training will be described too. Furthermore, the chapter describes college financing and the system of financial aid and loans and how students in Germany finance their living expenses and tuition costs. A detailed description of tuition policy in Germany is provided in Chapter 5.

The System of Higher Education in Germany

  Structure

Unlike higher education in the US, the system of higher education in Germany is almost exclusively public and largely state-run. Only six percent of students are enrolled in private higher education (Statistische Ämter, 2013). The German states (Länder) are involved in many institutional decisions including hiring, program offerings, admissions rules, student numbers and tuition levels.

Germany has a dual-tracked higher education system where higher education is offered by two types of institutions: Universities (Universitäten) and universities of applied science

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(Fachhochschulen, FH).[6] Universities of applied science were founded in 1971 as a response to a dramatic increase in student numbers in the 1960s. While universities have a strong focus on academic training and basic research, universities of applied science focus on professional education and conduct less research. Professors at universities of applied science have working experience outside of academia in addition to having a doctorate degree. Moreover, students at these institutions are required to complete a semester of practical training as part of the curriculum. In 2008, 72% of the students in higher education were enrolled in a university and 28% were enrolled in a FH (Müller, Pollak, Reimer & Schindler, 2009).

Within these tiers, German higher education institutions are fairly homogeneous regarding the degrees they offer, their level of prestige, funding, size, and many other characteristics. This homogeneity has decreased to a certain degree since 2006, when universities were encouraged to obtain more third-party funding and the German government began to offer additional funds on a competitive basis. Selected institutions receive additional money and the distinction "University of Excellence." The next section will describe enrollment rates and access rules.

Enrollment Rates and Access Rules

Enrollment in higher education is relatively low in Germany in comparison to international rates. This is particularly apparent in the net entry rate, an indicator that allows for the comparison of college enrollment rates internationally. The net entry rate is the sum of the age-group-specific proportions of first-time entrance to tertiary education. In Germany, the net entry rate to universities and universities of applied science was 42% in 2010 (OECD, 2012). This is one of the lowest net entry rates among OECD countries and lies substantially below the OECD average of 62%. Enrollment in higher education in Germany has increased significantly over the past decade. The net enrollment rate grew from 30% in 2000 to 42% in 2010 (OECD, 2012).

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[6] *Technische Hochschulen* and *Technische Universitäten* (technical universities), which specialize in physical sciences and engineering, also have the status of a university.

In Germany, access to higher education depends on whether students have obtained the *Abitur* degree in high school. All students who have received the Abitur degree have the statutory right to enroll in higher education. The German education system offers several pathways to obtaining the Abitur degree. Students receive the Abitur when graduating from the *Gymnasium* or from a general or vocational high school that offers the Abitur degree after 12th or 13th grade. The names of the latter schools differ between states. High schools which end after 10th grade, such as *Hauptschule* or *Realschule* do not prepare students for the Abitur degree.

The percentages of students who obtain the Abitur degree and enroll in higher education are as follows: In 2009, about 45% of an age cohort graduated with the Abitur degree (Statistisches Bundesamt, 2010). This number has increased from 31% in 1990. Thirty percent of an age cohort receives the general Abitur and 15% receive the restricted Abitur (*Fachabitur*) that allows them to study at universities of applied science (Statistisches Bundesamt, 2008). The majority of students who graduated with the Abitur degree enroll in higher education. Overall, 75% of Abitur graduates enroll in higher education within three years of having obtained the Abitur degree (Statistisches Bundesamt, 2010).

Higher education institutions base admission decisions on a number of criteria: A student's Abitur grade is the most important criterion. This grade partly depends on the grades in the last two years of schooling and in part on the scores in the Abitur exams. Higher education institutions are required to base admission mainly on Abitur grades; interviews and student essays play a minor role, and there are no affirmative action policies.

Although every student who has obtained an Abitur degree has the statutory right to enroll in higher education, in practice some students are not admitted to their preferred program or to their preferred institution due to a limited number of seats in popular programs, such as medicine or psychology. Furthermore, there are important social disparities in access to higher education which will be discussed in the next section.

Social Disparities in Access to Higher Education

In addition to having comparatively low enrollment rates, German higher education is characterized by relatively high social disparities in access to higher education (OECD, 2012).

Social inequalities in enrollment in higher education are the result of educational decisions over the lifespan of students. In Germany, two transition points are particularly important for the emergence of social inequalities in college enrollment: The transition to secondary education, where students decide whether to enroll in a more rigorous school type which prepares for the Abitur exams, and the transition to higher education.

There are strong social inequalities in the transition to a school type where students can graduate with the Abitur degree. Students whose fathers passed the Abitur exam have five times the odds of graduating with the Abitur degree than students whose fathers graduated from Hauptschule (Müller et al., 2009). The inequalities in completing the Abitur were larger in the past and have decreased markedly over the past forty years (Mayer & Pollak, 2006).

Social inequalities in college enrollment are exacerbated further by the fact that students from families with little education who have passed the Abitur exam are less likely to enroll in college than their peers with highly educated parents. Among students who received the Abitur in 2002, 85% of those whose parents have a college degree entered higher education whereas only 70% of the students whose parents did not have a college degree entered higher education within three years after graduation (Heine, Spangenberg & Lörz, 2007). Students from high socioeconomic backgrounds are also more likely to enroll in a university of applied science than in vocational training (Müller et al., 2009). Social inequality in college enrollment by social class is less than the inequality by parental education (Müller et al., 2009).

Together, the social inequalities in important transition points in the education system result in significant social inequalities in higher education enrollment. In 2005, only 11% of the 21 to 27 year olds from the lowest quartile of parental education and occupational prestige attended an institution of higher education. For the second lowest quartile the value was 29%, for the middle quartile it was 66% and for the highest quartile it was 81% (Isserstedt et al., 2010).

The high social inequalities in college access in Germany are partly due to the multi-tracked system of secondary education, where only some schools lead to the Abitur degree. As explained above, only 45% of an age cohort obtains the Abitur degree. A large part of the decision whether students will receive the Abitur degree is made when students are between 10 and 12 years old, the point at which the decision is made about whether they will enroll in a

school that prepares for the Abitur degree. This choice of academic track mostly lies with the parents, with teachers' recommendations, and the student's grades contributing to the decision. Students can transfer to Gymnasium or enroll in higher education under some circumstances without an Abitur degree, but less than one percent of college students have entered higher education without an Abitur degree (Freitag, 2012).

On average, inequalities in enrollment in higher education translate into large income inequalities in Germany. Anger, Plünnecke and Schmidt (2010) found that getting a higher education degree results (on average) in an annual rate of return of 7.2 percent, compared to a vocational degree (Anger, Plünnecke & Schmidt, 2010). Unemployment rates are also significantly lower among college graduates than among graduates of vocational training (Glocker & Steiner, 2011).

Following Boudon (1974), social inequalities in transition to higher education can be distinguished by *primary* and *secondary educational inequalities.* The term "primary educational inequalities" refers to social disparities in college enrollment that are due to differences in high school achievement by socio-economic background. The term "secondary educational inequalities," on the other hand, denotes social disparities in college enrollment that remain when differences in achievement are held constant. As such, these differences are due to social differences in educational decision making.

Empirical studies about the size of primary and secondary inequalities in Germany come to mixed conclusions. One study found quite large secondary educational inequalities based on the DZHW data which are also used in this dissertation (Müller et al., 2009). Abitur graduates whose parents have a college degree have 2.6 times the odds of enrolling in university than in vocational training compared to students who come from non-academic family backgrounds. This social disparity in college enrollment only decreases slightly to 2 times the odds when the Abitur grade is held constant, suggesting that secondary educational inequalities, which are due to differences in educational decisions, are quite large in Germany. Schnabel, Alfred, Eccles, Köller and Baumert (2002) come to similar conclusions. Maaz (2006), on the other hand, found smaller secondary inequalities in college enrollment based on a representative sample of Abitur graduates from the state of Baden-Wurttemberg. Among high school graduates whose parents do

not have a college degree, the intention to enroll in higher education is 0.10 of a standard deviation lower compared to students whose parents have a college education. When the Abitur grade as well as students' gender and socioeconomic status are held constant, the difference in enrollment intentions decreases to 0.05 of a standard deviation. Taken together these findings suggest that aspects other than academic preparation contribute quite strongly to social disparities in college enrollment in Germany.

The Vocational Education System

This last section briefly describes the structure of vocational education. Information about vocational education in Germany is relevant because Germany has a particularly large and well-developed sector of vocational education, which is an attractive option for some Abitur graduates. In 2010, about 17% of the Abitur graduates in Germany were enrolled in vocational education one year after high school graduation, while 44% of them were enrolled in higher education, 28% planned to enter higher education and 11% were undecided (Heine, Quast & Beusse, 2010).

In Germany there are three different types of vocational training (Baethge, 2008): One type is called dual vocational education (*Duale Berufsausbildung).* This type of vocational training is organized and financed by employers. In dual vocational education students are trained in one of the 340 recognized occupations, such as gardener, nurse or IT-specialist. One part of the training takes place at the workplace; the other part is taught in vocational schools. Trainees receive a modest monthly stipend. The second type of vocational training is taught at state-run vocational schools (*Berufsfachschulen*). In these schools students can graduate with an occupational degree, for example in nursing or information technology. The program includes a short period of training at the workplace. The third type of vocational training is a combination of vocational training and general education. Students do not receive an occupational degree as the school primarily prepares for dual vocational education. Over the past 15 years, the share of Abitur graduates who enter vocational education has decreased while the share who transition into higher education sector has grown (Baethge, 2008). The next part of this chapter will describe college costs and student financial aid in Germany and provide details about the tuition policy.

College Costs and Financial Aid in Germany

College Costs

With regard to the costs students pay for higher education, a distinction can be made between direct costs (e.g., tuition and books) and indirect costs (e.g., forgone income). From 1970 until recently, direct costs were relatively low in Germany. German higher education institutions did not charge tuition and students were only required to pay an administrative fee of approximately €100 per semester. As explained above, seven German states charged tuition for all public higher education from 2006 to 2014. Students in these states were charged €1,000 (ca. $1,350) per academic year. Details about tuition policy will be described in a separate section below.

Living expenses are, strictly speaking, not part of college costs because they need to be paid regardless of whether a person enrolls in higher education or not. Yet in an analysis of the effects of college costs on enrollment it is important to consider these costs because students can only succeed in higher education if they have enough money to cover their living expenses. The monthly cost of rent, food, transportation, health insurance, telecommunications and other expenses are €779 on average in Germany (Isserstedt et al., 2010). Taken together, students who studied in a state which charged tuition had costs (on average) of €862 per month to pay for their living expenses, tuition and administrative fees, whereas students in states without tuition had an average obligation of €779. These average costs vary across cities and also depend on students' life circumstances.

Financial Aid

Compared to most OECD countries, Germany has a generous financial aid system. The largest financial aid program in Germany is the federal BAFöG program (*Bundesausbildungsförderungsgesetz*). Introduced in 1971 to support low and middle-income students, BAFöG aid consists of 50% grant and 50% interest-free loan. Eligibility and the amount of aid depend on parental income and savings, the number and age of students' siblings, and whether students live with their parents. In general, students whose parents' combined net income is below €20,000 after taxes are eligible for the maximum amount of BAFöG aid

(ca. €670 per month in 2014); students whose parents earn more are eligible for incrementally smaller amounts. The eligibility cut-off lies at a yearly net income of approximately €35,000.

In 2012, the average amount of BAFöG aid was €445 per month for students who do not live with their parents (Middendorff et al., 2012). On average, 32% of students who study within the expected time to degree receive BAFöG grants and loans; 56% of the students from non-college educated families receive BAFöG aid, compared to 17% of students from college-educated families (Middendorff et al., 2012).

For a student with a low-SES background whose average costs are €779 per month (tuition is excluded), BAFöG pays on average 32% of the college costs. Students are generally eligible for BAFöG aid for three and a half years for a bachelor's program and two and a half years for a Master's program. Repayment of the loan begins after graduation. Individuals who earn less than €960 per month after taxes following college graduation can defer repayment. Most students who do not receive BAFöG are not eligible because the income of their parents is higher than the eligibility cut-off. Among the students who eventually disqualify for aid, 53% disqualify because they study longer than the expected time to earn a degree or have changed their study program.

In addition to the BAFöG program, the German government provides indirect financial support for higher education. Students receive free or reduced-cost health insurance and, if their parents are employed, they are covered by their parents' long-term care insurance. Students of parents who are unemployed do not receive the long-term care insurance. In addition, students receive discounts for many public services and for public transportation. Parents of students receive tax exemptions and deductions along with add-ons to their pensions and unemployment benefits. Taken together, BAföG aid and the different forms of indirect public support make up (on average) about 50% of the financial resources students' have available (Schwarzenberger & Gwosc, 2008). German financial aid does not focus strongly on equalizing financial need because due to tax deductions, high income students and their parents, receive a very similar share of financial aid from resources from public support as students from low-income families who have a much higher financial need (Schwarzenberger & Gwosc, 2008).

Beyond the need-based BAFöG program, there are a number of public "merit-based" programs. They support relatively few students; only about one percent of students receive fellowships from these programs (Middendorff, Isserstedt & Kandulla, 2009). A national foundation funded by the federal and state governments, as well as private donors (Studienstiftung des Deutschen Volkes), awards fellowships for high-achieving students. Furthermore, the churches and the five major political parties sponsor foundations that award fellowships for students who excel academically and are engaged in political work or community service. Public "merit-based" aid programs predominantly support students from privileged socioeconomic backgrounds. Sixty-six percent of fellowship recipients come from families that have obtained higher education, while this group only makes up 56% of the student population (Middendorff, Isserstedt & Kandulla, 2009). The German government introduced a new merit aid program in 2010 which supports high-achieving students regardless of their financial background (Deutschlandstipendium). In 2013, about only 0.8% of students in Germany received this fellowship in the amount of €300 per month. Fellowships from private foundations are rare, and almost no financial aid is awarded by the higher education institutions directly.

Student Loans

Student loans are offered by private and government-owned banks. The government-owned KFW Bank offers the most popular loan program and provides about 92% of student loans in Germany (Müller, 2012). The KFW loan program offers up to €650 per month regardless of the students' or their parents' income or savings. The nominal interest rate is currently 3.36% and the interest begins to accrue immediately. Students can defer repayment for two years after graduation. The KFW loan program is available to students who study full time towards their first degree, are younger than 35, are EU citizens who graduated from a German high school or lived in Germany three years prior to college enrollment, or are non-EU citizens who graduated from a German high school (which makes most high school graduates from immigrant families eligible for the KFW loan program).

Few German students use loans outside of the BAFöG program to finance their college education. Between five and six percent of students take out such loans from private or state-owned banks (Ebcinoglu & Gersch, 2008; Isserstedt et al., 2010). Despite their higher financial

need, low-SES students are not more likely to take out loans outside of the BAFöG program than high-SES students (Ebcinoglu & Gersch, 2008). Students who take out loans outside of the BAFöG program, on average take €400 per month which covers about half of their average monthly costs (Isserstedt et al., 2010).

Financial Sources and Unmet Financial Need

Table 1 summarizes the average financial resources low and high-SES students have available to them, and the funding source. As described above, the sources of financial support vary considerably depending on the socioeconomic background of students. On average, low-SES students receive funding from these sources in the following shares: parents (26%), BAFöG (32%) and own employment (30%). High-SES students receive a much larger proportion from their parents (63%) and a much smaller amount from BAFöG (6%) and from their own employment (21%).

Table 1

Average Financial Resources per Month by Source and Socioeconomic Background in 2009

Sources	Lowest SES-Quartile		Highest SES-Quartile	
	In Euro	Percent of total Financial Resources	In Euro	Percent of total Financial Resources
Parents	204	26 %	525	63 %
BAFöG aid (50% loan, 50% grant)	251	32 %	50	6 %
Employment	234	30 %	175	21 %
Other (eg. savings)	94	12 %	83	10 %
Average total financial resources available per month	783	100%	833	100%
Average need (excl. tuition) per month	779		779	
Average unmet need per month	-4		-54	
Loans outside of BAFöG	Only 5% of students take out loans outside of BAFöG, on average €400 per month. These loans are not included in the breakdown of financial resources breakdown because few students take out loans.			

Note. The amounts in Euro are calculated based on information about the financial resources and funding sources provided by Isserstedt et al. (2010).

The amount of unmet financial need, which is defined as the amount not covered by BAFöG, employment, parental support and other sources, is low on average. As described in Table 1, the average low-SES student can pay college costs and living expenses with a combination of BAFöG, employment, parental support, and other sources and does not need to take out an additional loan. However, since financial needs are barely met, the average low-SES student does not receive sufficient resources from parental support or financial aid to pay tuition. Students who were required to pay tuition needed to work more hours, take out a loan or received more financial support from their parents to be able to pay the additional college costs.

It is important to stress that these numbers are averages across a heterogeneous group of students. Unmet financial need is likely to be much higher for students who are not eligible for BAFöG because their parental or own income is just above the eligibility cut-off of €35,000, because they have studied longer than the expected time to degree, or have changed their major. Unmet financial need is also higher for students who receive no support from their parents or who cannot work while in college.

Furthermore, low-SES students might face unmet financial need because they are averse to taking out loans in general. Only 9% of low-SES students use loans to pay their tuition (BMBF, 2010) and only 22% of them consider financing their costs with loans (Ebcinoglu & Gersch, 2008) despite the fact that the majority of them need loans to finance their college education. The aversion to loans means that low-SES students often lack financial resources. Several recent studies suggest that low-SES students have unmet financial need. Ebcinoglu and Gersch (2008) found that 30% of the low-SES students have financial needs that would not be covered even if they lowered their standard of living. Even though tuition is a negligible portion of their total costs, 52% of the low SES-students say that they do not have enough money to pay tuition (Isserstedt et al., 2010). Thus, although students only lack the seemingly small amounts annually, this cost, in conjunction with loan aversion, might prevent them from pursuing a college degree or lead them to drop out.

Chapter 3

Theoretical Perspectives on Enrollment Effects of Tuition

This dissertation draws on theories from economics, psychology and sociology to develop hypotheses about the enrollment effects of the introduction of tuition. I use three different theoretical perspectives: rational choice, norm-based and behavioral economics theories. These theories suggest different hypotheses regarding whether and how moderate tuition affects students' enrollment decisions. In this chapter, I will describe the main features of these theoretical perspectives and explain whether and through which mechanisms they predict an enrollment effect of tuition. Furthermore, using contextual information from Germany, I will discuss what hypotheses the theories suggest about the enrollment effects of tuition for students in Germany in general, and for students from low parental education backgrounds in particular.

Rational Choice Theories

The vast majority of studies about the enrollment effect of tuition either explicitly or implicitly follow a rational choice perspective. Most studies use human capital theory (Becker, 1962; Becker, 1993; Schultz, 1961) as a theoretical framework. Recently, some studies, such as Helbig et al. (2012), applied a sociological rational choice approach (Breen & Goldthorpe, 1997; Erikson & Jonsson, 1996). Human capital theory and sociological rational choice theory are part of a family of rational choice theories that have been developed in the fields of economics, political science, psychology, and sociology. While the two theories developed separately in different disciplines, they have very strong similarities. Given these similarities, it is perhaps surprising that human capital theory and sociological rational choice theory have rarely been compared and used side by side. Therefore, I will first present human capital and sociological

rational choice theory and show their similarities. Following this comparison, I will discuss which hypotheses can be deduced from rational choice theories regarding the enrollment effects of tuition in Germany.

Human capital theory

Human capital theory was developed by Gary Becker (1962; 1993) and Theodore Schultz (1961) in the 1960s and has become one of the most influential theories explaining educational decisions. Human capital theory explains educational decisions with the fundamental assumption that individuals choose the educational level that best maximizes the individuals' lifetime net benefits. The theory suggests that individuals pursue additional education, for example a college degree, if the present value of the expected lifetime benefits of a college degree, net of the costs, is higher than for other post-schooling options such as earning a vocational education degree.

Human capital theory uses a broad concept of costs and benefits. In his Nobel Lecture, Becker explained: "The economic approach I refer to does not assume that individuals are solely motivated by selfishness or material gain […]. The analysis assumes that individuals maximize welfare as they conceive it..." (1993b, p. 1). The theory thus takes into consideration monetary as well as non-monetary costs and benefits, the latter of which are referred to as psychic costs and benefits. In human capital theory, the monetary benefits of a college degree are contained in the additional discounted lifetime earnings an individual earns with a college degree compared to without a college degree. Monetary costs consist of direct costs, that is, costs for tuition and study material minus financial aid, and indirect costs which include forgone income while enrolled in higher education. Psychic costs of a college degree consist of the effort involved in studying, while the pleasures of mastering a skill or achieving high social status are examples of the psychic benefits. Given that some of the costs and benefits occur in the future, human capital theory expects that individuals consider the discounted present value of costs and benefits using a market rate of interest as a discount rate. I will now turn to the main features of sociological rational choice theory and compare them to human capital theory.

Sociological rational choice theory

The foundations of sociological rational choice theory date back to the 1970s. Mancur Olsen (1971), Raymon Boudon (1974), and James Coleman (1990) among others, pioneered this strand of sociological theory. In the 1990s, sociological rational choice approaches were advanced in several sociological subfields. In the field of sociology of education, a number of sociologists formulated rational choice theories (Boudon, 1974; Breen & Goldthorpe, 1997; Erikson & Jonsson, 1996; Esser, 1999; Goldthorpe, 1996) as a critique of prominent status attainment and structural theories. Their goal was to provide more suitable explanations for macro-level changes in educational inequalities and to provide a formalized model of educational decisions. Sociological rational choice theory is prominent in European sociology, whereas only recently has it received more attention in US sociology (Kroneberg & Kalter, 2012). Erikson and Jonsson (1996) describe a sociological rational choice approach that most comprehensively addresses enrollment decision into higher education. For this reason, this dissertation describes the sociological rational choice theory as advanced by Erikson and Jonsson (1996).

Sociological rational choice theory and human capital theory stem from the same theoretical tradition and use very similar assumptions and concepts, which I describe below. Like human capital theory, sociological rational choice theory assumes that individuals make rational educational decisions which maximize the individuals' net benefits in monetary and non-monetary terms. Similarly, sociological rational choice theory uses a broad and subjective concept of costs and benefits encompassing both monetary and non-monetary aspects. The term utility is used to refer to benefits net of costs and is the same as net benefits. Despite being open to a broad concept of utility, sociological rational choice argues that educational choices can usually be explained by assuming that individuals maximize "basic goals" (Hechter & Kanazwa, 1997; Voss & Abraham, 2000), which they define as maximizing lifetime income and minimizing downward social mobility and risks (Breen & Goldthorpe, 1997, Erikson & Jonsson, 1996). Sociological rational choice theorists argue that the concept of utility needs to be limited for theoretical reasons. Using a very wide version would allow explanation of any behavior with the argument that the actor had a preference for it and turn sociological rational choice theory

into an empty theory (Hechter & Kanazwa, 1997).[7] Additionally, the theory would not be falsifiable. In this respect sociological rational choice theory differs slightly from human capital theory. Human capital theory does not explicitly limit the concept of utility (Becker, 1992).

Another minor difference between human capital theory and sociological rational choice theory lies in which non-monetary aspects of educational attainment they emphasize. While human capital theory emphasizes the psychological costs and benefits of education, such as the efforts or pleasures of learning, sociological rational choice theory emphasizes sociological aspects, such as the benefit of maintaining one's parents' social status. Both theories are open to taking into account the psychological as well as the social costs and benefits of an educational decision.

In addition to using a very similar concept of utility, human capital theory and sociological rational choice theory also share a number of fundamental assumptions, which I will describe in the next section. Given the similarities between the two theories, I will describe them together and refer to them as rational choice theories.

Shared assumptions of human capital and sociological rational choice theory

Human capital theory and sociological rational choice theory share a number of fundamental assumptions such as their concept of rationality and their explanations of differences in net benefits by socioeconomic (SES) background. Both rational choice theories use a weak notion of rationality. Individuals are not assumed to act perfectly rational. Instead rational choice theories argue that individuals have consistent preferences and act rationally in their central tendencies. In addition, the two rational choice theories do not assume that individuals are perfectly informed. Instead, they expect individuals to make decisions based on the information they have available and to "maximize welfare as they conceive it" (Becker, 1993b, p. 1). Furthermore, human capital theory and sociological rational choice theory do not assume that individuals base decisions on an explicit calculation of costs and benefits. Instead,

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[7] In recent years, a few theorists developed wide versions of sociological rational choice theory that also include preferences such as acting in accordance to one's values and norms. These versions have been met with criticism. Kroneberg and Kalter (2012) provide a summary.

they argue that individuals usually rely on simple ranking orders. Goldthorpe aptly expresses the key assumptions of rational choice theory and writes: "The version of rational choice theory that I take up implies only a rather weak notion of rationality. I assume that actors have goals and, in choosing their courses of action, tend in some degree to assess the costs and benefits rather than, say, unthinkingly follow social norms or giving unreflecting expression to cultural values" (1996, p. 485).

Human capital theory and sociological rational choice theory also share the assumption that the net benefits individuals receive from a college degree is influenced by their socioeconomic background in addition to a number of other factors such as ability. As I will explain in more detail below, both theories argue that students from low socioeconomic backgrounds face higher monetary costs and receive lower non-monetary benefits from a college degree because they have fewer economic, cultural and informational resources. Both theories contend that objective differences in economic and cultural resources usually suffice as an explanation of why adolescents from low socioeconomic background are, ceteris paribus, less likely to enroll in higher education than their more affluent peers. Sociologists from a rational choice perspective explicitly argue that social differences in preferences, perceptions, norms or discount rates should only be put forward if empirical evidence suggests that explanations based on actual class differences are insufficient (Erikson & Jonsson, 1996). In the following, I will describe the four hypotheses rational choice theories advance for explaining why students from low socioeconomic backgrounds, ceteris paribus, receive lower net benefits from a college degree than their more affluent peers:

First, rational choice theories argue that youth from low-SES backgrounds face higher monetary costs for a college degree. While the costs in terms of tuition and forgone income are similar regardless of socioeconomic background, the costs of obtaining the necessary funds for tuition and living expenses are higher for low-income students because they are monetarily constrained and may need to pay interest on a loan or work part-time while in college. Human capital theory refers to these costs as the costs of capital.

Second, rational choice theories argue that individuals assess the net benefits they expect from a college degree depending on (a) their probability of completing a college degree and (b)

the risks and adverse consequences that occur if they fail in higher education. Based on this reasoning, rational choice theories argue that adolescents from low socioeconomic backgrounds expect lower monetary and non-monetary net benefits from a college degree because they typically have a lower probability of successfully completing a college degree than adolescents from more affluent families given the same level of academic preparation. The assumed reason for this is that they can rely less on information and guidance from their families (Erikson & Jonsson, 1996).

Third, rational choice theories assume that youths from low socioeconomic backgrounds expect lower monetary and non-monetary net benefits from a college degree because pursuing higher education entails a higher risk for them than it does their upper class peers. The reasons for the higher risks are twofold: First, enrolling in higher education is more risky for low-income students because they cannot temporarily rely on their parents' wealth as a "financial safety net" in case they fail to complete their higher education (Pfeffer & Hällsten, 2012). Second, students from low-income families face an additional risk if they need to finance their college degree with student loans. The consequences of failing in higher education are particularly harsh for students who borrowed for college because they will need to repay any loans accumulated in addition to struggling to earn their livelihood without a college degree or vocational training. In comparison, students from more advantaged socioeconomic backgrounds in Germany, who mainly finance their education with parental allowances, have lower risk in the event of failing because they most likely do not need to repay parental allowances.

Fourth, rational choice theories indicate that students from low socioeconomic backgrounds receive lower non-monetary benefits from a college degree. Following Keller and Zavalloni (1964) and Boudon (1974), sociological rational choice theory assumes that individuals value the benefits of a college degree in relation to their social position. Young people from middle and upper class backgrounds are expected to receive non-monetary benefits from a college degree because it allows them to reach or exceed their parents' social position and level of prestige. Adolescents from working class backgrounds do not receive this additional benefit. Given that one of the main goals of sociology is to explain social differences, sociological rational choice theory emphasizes social differences in the benefits of education

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more strongly. Yet, human capital theory also argues that studnets from low-income families receive lower non-monetary benefits from the increased status that a college degree offers (Brewer, Hentschke & Eide, 2010). Becker, for example, wrote in his 1962 article: "Children from higher-income families probably, on the average, (…) receive greater psychic benefits from human capital" (p. 131). In the following, I will describe the hypotheses that can be deduced from rational choice theory regarding the enrollment effects of tuition.

Hypotheses of rational choice theories about enrollment effects of tuition

Rational choice theory suggests that the introduction of moderate tuition prevents high school graduates from college enrollment in two situations:

(a) if high school graduates are credit constrained.

Rational choice theories assume that high school graduates who expect net benefits from a college degree but cannot pay for tuition with parental support, employment or savings will take out a student loan because a loan allows them to maximize net benefits in the long run. Yet, if the capital market is imperfect and does not offer sufficient loans even moderate tuition charges might prevent students from pursuing a college degree. Human capital theory refers to these students as "credit constrained."

(b) if high school graduates expect net monetary and non-monetary benefits from a college degree that they value positively but equal or less the total amount of tuition.

Rational choice theories suggest that high school graduates who expect positive net monetary and non-monetary benefits from a college degree that they value no more than the total amount of tuition give up their enrollment plans when tuition is charged because they do not expect a benefit from a college degree in the presence of tuition charges. Education economists sometimes refer to students whose enrollment decision changes when the cost is increased by a specific amount as "extra-marginal" students. High school graduates who expect negative

monetary and non-monetary net benefits from a college degree are not affected by tuition because they would not study regardless of whether tuition is charged.

In the following, I describe empirical evidence regarding the extent to which students in Germany are credit-constrained or anticipate positive net benefits from a college degree that they value no more the total tuition costs of €3,000 for a bachelor's degree. Given that one research question in this dissertation is whether the enrollment effect of tuition varies by parental education, I will describe empirical evidence for students from high and low parental education backgrounds. Some of the empirical studies examined differences by social class or socioeconomic status. There concepts are not the same as parental education background. Yet, they are sufficiently correlated that they give an indication of college financing for students from low parental education backgrounds. Based on the empirical evidence, I will deduce the hypotheses rational choice theories suggest about the enrollment effect of tuition for students in general and for students from low parental education backgrounds in Germany.

Are there enrollment effects of tuition due to credit constraints?

The empirical evidence suggests that only a minimal number of students in Germany are credit constrained and cannot pay for tuition due to lack of loans. In Germany, the state-owned KFW bank offers student loans in the amount of up to €7,800 per year regardless of students' or their parents' income or savings. The nominal interest rate currently is 3.6%. Repayment can take as long as 25 years and can be deferred for up to two years after graduation or longer if the net annual net income is less than about €13,000. All Abitur graduates are eligible for the loan program with the exception of the small number of students who are older than 44 or non-EU citizens who did not graduate from a German high school.

Students in Germany need €9,350 per year, on average, to pay for their living expenses (Isserstedt et al., 2010). Surveys document that about 95% of students in Germany pay these costs through a combination of financial support from their parents, financial aid, and employment and do not take out additional loans (Ebcinoglu & Gersch, 2008; Isserstedt et al., 2010). Students who take out loans borrow, on average, €4,800 annually (Isserstedt et al., 2010). Despite their higher financial need, low-SES students are not more likely to take out loans than

high-SES students (Ebcinoglu & Gersch, 2008). Given that very few students finance their education with loans - and those who do, on average, do not take out the maximal amount - suggests that only a minimal number of high school graduates, regardless of their parents' socioeconomic background, are credit constrained and cannot pay €1,000 in tuition per year. If the introduction of tuition affects enrollment in Germany, the effect is most likely not due to a lack of student loans and credit constraints.

Are there enrollment effects of tuition due to low monetary benefits from a college degree?

As explained above, rational choice theories suggest that the introduction of tuition will discourage individuals from entering higher education if they value the sum of the net monetary and non-monetary benefits from a college degree positively, but no more than the total tuition cost. I first present the empirical evidence about the monetary benefits of a college degree in Germany. On average, college graduates in Germany earn an additional discounted lifetime income (net of direct and indirect college costs) of €107,000 compared to Abitur graduates who do not complete higher education (Anger, Plünnecke & Schmidt, 2010). Thus, very few college graduates receive net monetary benefits from a college degree that are lower than the total tuition costs of €3,000. If the introduction of tuition discourages college enrollment in Germany overall, the effect is most likely not due to students expecting low monetary benefits from a college degree.

The question remains, however, whether college graduates from low parental education backgrounds receive lower monetary net benefits from a college degree than students in general and are more sensitive to tuition for this reason. On the one hand, the monetary costs of a college degree might be higher for students from low parental education backgrounds than for students from college-educated families because the former typically receive less financial support from their families and need to pay interest on a loan or work part-time while in college. On the other hand, college graduates from low parental education backgrounds might receive higher rates of return from a college degree than individuals from college-educated families because they receive a lower lifetime income *without* a college degree (Anger, Plünnecke & Schmidt, 2010; Schnabel & Schnabel, 2002).

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The empirical evidence suggests that the returns to a college degree are three percentage points *higher* for college graduates from low parental education backgrounds than for their peers from college-educated families (Schnabel & Schnabel, 2002). The higher returns to a college degree for graduates from low parental education backgrounds thus seem to outweigh the higher costs they face. This result was also found in the US where students from low parental-education backgrounds receive higher or equally high returns from higher education as their peers with high parental education (Ashenfelter & Rouse, 1998; Brand & Xie, 2010).

Students from low parental education backgrounds also do not seem to be grossly misinformed about the high monetary benefits of a college degree. Based on the DZHW data used in this dissertation, I found that high school graduates from lower parental education backgrounds assess the employment prospects of college graduates only slightly less positively than high school graduates from more advantaged educational backgrounds (Kroth, forthcoming). The differences in the expected employment prospects only explain 3% of class disparities in college enrollment (Schindler & Reimer, 2010). Becker and Hecken (2009a) found similar results. As a preliminary result, it can be concluded that college graduates from low parental education backgrounds in Germany receive net monetary benefits from a college degree that are substantially higher than the €3,000 in tuition charges and that high school graduates from these backgrounds are comparatively well-informed about the monetary benefits of a college degree.

It needs to be taken into consideration, however, that the high net monetary benefits of a college degree only benefit those students who successfully complete a degree program. High school graduates do, however, face uncertainty about whether they will be able to succeed in higher education. This uncertainty about graduating is significant in Germany given that about 21% of the college students leave higher education without a degree (Heublein, Hutzsch, Schreiber, Sommer & Besuch, 2010).[8] Rational choice theories consider the influence of uncertainty. They argue that uncertainty about the probability of success lowers the monetary

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[8] While this college drop-out rate might seem high, it lies well below the average drop-out rate in OECD countries of 31% (OECD, 2009).

and non-monetary benefits individuals expect of an educational degree. Specifically, rational choice theories assume that individuals assess their net benefits from a college degree depending on (a) their probability of completing a college degree and (b) the risks and adverse consequences in case they fail in higher education. Furthermore, and as described above, rational choice theories assume that high school graduates from low parental education backgrounds, ceteris paribus, have a lower probability of completing a college degree and face more adverse consequences if they fail to graduate than their peers from college-educated backgrounds. In the following, I present the empirical evidence from Germany about the probability of completing a college degree and the consequences of failing to do so.

Probabilities of completing a college degree. The scarce empirical evidence suggests that high school graduates from low parental education backgrounds in Germany are more uncertain about their abilities to succeed in higher education than their peers from college-educated families. Data from the DZHW surveys indicate that Abitur graduates from low parental education backgrounds are less optimistic about their abilities to complete a college degree than their peers from college-educated families when Abitur grades and the type of high school are held constant. These doubts about the ability to succeed are associated with a lower probability of college enrollment (Kroth, forthcoming).

Even though Abitur graduates from low parental education backgrounds are less optimistic about their abilities, there is no evidence that their actual probability of completing a college degree is lower than that of their peers from college-educated backgrounds. A literature review about college completion concluded that the relationship between socioeconomic background and degree completion in Germany is complex and that the empirical findings are inconclusive (Heublein & Wolter, 2011). While many studies did not find a relationship, some found a positive (Pohlenz & Tinsner, 2004) and some a negative relationship (Heublein, Spangenberg & Sommer, 2003) between higher socioeconomic status and graduation rates. The latter study did not adjust for differences in high school achievement.

Risks and adverse consequences of failing in college. To my knowledge, the question about whether students from low parental education backgrounds are concerned about the lack of a "financial safety net" in case they fail in higher education and expect lower net benefits from a

college degree for this reason has not been studied in Germany. The argument seems plausible, however.

Regarding potential concerns about student loans, the empirical evidence suggests that students from Germany in general, and those from low parental education backgrounds in particular, are averse to student loans. Students from low socioeconomic backgrounds are particularly "loan averse." Only 9% of them take out loans outside of the BAFöG program despite the fact that the majority of them indicate that they struggle in financing their college education (Ebcinoglu & Gersch, 2008; Isserstedt et al., 2010). Low-SES students are not more likely to take out loans than more affluent students. Among both groups, only 22% of students consider financing their costs with loans (Ebcinoglu & Gersch, 2008). Furthermore, among Abitur recipients who decided against pursuing a college degree, 71% state that not wanting to take out loans was an important reason (Heine, Quast & Beusse, 2010). In comparison, only 60% state they did not need a college degree for their career goals. Survey results suggest that students mostly reject loans for normative reasons and not because they are concerned about problems with repayment. Ebcinoglu and Gersch (2008) found that 63% of the students from low parental education backgrounds reject loans because they feel the state should pay for their higher education, whereas only 28% reject loans because they are concerned about not being able to repay them. Because this finding is based on a survey of enrolled students, Abitur graduates might be more concerned about not being able to repay their loan and expect lower net benefits from a college degree as a consequence.

The actual financial consequences of not being able to complete higher education and/ or of not being able to repay a loan immediately after having dropped out of college appear comparatively moderate in Germany. College drop-outs forfeit the relatively low direct costs of a college degree, the study efforts, and the forgone income for the time while they pursued a college degree. Yet, most college drop outs successfully earn a vocational education degree. In case they have taken out a student loan, they can defer repayment for two years and longer if they earn less than €13,000 annually.

To conclude, the empirical evidence suggests that high school graduates from low parental education backgrounds are, ceteris paribus, more uncertain about whether they are able

to complete a college degree. Although there is no empirical evidence, they also might anticipate more adverse financial consequences in case they fail in higher education because they have no "financial safety net" and might need to repay a loan. It is, however, difficult to assess how much these uncertainties and concerns lower the net benefits high school graduates from low parental education backgrounds expect from a college degree (Becker, 1992).

Are there Enrollment effects of tuition due to low non-monetary benefits from a college degree?

In this section, I present evidence about the non-monetary costs and benefits of a college degree in Germany. In particular I discuss whether the non-monetary costs of a college degree might reduce the expected net benefits of a college degree to an amount that Abitur graduates value no more than €3,000. As explained above, sociological rational choice theory argues that high school graduates from college-educated families receive additional non-monetary benefits from college because a college degree allows them to reach or exceed their parents' social class and prestige. High school graduates from low parental- education backgrounds, on the other hand, are assumed to receive less non-monetary benefits because they do not need the status and prestige that come with a college degree to reach their parents' social class (Erkison & Jonsson, 1996). To my knowledge, this hypothesis has not been studied directly in Germany. Evidence based on the DZHW surveys document, however, that students from low parental education backgrounds value a high income and status just as much as young people from college-educated families (Kroth, forthcoming). This finding suggests that the non-monetary benefits of a college degree might be quite similar regardless of parental education.

Although the non-monetary benefits of a college degree might be similar, potential students from low parental education backgrounds likely face higher non-monetary *costs*. While no empirical evidence is available on this issue, it seems likely that having to work and/or to take out a loan while in college, the higher uncertainty about being able to complete a college degree, and the more adverse consequences in case of failure in higher education affect potential students in terms of non-monetary, psychic costs. The non-monetary costs and unpleasant feeling of uncertainty, risks and owing money might lower the net benefits high school graduates from low parental education backgrounds expect from a college degree. Yet, just like with monetary costs,

it is difficult to assess how much these concerns lower the net benefits high school graduates from low parental education backgrounds expect from a college degree.

Hypotheses of rational choice theory about the enrollment effects of tuition.

To summarize, rational choice theories argue that high school graduates are affected by moderate tuition if they are credit-constrained or if they anticipate positive net benefits from a college degree that they value no more than the total tuition costs. This section described the empirical evidence about the extent to which Abitur graduates in Germany are in one of these situations. In the following, I summarize the findings and deduce the hypotheses rational choice theories suggest about the enrollment effects of moderate tuition on Abitur graduates from high- and low parental education backgrounds in Germany.

Regarding Abitur graduates from high parental education backgrounds the empirical evidence suggests that they are not credit constrained and receive net monetary benefits from a college degree (€107.000) that exceed the tuition costs by a large margin. Furthermore, they face lower monetary and non-monetary costs that their peers from low parental education backgrounds because they are fairly certain about their abilities to complete a college, mostly do not need to finance their education with costly loans, and can rely on their parents as a temporary "financial safety net" in case they fail in higher education. In addition, Abitur graduates from college-educated backgrounds may receive non-monetary benefits from a college degree because a college degree allows them to reach or exceed the social status of their parents.

Rational choice theories predict that there are always some prospective students who are on the margin of benefiting from a college degree and who will give up college enrollment in the presence of small tuition charges. Yet, given that Abitur graduates from high parental education backgrounds are not credit constrained and receive monetary and non-monetary benefits from a college degree that are substantially higher than the total tuition cost of €3,000, rational choice theories suggest that only a negligible number of Abitur graduates from college-educated family backgrounds in Germany forgo higher education because of the introduction of tuition.

Deducing the hypotheses of rational choice theories about the tuition effects for Abitur graduates from low parental education backgrounds is a bit more complex. Most aspects suggest

that adolescents from this group are not significantly affected by the introduction of moderate tuition. First, just like their peers from college-educated family backgrounds, students from low parental education backgrounds in Germany have access to sufficient student loans and are not credit constrained. Second, college graduates from this background, on average, receive high monetary benefits from a college degree. Their returns to a college degree are even slightly higher than the returns of their peers from high parental education backgrounds. These higher returns might outweigh the higher monetary costs they face due to the interest cost of loans and part-time employment. High school graduates from low parental education backgrounds also seem to be well informed about the benefits of a college degree in terms of future employment. Finally, contrary to the hypotheses of rational choice theories, the scarce empirical evidence suggests that Abitur graduates from low parental education backgrounds receive sizable non-monetary benefits from a college degree because they value the higher income and status that come with a college degree just as much as their peers from college-educated families.

A few factors, however, might reduce the monetary and non-monetary benefits Abitur graduates from low parental education backgrounds expect from a college degree and might lead to a higher sensitivity to tuition charges. Abitur graduates from this social background are more uncertain about whether can complete a college degree than their peers from college-educated families even when high school grades are held constant. They thus tend to misperceive their probabilities of success. While there is no empirical evidence, students from low parental education backgrounds might also expect lower benefits from a college degree because they are concerned about not having a "financial safety net" in case they fail in higher education. The scarce evidence about concerns about loans suggests that majority of students from low parental education backgrounds are not very concerned about repaying loans but reject them for normative reasons. Furthermore, the need to borrow money, the uncertainty about success in higher education and the more adverse consequences in case of failure might also be unpleasant and entail non-monetary costs for students.

As noted above, rational choice theories predict that there are always some prospective students who are on the margin of benefitting from a college degree and who thus will give up college enrollment in the presence of small tuition charges. High school graduates from low

parental education backgrounds are more likely to be in this group because of the factors mentioned above. It is difficult, however, to quantify the extent to which misperceptions about the probability of success in higher education, concerns about adverse consequences in case of failure and unpleasant feelings of uncertainty, risk, and debt reduce the net benefits high school graduates from low parental education backgrounds expect from a college degree. However, a number of conceptual analyses from economics conclude almost uniformly that human capital theory predicts no or only minimal negative effects of the introduction of tuition on enrollment decisions in England and Germany (Barr & Crawford, 1998; Canton & de Jong, 2005; Galindo-Rueda et al., 2004; Winter et al., 2010). These economists argue that the monetary benefits of a college degree outweigh the monetary and non-monetary college costs by such a large margin in these countries that the introduction of rather minimal tuition should not significantly affect students' enrollment decisions regardless of their socioeconomic backgrounds. Galindo-Rueda et al. (2004, p. 75) for example write: " ...many economists have argued that the huge wage gains from a degree, combined with a relatively low tuition, are unlikely to put students off going to university."

While this conclusion stems from research in economics based on human capital theory, sociological rational choice theory, in my view, suggests analogous hypotheses about tuition effects in Germany. The reason is that while misperceptions about success probabilities, concerns about adverse consequences in case of failure and unpleasant feelings of uncertainty, risk, and debt might affect prospective students in an important way, it would arguably contradict the thinking tradition of rational choice theory to argue that these factors lower students' expected net benefits of a college degree in a major way for a significant number of high school graduates. The reasons are twofold:

First, taking into account that the average net monetary benefits of a college degree lie at about €107,000 and assuming that net monetary benefits are approximately normally distributed, only a small number of high school graduates should receive net benefits that lie in the narrow margin between zero and €3,000. Since the German tuition policy increases the cost of higher education only marginally, only a small margin of high school graduates should be affected by them.

The second reason is that these perceptions, concerns and unpleasant feelings are largely not based on students' objective situation. As explained above, there is no evidence that Abitur graduates from low parental education backgrounds have a lower probability of completing a college degree than their peers from college-educated backgrounds when high school grades are held constant. Similarly, the financial consequences of not being able to complete higher education and/ or of not being able to repay a loan immediately after leaving college appear moderate in international comparison. Rational choice theories, however, explicitly reject invoking *systematic* differences in preferences, perceptions, norms, or discount rates between social groups as an important explanation for social differences in educational decisions (Erikson & Jonsson, 1996; Goldthorpe, 1996). Quite to the contrary, the rational choice perspective, at least in sociology, developed as a critique of theories that view potential social differences in preferences, perceptions, or norms regarding education as the predominant explanation for social inequalities in educational decisions. While rational choice theories do not assume that individuals are perfectly informed, they reject the idea that individuals are grossly misinformed about benefits or drastically overestimate costs and risks. Rational choice theories argue that social differences in the expected costs, benefits and success that are due to *objective,* differences in the economic, cultural and informational resources between social groups generally suffice for explaining social inequalities in educational decisions.

To sum up, rational choice theories, such as human capital theory in economics and sociological rational choice theory, assume that individuals make rational decisions that maximize their expected net benefits in terms of income, status and risk avoidance given socially-specific constraints in economic and cultural resources. This theoretical perspective suggests that the introduction of moderate tuition in Germany should have almost no effect on students from high parental education families and, potentially, a small effect on students from low parental education backgrounds. If the introduction of tuition significantly affects enrollment decisions in Germany, the effect is likely not due to students' objective situation but to norms and misperceptions. I will present these theoretical perspectives in the next sections.

Norm-based Theories

Norm-based theories provide a different perspective on the degree to which moderate tuition affects enrollment decisions. This theoretical perspective indicates that norms and values about education shape educational decisions and that differences in norms and values are important explanations for social inequalities in educational achievement and educational decisions (Hyman, 1953). A number of conceptual analyses about tuition effects in Europe implicitly use norm-based theories (Callender 2003; Hesketh, 1999; Johnstone, 2004; Marcucci, 2013). These studies argue that high school graduates in Europe are sensitive to moderate tuition because they and their parents have internalized a norm that one should not have pay for higher education. This norm is argued to have developed because free-of-charge higher education is an important tradition in countries such as England and Germany that historically did not charge tuition.

In Germany the empirical evidence suggests that many young people have internalized a norm that it is the role of the state – and not their responsibility– to pay for higher education. The vehement student protests in many cities against tuition that is minimal by international standards suggest that that the introduction of tuition violates an important social norm in Germany. One of the most prominent slogans in these protests was the normative claim that higher education is a human right that has to be provided by the German state. Survey data also suggest that students in Germany have internalized a norm against tuition charges. One study found that only 10% of the students agreed with the statement that tuition charges are appropriate in Germany and only 19% agreed that students should bear a part of the costs of higher education (Dreyer et al., 2006).

Furthermore, annual surveys at most German universities document that about 63% of students in Germany rejected tuition charges and that about 70% demanded the abolishment of tuition (Voeth, Richter, & Becker, 2011). This strong rejection of tuition did not decrease over time, suggesting that free higher education is an important social norm in Germany.

Studies from a norm-based perspective also suggest that students from low parental-education and income backgrounds react strongly to moderate tuition due to a norm that one should not take on debt for a college degree (Callender & Jackson, 2005; Forsyth & Furlong,

2000; Perna, 2008). Empirical evidence suggests the existence of a norm against borrowing for higher education among students from low socioeconomic backgrounds in England and Germany. Callender and Jackson (2005), for example, found that students of low social class in England are significantly more likely to agree with statements such as "owing money for education is basically wrong" than their peers of high social class. On a standardized factor scale measuring norms towards borrowing for college, the scores of working class students were 0.2 standard deviations higher than the scores of upper-class students. This effect corresponds to a Cohen's *d* of 0.2 which is considered a small effect. For both groups, debt aversion is a predictor for forgoing higher education (Callender & Jackson, 2005).

In Germany, there is also evidence that high school graduates have internalized a norm that one should not take on debt for higher education. As mentioned above, only 9% of the students from low parental education backgrounds use loans outside of the BAFöG program despite the fact that the majority of them indicate to struggle in financing their college education (Isserstedt et al., 2010; Ebcinoglu & Gersch, 2008). Survey results suggest that students mostly reject loans for normative reasons. Ebcinoglu and Gersch (2008) found that 63% of the students from low parental education backgrounds reject loans because they feel the state should pay for their higher education while only 28% reject loans because they are concerned about not being able to repay them.

In summary, the empirical evidence in Germany and in England suggests there are strong social norms against paying tuition for higher education and against paying for higher education with student loans. Norm-based theories therefore suggest that even moderate tuition has a considerable negative effect on enrollment decisions – in particular for students from low parental education backgrounds.

Behavioral Economics

Behavioral economics (Kahnemann & Tversky, 1979) provides an alternative view on whether, and if so, why moderate tuition might affect enrollment. This theoretical approach from economics uses concepts from cognitive psychology, neuroscience, and sociology to better

explain individual decision making. Its key argument is that individuals tend to deviate from rational decision making in situations of risk and uncertainty and when they lack knowledge and time. Due to cognitive biases, individuals are believed to systematically misperceive the net benefits they receive from outcomes and thus make decisions which do not maximize their long-term net benefits (Rabin, 1998). Given that the decision whether to enroll and whether to pay for higher education is surrounded by uncertainty and risk, behavioral economics could be a useful new perspective for understanding students' reactions to moderate tuition. Concepts from behavioral economics have been used to explain low application rates to financial aid programs (Dynarski & Scott-Clayton, 2006) but to my knowledge they have not yet been applied to studying the effects of newly introduced tuition. Behavioral economics suggests that the introduction of moderate tuition has considerable negative effects on enrollment decisions, particularly among students from low parental- education backgrounds, due to cognitive biases, such as hyperbolic discounting, loss aversion, the zero price effect, the unfairness effect, and loan aversion. In the following, I will describe these cognitive biases and discuss their implications for studying the enrollment effects of introducing tuition.

The concept of hyperbolic time discounting denotes the tendency of individuals to overestimate the net benefits of immediate gains when deciding between smaller, immediate gains and larger, more distant gains. In an experiment Bettinger and Slonim (2007) found that about 43% of children aged between 5 and 16 follow the hyperbolic discounting bias when making decisions. When asked to choose between receiving a $10 gift card immediately or a gift card for an amount up to $25 in 2 months, these children chose the smaller, immediate gain. However, when asked to decide between receiving a $10 gift card in two month or a $25 gift card in four months, the children chose the higher, later benefit. Individuals, therefore, often have inconsistent discount rates and intertemporal preferences. If some benefits are available immediately, individuals underestimate future, larger benefits at a much higher rate than when no immediate gains are available. The children in this experiment, for example, valued $10 now higher than $25 in two months, implying a discount rate of higher than .4, but when no immediate rewards were available they valued $10 in two months less than $25 in four months, implying a discount rate of lower than .4. This finding deviates from classical rational choice

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theory which assumes that individuals discount at a constant rate (Becker, 1992; Loewenstein & Thaler, 1989).

Based on evidence from cognitive psychology, behavioral economics suggests that teenagers are particularly susceptible to hyperbolic time discounting and short-term thinking when making decisions that involve immediate desires against long-term benefits because the brain area responsible for planning and self-control (executive function system) matures later in life than the brain area that is sensitive to monetary and social reward (limbic system) (Atkins, Bunting, Bolger & Dougherty, 2012; Lavecchia, Liu & Oreopoulos, 2014; Schneider & Caffrey, 2012).

The concept of hyperbolic discounting suggests that the introduction of tuition might affect enrollment rates in Germany more negatively than in other countries due to Germany's attractive system of vocational education. In Germany, Abitur graduates can choose between pursing vocational education, which immediately pays a small wage and often leads to a secure income, and higher education which, on average, offers higher wages in the long-run. The concept of hyperbolic discounting suggests that high school graduates in Germany discount the future benefits of a college degree at particularly high rates because they have the option to receive immediate, secure wages from vocational education. As a consequence, high school graduates who are particularly drawn to immediate gains and who strongly underestimate the net benefits they will receive from a college degree, might value the net benefits of a college degree less than €3,000 and thus give up college enrollment when tuition in this amount is charged.

A second concept from behavioral economics that seems relevant for tuition effects is loss aversion. This cognitive bias is often described with the expression "losses loom larger than gains." It describes the empirical finding that individuals experience greater psychological dissatisfaction from a financial loss than they receive satisfaction from a gain of the same size, although logically these values are equivalent in absolute terms (Kahneman & Tversky, 1984). Experimental research found that the attractiveness of a possible gain needs to be about twice as high to compensate for the dissatisfaction of a loss (Kahneman & Tversky, 1992). Due to the psychological dissatisfaction associated with losses individuals tend to forgo benefits if obtaining them requires a loss – even if the loss is substantially smaller. Due to the psychological

dissatisfaction associated with losses individuals tend to prefer decision options that involve fewer losses even if these options also offer substantially lower net benefits than decision options that require higher initial losses or investment. Having to pay tuition is a situation where loss aversion might operate strongly. When tuition is charged, for the first time in their lives many high school graduates are asked being asked to invest or to forgo current assets for uncertain future benefits. In contrast, in a system of free higher education, students only lose the less-tangible forgone income. Loss aversion suggests that some prospective students forgo the high net benefits of a college degree if tuition is charged because they want to avoid the immediate, albeit much smaller, tuition costs.

Two other cognitive biases described in behavioral economics that seem relevant for predicting tuition effects are the zero-price effect and the unfairness effect. The zero price effect is a relatively new concept that describes the observation that individuals experience more dissatisfaction from paying for a good that used to be offered for free as compared to paying for a good for they are used to paying for (McAuley, 2010; Shampanier, Mazar, & Ariely, 2007). Furthermore, individuals experience more dissatisfaction from paying a fee that they consider unfair as compared to a fee that they consider justified (Kahneman, Knetsch & Thaler, 1986).

Individuals thus experience a separate psychological dissatisfaction from paying fees when they are new and/or considered unfair. One example for this cognitive bias is the observation that drivers who are asked to pay a newly introduced road toll often drive more expensive and time-consuming detours that are significantly more costly than the toll (Bazerman 1998; McAuley, 2010). Similarly, individuals who go through great effort to fit their entire luggage into a carry-on bag in order to avoid a new baggage fee seem to be affected by a zero-price and unfairness effect (Lieber, 2011). As has been described above, tuition in Germany was a new few that students overwhelmingly consider as unfair given a strong norm for free higher education (Dreyer et al., 2006; Voeth, Richter, & Becker, 2011). The concepts of zero-price effect and unfairness effect suggest that some prospective students forgo the high net benefits of a college degree if tuition is charged because they want to avoid the displeasure of paying a fee that is new and considered unfair.

Like norm-based theories, behavioral economics also suggests that prospective students are averse to student loans. The theory assumes that individuals often use simple decision rules to make decisions instead of rationally evaluating the costs and benefits. With regard to loans, behavioral economics suggests that individuals follow a rule of thumb or a heuristic not to borrow for non-durable goods such as education (Thaler, 1990). This argument is, for example, based on findings that individuals experience more displeasure from spending future income than current assets, especially if they have little income (Shefrin & Thaler, 1988).

Behavioral economics furthermore suggests that individuals from low income backgrounds are more likely to be loss averse and to discount future benefits, not because they are more prone to the influence of cognitive biases, but because of the concept of diminishing sensitivity (Tversky & Kahnemann, 1992). This cognitive mechanism implies that individuals assess the magnitude of an immediate cost or a loss not in absolute terms but with their current income situation as a reference point. For this reason students from low income backgrounds are expected to perceive the losses from the introduction of tuition more unpleasant and the gains of an immediate salary from vocational education as more attractive.

In summary, behavioral economics suggest that even moderate tuition has a substantial negative effect on college enrollment, particularly for students from low parental-income and -education. Because of cognitive biases, high school graduates are expected to systematically underestimate the net benefits they will receive from a college degree in the long run and to overvalue the monetary and non-monetary costs of paying a new fee that they consider unfair and of spending future income in the form of loans. As a consequence, high school graduates are expected to be unwilling to pay tuition although doing so would allow their future selves to receive substantially higher net benefits in the long run.

Conclusions about Theoretical Perspectives on Tuition Effects

This chapter presented the theoretical foundation of this dissertation by drawing on theories from economics, psychology, and sociology. These three theoretical perspectives are rational choice theories, norm-based theories and behavioral economics theories. I first described

the assumptions of these theories and discussed how they explain the potential enrollment effect of the introduction of tuition in Germany. Using contextual information from Germany I then deduced the hypotheses the theories suggest about the enrollment effects of moderate tuition for students in Germany. The review of theories indicates that the three theoretical perspectives suggest diverging hypotheses regarding whether, to what extent, and through which mechanisms moderate tuition affects enrollment decisions in the German context.

On the one hand, rational choice theories, such as human capital theory and sociological rational choice theory suggest that the introduction of moderate tuition in Germany has almost no negative effect on high school graduates from high parental education families and potentially a small negative effect on high school graduates from low parental education backgrounds. Rational choice theories argue that individuals make rational educational decisions that maximize their expected net benefits in terms of income, status, and the avoidance of risk given their socially-specific resources. The theoretical perspective suggests the introduction of tuition negatively affects enrollment decisions if prospective students are credit constrained or if they expect positive net monetary and non-monetary benefits from a college degree that they value no more than the total amount of tuition. In Germany the effect of tuition is expected to be small, because most high school graduates are not credit constrained and receive monetary and non-monetary benefits from a college degree that outweigh the costs by a large margin so that the introduction of rather minimal tuition costs should have almost no effect on enrollment decisions. Rational choice theory suggests that high school graduates from low parental education backgrounds are potentially deterred by tuition charges in a minor way because misperceptions about the probability of success in higher education, concerns about adverse consequences in case of failure and unpleasant feelings of uncertainty, risk and debt might lower the monetary and non-monetary benefits they expect from a college degree.

On the other hand, norm-based theories and behavioral economics theories, suggest that even moderate tuition may discourage college enrollment to a substantial degree in Germany, particularly among students from low parental education and -income backgrounds. These theories challenge the assumption that students react rationally to the imposition of tuition and only give up college enrollment if they are credit constrained or expect monetary or non-

monetary net benefits from a college degree that they value less than the tuition costs. Norm-based theories suggest that high school graduates react strongly to tuition because they have internalized a norm that one should not pay for higher education and that one should not take on debt for a college degree. Behavioral economics, in contrast, suggests that high school graduates, in particular those from low parental education and -income backgrounds, might be deterred even by moderate tuition charges because of cognitive biases. Due to cognitive biases, such as hyperbolic discounting, loss aversion, the zero price effect and loan aversion, high school graduates are expected to systematically underestimate the net benefits they receive from a college degree and to overvalue the monetary and non-monetary costs of paying a new, as-unfair-considered fee and of borrowing for college. As a consequence, norm-based theories and behavioral economics theories suggest that high school graduates are unwilling to pay tuition although doing so would allow their future selves to receive substantially higher net benefits. The next section will review the literature on how tuition increases or the introduction of tuition affect college enrollment in the US, the UK, the Netherlands, and Germany.

Chapter 4

The Enrollment Effects of Tuition in the US, England, the Netherlands and Germany: A Review of the Literature

This chapter reviews the existing literature on how the introduction of tuition and increases in tuition influence matriculation decisions. In the United States, a large body of literature has examined the effects of tuition increases on college enrollment. A brief overview about this literature will be given first. As mentioned in the introduction, it is unclear whether the effects found in the US apply to German and European institutional contexts given that they are quite different, for example, in terms of the post-secondary education system and in returns to higher education. Before reviewing the empirical findings about the enrollment effects of tuition in Germany, this chapter reviews the corresponding literature from the UK and the Netherlands. These two countries were chosen because they introduced or increased tuition to moderate levels in the last decade and because empirical research has been conducted on this policy change in these countries. The chapter concludes by reviewing the literature on the effects of financial aid, student loans and concerns about college financing on enrollment decisions in Germany. This literature is relevant because students' reactions to tuition costs are influenced by the effectiveness of financial aid policies and because the evidence about the effects of financial aid and perceptions about costs provide information about how students might react to tuition.

Enrollment effects of tuition in the US

In the United States, a large body of literature has examined the effects of tuition increases on college enrollment. These studies consistently found negative effects (e.g. Cameron & Heckman, 2001; Hemelt & Marcotte, 2011; Kane, 1994; McPherson & Shapiro, 1991). Leslie and Brinkman (1987) and Heller (1997) conducted meta-analyses of this research. Based on

studies until 1996, Heller found that a $100 increase in annual tuition (on average) is associated with an enrollment decline of 0.4 to 0.5 percentage points. More recent studies found similar effect sizes (Cameron & Heckman, 2001; Kane, 1994; Kane, 1999).

The evidence about whether low-SES students are more affected by tuition increases than their high-SES peers is mixed. Studies based on data from the 1980s found that tuition had a stronger effect on low-SES students than on their high-SES peers. For this student group, a $100 increase in tuition was associated with a decrease in enrollment by 0.7 percentage points (Kane, 1994, 1996; McPherson & Schapiro, 1991). Two more recent studies, however, did not find robust evidence that low-SES students are more sensitive to tuition increases (Cameron & Heckman, 1998; Ellwood & Kane, 2000).

There is evidence that the effect of tuition costs on college enrollment has decreased in the US over the past twenty years. More recent analyses found that tuition increases did not affect student enrollment in higher education (Heller, 1999; Shin & Milton, 2006; Long, 2004; Wetzel, O'Toole & Peterson, 1998). This was also found for students from low-SES backgrounds (Long, 2004). Although tuition increases appear to no longer have a strong impact on whether low-SES students enroll in college, they continue to strongly influence the kind of college education low-SES students pursue. Because of tuition increases, low-SES students often enroll in less pricy two-year colleges and rule out more expensive four-year colleges (Long, 2004). The choice of a two-year degree has as a consequence that low-SES students have less favorable employment opportunities and lower returns to education. US higher education researchers argue that the question about college access has turned into a question about access to what.

Enrollment effects of tuition in the UK

The UK is an interesting case for studying the effects of introducing moderate tuition. In 1998, the government introduced up-front tuition in the amount of £1,000 ($1,600) per year for all public higher education. Scotland abolished up-front tuition in the year 2000 after

The tuition level in the UK initially depended on parental income so that 42% of the students were exempt from tuition (Greenaway & Haynes, 2003). Research on the effect of

introducing tuition suggests that moderate tuition does not affect the enrollment rates of students from middle and upper income families in the UK (Galindo-Rueda et al., 2004). The effect of tuition on students with low parental income cannot be studied based on the 1998 reform because this group was exempt from tuition (Galindo-Rueda et al., 2004). A number of studies from the UK found, however, that concerns about tuition costs play an important role in enrollment decisions, especially among individuals from low socioeconomic background (Pennell & West, 2005; Wilkins et al., 2012).

In 2006, the government of England increased tuition from £1,000 to £3,000 per year while the governments of Scotland and Wales did not follow suit. Tuition was now charged regardless of students' income situation and was deferrable until after graduation.[9] A review commissioned by the UK government concluded, "the 2006 reforms have not had a negative impact on full-time participation rates, either at an aggregate level or for particular groups of students" (Browne, 2010a, p. 20). This conclusion is based on the finding that participation rates continued to grow after 2006 on the aggregate and for students with low parental income (Browne, 2010b). The report has been criticized for "drawing an overly rosy picture" given participation rates might have grown more in the absence of the tuition increase (Wilkins et al. 2012). Further empirical evidence about the effect of the 2006 tuition increase is still lacking. It is difficult to estimate how the tuition increase affected low-income students given that grant aid was raised significantly for this student group at the same time the tuition increased.

In 2012, almost all higher education institutions in England increased tuition to £9,000. Application data indicate that the number of UK-born high school graduates who applied to university in 2012 dropped by 7.6% compared to the year before (Shepherd & Sedghi, 2012). This initial evidence suggests that this tripling of tuition discouraged a sizable number of high school graduates from enrolling in higher education. More detailed research is necessary, however, to assess whether this strong effect of tuition persists or is just a shock effect immediately after the tuition hike (Wilkins et al., 2012).

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[9] This is the tuition level for full-time students. Scotland abolished tuition in 2007.

Enrollment effects of tuition in the Netherlands

The Netherlands is an interesting case for studying the effects of small increases in tuition on enrollment. In the Netherlands, tuition for public higher education was introduced in 1945. The government increases tuition annually by about €40. In the year 2000, tuition cost €1,350 per academic year – an amount that increased to €1,800 by 2013. A number of studies investigated how these small annual tuition increases affect college enrollment in the Netherlands using time-series analyses. The studies suggest that the small tuition increases do not affect enrollment decisions in the Netherlands (Canton & De Jong, 2005; Kodde & Ritzen, 1984; Oosterbeek & Webbink, 1995). This is not surprising given that tuition increases in this amount merely adjust for inflation.

A limitation of the studies from England and the Netherlands is that they could only examine tuition effects by exploiting changes in tuition levels over time and do not have comparison groups that are not affected by tuition. These studies found that enrollment remained stable after the introduction of tuition in England and tuition increases in the Netherlands. Yet, there was a trend towards growing enrollment rates in England and the Netherlands prior to reform of tuition policies. This positive enrollment trend might have masked a negative effect of tuition. Due to the lack of a valid comparison group we do not know whether enrollment rates would have grown had tuition not been introduced or increased. To get closer to a causal effect of tuition, it is therefore important to consider the general trends in enrollment by using a comparison group that was not affected by tuition (Dynarski, 2002; Long, 2007).

Enrollment effects of tuition in Germany

Four studies have, to date, analyzed how the introduction of tuition in Germany affected the college educational decisions of high school graduates (Bruckmeier & Wigger, 2014; Helbig et al., 2012; Hübner, 2012; Quast et al., 2012). These studies investigated changes in students' registration behavior and intentions to enroll in higher education after tuition policy reform. Hübner (2012) examined the effect of the introduction of tuition in some German states in 2006 on college registration behavior. In the German context, college registration is not the same as

enrollment because students can register at a higher education institution without having to enroll in classes or pass exams. Based on data from the Federal Statistical Office of Germany, Hübner found that registration rates dropped by 2.7 percentage points in tuition-states relative to non-tuition-states after 2006. He argues that this finding suggests a negative effect of tuition costs on college enrollment in Germany. Based on a formal model he predicted that tuition would lead to a decline in registration by 6.9 percentage points if tuition were introduced across Germany. The study did not investigate differential effects by socioeconomic background.

Bruckmeier and Wigger (2014) replicated the findings by Hübner to see whether his findings are robust to when the model is changed in a number of ways. The authors found no evidence for a significant effect of the introduction of tuition on enrollment when state fixed effects are included, the number of Abitur graduates, high-school reforms, and unemployment rates are held constant in states over time, and when it is considered that the actual charging of tuition began at different points in time in a time span of one-and-a-half years.

One shortcoming of both studies, however, is that registration behavior is not an adequate proxy for actual college enrollment in Germany. Before tuition was introduced, some high school graduates registered at a university not because they were interested in pursuing higher education; rather they simply wanted to receive the attractive side benefits associated with college enrollment such as discounts on public transportation and reduced-cost health care. Such aberrant behavior was possible because students were not required to pass exams. As Hübner (2012) and Helbig et al. (2012) caution, the decline in registration rates after the introduction of tuition in 2006 might be due to the fact that "pseudo-students," who merely seek the side-benefits, stopped registering for college. Another shortcoming of these studies is that they might underestimate the effect of tuition on registration behavior because Hübner (2012) specifies the year 2006 as the year prior to the policy change and Bruckmeier and Wigger (2014) specify the year 2005 as the pre-policy year. However, tuition was announced in January of 2005 (see Table 2). In addition to examining the effects of the beginning of the charges in 2006, the effects of the announcement of tuition in the year 2005 should , therefore, be examined to by specifying the year 2004 as the pre- policy year. Moreover, differences in changes between states in aspects which significantly affect enrollment rates, such as the socio-demographic composition of the

graduating cohorts, the number of Abitur graduates and unemployment rates in states over time, were not held constant in the study by Hübner (2012). Bruckmeier and Wigger (2014) adjust for changes in the number of Abitur graduates and unemployment rates in states over time.

Two studies investigated how the introduction of tuition in Germany affected the *intentions* of high school graduates to enroll in higher education (Helbig et al., 2012; Quast et al., 2012). Based on data collected by the survey institute DZHW (Deutsches Zentrum für Hochschul- und Wissenschaftsforschung), these studies found that enrollment intentions did not decline in tuition-states relative to non-tuition states after tuition was introduced—neither for students in general nor for students with low parental education or social class. Helbig et al. (2012) conclude from their findings that there is no evidence of a negative effect of tuition on enrollment intentions and suggest that further research about the effects of tuition on actual enrollment behavior should be conducted. Quast et al. (2012), on the other hand, interpret the null effect findings as evidence that the political debate about tuition led some high school graduates to abandon their enrollment intentions, regardless of whether tuition was introduced in their home state. As evidence they cite a general decline in enrollment intentions across Germany that started in 2002. This dissertation addresses this line of reasoning by studying the effect of tuition on actual enrollment and on intentions to enroll in higher education.

As mentioned above, one shortcoming of these two studies is that they used the intention to enroll in higher education as an outcome variable. Enrollment intentions are, however, a weak proxy for actual enrollment behavior. This is particularly the case when estimating the effects of tuition on enrollment, because it is likely that tuition hinders students from enrolling for financial reasons while it may leave their intention to enroll unaffected. More research is thus important to establish whether and how the introduction of tuition affects *actual enrollment decisions* in Germany. The following sections review the literature about how students' concerns about financing their living expenses, financial aid and student loans affect college enrollment in Germany. Because of the scarcity of literature, peer-reviewed as well as non-peer-reviewed research is covered.

The Effects of Concerns about College Cost on Enrollment in Germany

There is little literature in Germany about the degree to which high school students are concerned about how they will finance their living expenses while in college and how these concerns affect enrollment decisions (Becker, 2000; Becker & Hecken, 2009b; Heine, Quast & Beusse, 2010). The research focuses on concerns about financing room and board because tuition was not charged at that time. These studies found that high school students who are concerned about how they will finance their living expenses while in college are less likely to enroll in higher education. Measured at the mean, a one point increase (on a five point scale) in being concerned about the costs of higher education is associated with a 2 percentage point drop in probability of enrollment after adjusting for a number of student socio-demographic characteristics and achievement measures. The results are similar to studies based on high school students in the state of Saxony from 2000 to 2006 (Becker, 2000; Becker & Hecken, 2009b). Although concerns about financing room and board may affect enrollment decisions, the literature suggests that concerns about living expenses play a less important role in enrollment decisions than other factors. Heine, Quast and Beusse (2010) emphasized that students' Abitur grades, interests in academic training and expectations about labor market prospects of college graduates have a stronger effect on college enrollment than concerns about financing room and board.

In summary, this literature suggests that students' concerns about paying for living expenses while in higher education are negatively related to college enrollment in Germany. It is important to stress, however, that this literature studied the effects of students' subjective concerns about college costs on enrollment behavior—not the effects of actual cost increases. Studies about the effects of introducing tuition provide more direct evidence about how college costs affect enrollment behavior. The following final section of this chapter will review the literature about the effects of financial aid and student loans in Germany.

The Effects of Financial Aid in Germany

One of the main goals of financial aid is to break the link between students' social background and their opportunity to enroll in higher education. The following section reviews the literature about the degree to which financial aid achieves this objective in Germany. As with the research on college costs, empirical findings about the effect of financial aid are scarce in Germany. So far, the BAFöG program is the only aid program whose effects have been studied.

The existing research suggests that both eligibility for the BAFöG program and the amount of aid provided have a positive effect on college enrollment. Steiner and Wrohlich (2008) found that the amount of BAFöG aid has a positive effect on college access. Using data from the German Socioeconomic Panel (SOEP), they estimated the amount of BAFöG aid offered to individual high school graduates with a detailed microsimulation model. To account for the fact that college enrollment decisions are made in a time span of several years after high school graduation and to account for the right-censored character of the observations, Steiner and Wrohlich estimated a discrete-time hazard model with the competing risks "vocational training" and "enrollment in higher education." They found that the amount of BAFöG aid positively affects college enrollment rates. An increase in BAFöG aid by about €83 per month is associated with an increase in enrollment rates by 2 percentage points, from a baseline of 76%. Steiner and Wrohlich conclude that the BAFöG program has a strong effect on enrollment because an increase in the BAFöG amount has a stronger effect on enrollment than a €1,000 difference in parental income. In a more detailed follow-up study, the authors estimated that an increase of the monthly BAFöG amount by €100 increases the transition rate into higher education by 2.9 percentage points (Steiner & Wrohlich, 2012).

The findings about the effects of BAFöG aid are, however, mixed. In an earlier study, Baumgartner and Steiner (2006) found no evidence of a positive effect of increased BAFöG amounts on enrollment. Their study, which is also based on SOEP data, uses an increase in BAFöG aid by 10% in the year 2001 as a natural experiment. However, the authors caution that their estimates might be inefficient because they only use eligibility status for the identification of BAFöG effect and employ a relatively small sample. Lauer (2002) investigates the effect of BAFöG using microeconomic modeling and SOEP data. She finds that being eligible for BAFöG

aid had a very strong positive effect on the probability of pursing a college degree. The amount of grant aid offered affects enrollment decisions as well, but to a lesser extent than whether or not a student is eligible for BAFöG aid.

Taken together, the findings suggest that eligibility for the combined grant/loan program significantly increases college access among low-SES students in Germany. The research also suggests that even small increases in the amount of BAFöG aid increase college enrollment among low-SES students.

The Effects of Student Loans in Germany

The existing research suggests that student loans are not very effective at opening the door to higher education in Germany. As described in Chapter 2, only five to six percent of students use loans outside of the BAFöG program to finance their college education (Ebcinoglu & Gersch, 2008; Isserstedt et al., 2010). The vast majority of students make use of public loans from the state-owned KFW bank; only very few students take out private loans. On average, these students borrow €400 per month, which covers about half of the financial resources they have available (Isserstedt et al., 2010). In addition, students take out loans as part of the BAFöG program. It seems reasonable to assume that for students who take out money for financing their college degree, the availability of a loan increases their inclination to pursue a college degree.

The existing evidence suggests, however, that a key problem with loans in Germany is their low popularity and take-up. The vast majority of Abitur recipients are unwilling to take out loans in addition to those provided by the BAFöG program. Among Abitur recipients who decided against pursuing a college degree, 71 percent state that not wanting to take out loans was an important reason (Heine, Quast & Beusse, 2010). In comparison, only 60% state they did not need a college degree for their career goals. Low-SES students seem particularly "loan averse." Despite facing unmet financial need, they are no more likely to take out additional loans than more affluent students (Ebcinoglu & Gersch, 2008). Among both groups, only 22% of students consider financing their costs with loans (Ebcinoglu & Gersch, 2008).

Two studies investigate the effects of student loans on college enrollment. Lauer (2002) finds that grant offers increase college access whereas loan offers have a less positive impact on college access decisions. Although there is evidence that Abitur graduates usually reject student loans, Baumgartner and Steiner (2005) found that loans and grants have a similar effect on enrollment. They come to this conclusion using BAFöG system reform as a natural experiment. Since 1990, half of the BAFöG was given as a loan and half as a grant, whereas before 1990 it was entirely a loan. Baumgartner and Steiner (2005) found that this reform had no influence on college enrollment rates. Based on this study, it appears that low-income students react similarly to grants and loans. The findings of this study might be of limited significance, however, because they are based on enrollment decisions twenty years ago and the student population and the financial situation has changed since then.

Ebcinoglu and Gersch (2008) investigated the reasons students reject private student loans. In a survey of 4,700 students in Germany, they found that 57% of the students rejected loans because they did not want to have debt. Twenty-eight percent rejected loans because they were concerned they would not be able to repay them, a concern found to be stronger among low-SES students among whom 35% rejected loans because they did not think they could pay them back compared to 25% of high-SES students.

In summary, the existing research suggests that loans in addition to the BAFöG program are not an effective strategy for making higher education accessible for low-SES students in Germany. German students, especially if they are from low-SES backgrounds, are very averse to taking out loans for higher education. However, as public student loans were only introduced in 2005, the aversion to student loans in Germany may thus decrease over time as students become accustomed to financing education with loans.

Taken together, this review of the literature demonstrates that despite a number of studies on this subject, we still know relatively little about how the introduction of tuition affects college enrollment and to what degree moderate tuition affects enrollment in OECD countries outside of the US. There is ample evidence indicating that tuition increases negatively affect enrollment decisions in the US, an effect that seems to have decreased in recent years. Studies from England, on the other hand, did not find a negative effect of tuition on enrollment. So far, there is

no evidence that the introduction of tuition in 1998, or the tripling of tuition in 2006, deterred students from enrolling in higher education. Future research will establish whether the decline in enrollment after the tripling of tuition in 2012 persists. The effect on students of low socioeconomic status could not be studied in England because of a lack of data and because this group was exempt from tuition until 2006. An important limitation of the studies from England is, however, that they do not have comparison group which is unaffected by tuition and might therefore underestimate the effects of tuition. In the Netherlands a number of studies demonstrated that small tuition increases of about €40 do not affect enrollment. Yet, this research does not permit conclusions about the effect of introducing tuition and about the effects of larger increases.

Overall, the existing research from Germany suggests that the introduction of tuition did not deter students from enrolling in higher education. One advantage of these studies is that they use a comparison group by studying students in states where tuition was not introduced. Yet, the validity of the studies is limited by the fact that they do not study the effects on actual college enrollment but use proxies such as registration behavior and enrollment intentions. More research about the effect of tuition in Germany is important because these studies only investigated how tuition affects whether students *register or say they will enroll*—not how tuition affects their *actual enrollment decisions*.

The German literature suggests, however, that high school graduates from Germany are very sensitive to costs, especially students who come from low SES-backgrounds. This high cost-sensitivity becomes evident through students' strong concerns about financing their living expenses while in higher education and by the fact that the BAFöG financial aid program has a strong positive effect on enrollment decisions while loan programs do not seem to encourage enrollment.

Chapter 5

Tuition Policy in Germany

In Germany, tuition for public higher education was banned by federal legislation until 2005. Following a lawsuit by several conservative state governments, the German constitutional court ruled on January 26, 2005, that the federal ban violated the constitution. Thereafter, the states had the right to determine their tuition policies autonomously. On the day of the court ruling, state governments run by conservative party majority (Christian Democrats and Free Democrats) announced their plan to introduce tuition for all new and continuing students in public higher education. These seven states passed legislation regarding tuition between December 2005 and July 2006 and started charging tuition between October 2006 and October 2007.[10] In the remaining ten states, students knew that tuition would not be introduced in the next years because the Social Democratic Party, which strongly opposes tuition, was part of the state governments. Beginning in 2010, the tuition-states abolished tuition after the conservative parties lost the political majorities in the state elections. Table 2 summarizes when the states announced, passed, initiated and abolished tuition, as well as the respective tuition levels.

[10] The state of Hesse did not announce tuition until April 2006, and began charging tuition in October 2007. Tuition initially was banned in the state constitution.

Table 2

Tuition Policies: Introduction, Abolition, and Amount

State	Announced by state government	Passed by state legislature	Tuition charged for the first time	Abolished by state legislature	Charges ceased	Amount in Euro per academic year
Baden-Württemberg	Jan 2005	Dec 2005	April 2007	Dec 2011	April 2012	1,000
Bavaria	Jan 2005	May 2006	April 2007	April 2013	Oct 2013	900 (weighted average)
Hamburg	Jan 2005	June 2006	April 2007	Sept 2011	Oct 2012	1,000 (750 after Oct 2008)
Lower-Saxony	Jan 2005	Dec 2005	Oct 2006	Dec 2013	Oct 2014	1,000
North Rhine-Westphalia	May 2005	March 2006	Oct 2006	Feb 2011	Oct 2011	900 (weighted average)
Saarland	Nov 2005	July 2006	Oct 2007	Feb 2010	April 2010	1,000
Hesse	April 2006	Oct 2006	Oct 2007	July 2008	Oct 2008	1,000

Note. Information was obtained from Deutsches Studentenwerk and author's press research. Weighted averages were obtained from Hübner (2012).

In Germany, the introduction of tuition was a politically charged issue driven by the political majorities within each state. States governed by one or both conservative parties exclusively introduced tuition, while all others did not.[11] There is no evidence that the introduction of tuition was endogenous in that it was driven by enrollment rates or expectations about future enrollment rates. For example, the state of Rhineland-Palatine did not introduce tuition despite the fact that it had the highest enrollment rates of all states and the state of NRW

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[11] An exception is the state of Thuringia which did not introduce tuition despite having been governed by an exclusively conservative government in 2005. Government representatives from the state explained that they will postpone the introduction of tuition for now because they did not want Thuringia to be the only East German state which charges tuition. Thuringia experienced a stronger growth in enrollment prior to the policy change than any other German state (Heine, Spangenberg, Willich, 2008). It thus seems likely that political reasons and not concerns about a potential drop in enrollment rates explain why this state did not introduce tuition.

introduced tuition despite having very low enrollment rates (Heine, Spangenberg & Willich, 2008). Furthermore, as will be shown below, enrollment rates developed similarly in the groups of tuition-states and non-tuition states prior to the policy change. Given that the introduction of tuition was driven by political majorities and not by expected future enrollment, this study can address the endogeneity problem that exists in many studies examining the effect of tuition by comparing enrollment patterns in states with different tuition levels. In those studies it is likely that states that increased tuition expected stronger growth in enrollment than states that did not introduce tuition. For this reason, tuition increases are endogenous and it possible that they underestimate the tuition effect because enrollment would have grown more in tuition states than in non-tuition states in the absence of tuition increases (Long, 2007).

Tuition was announced, passed, and implemented almost simultaneously in the seven states. The tuition-states announced the tuition in January of 2005, passed them in the state parliaments within half a year, and charged tuition for the first time within half a year after October 2006. The state of Hesse is an exception; it introduced tuition in 2007, a year later, because the government needed to wait for a court ruling about whether the state constitution permitted charging tuition. In 2008, Hesse elected a social democratic government which immediately abolished tuition. Since tuition was only charged for one year, Hesse is excluded from the analysis. The state of Saarland is also excluded from the analysis because the low number of observations in this small state does not permit a state-level analysis (personal communication from the survey institute DZHW).[12] Therefore, the group of tuition-states in this analysis includes: Lower Saxony, Hamburg, Baden-Württemberg, Bavaria, and North Rhine-Westphalia; the group of non-tuition states are all other states except Hesse and Saarland.

This study assesses whether tuition has begun to affect enrollment behavior at two different points in time: when tuition was announced and when it was charged for the first time. Looking at both time points is important because, as we know from Ashenfelter's dip (1978), individuals frequently react to policy changes prior to their implementation if they anticipate them. If students react to the announcement of tuition, the Abitur graduates of 2005 would be the

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[12] I will check whether using data from Saarland change results.

first cohort to display a change of behavior; if students react only to the implementation of tuition, the Abitur graduates of 2006 would be the first group in which we would expect behavioral changes. Abitur graduates in the class of 2004 or before could not have anticipated the tuition policy. Krause (2008) analyzed the media coverage of the time and concluded that it was unclear whether the Constitutional Court would abolish the federal ban of tuition and that conservative policy makers changed their view on tuition very rapidly after the court ruling.

Given the short-term nature of the college application process in Germany, high school graduates of the year 2005 had enough time to change their enrollment plans after the tuition policy was announced in January of 2005. In Germany, students generally graduate from high school in May, college applications are due in mid-July, students receive acceptance letters between mid-August to early October whereas the fall term, when most students begin their studies, starts in mid-October.

Tuition has been a controversial issue in Germany and was abolished successively beginning in 2010[13] when the conservative parties lost the political majorities in the state elections (see Table 2). The Abitur graduates from 2010, the next cohort surveyed by the DZHW, could anticipate that tuition would be abolished at least in some states. Data from the year 2010 can therefore note be used to reliably estimate tuition effects. In contrast, the 2006 to 2008 high school graduates could not anticipate that tuition would be abolished because it was very difficult to foresee which parties would win in the next state elections and whether the next government would abolish tuition. This study therefore examines the effects of tuition on enrollment until the year 2008.

Tuition costs were almost uniform in Germany. Most states charged €1,000 per academic year for all public higher education. A couple of mostly small higher education institutions in Bavaria and North Rhine-Westphalia charged lower amounts. Yet, the weighted average of tuition in these states was €900 and thus very close to the amount in the other states (Hübner, 2012). Since the average time to complete a bachelor's degree in Germany is three years, the

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[13] The state of Hesse already abolished tuition in July of 2008, which is why this state is excluded from the analysis.

total tuition cost was €3,000. Overall, few students were exempt from tuition; students with a disability and students who had children or were caregivers did not have to pay tuition. About seven percent of students received a tuition waiver for these reasons (Isserstedt et al., 2010). 2010). In Bavaria and Baden-Württemberg, a higher percentage of students received tuition waivers because students who had two siblings enrolled in college were also exempt from tuition. To the extent that tuition waivers limit the effect of tuition estimated in this analysis, this study identifies a lower bound of the true effect. It seems reasonable to assume that the existence of tuition waivers would only marginally weaken a potentially negative effect of tuition on enrollment. Not only did few students receive an exemption, but those who applied faced uncertainty about whether and for how long they would receive a waiver; they could only apply for a tuition waiver after enrolling, and institutional regulations varied markedly. Given this uncertainty inherent in the waiver policies, it seems unlikely that the policy would have induced prospective students to claim a disability or to have children in order to avoid tuition charges.

German tuition policy did not differentiate between in- and out of state students. Students enrolled in a tuition-state were charged tuition regardless of whether they were from in or out of state, while students in non-tuition-states did not have to pay tuition. Students from tuition-states could therefore avoid tuition by enrolling in a non-tuition-state. To the extent that students avoided tuition, the estimates of this study identify a lower bound of the true effect of the introduction of moderate tuition. Yet few students made use of this strategy. Two studies found that the share of students from tuition-states who studied in their home state remained stable after the introduction of tuition (Heine et al., 2008; Isserstedt et al., 2010). A third study found that the share of students from tuition-states who studied in their home state decreased significantly but slightly (by two percentage points) after the introduction of tuition relative to the change in the share of students who study in their home state in non-tuition-states (Dwenger, Storck & Wrohlich, 2012). This relative decline is due to an increase in the percentage of students from non-tuition states who remain in their home state. As three studies based on different data suggest that very few Abitur graduates left their home states in order to avoid tuition, it seems reasonable to assume that overall, students did not make use of this option to escape tuition. This is not surprising given that enrolling out-of-state when the preferred institution is in-state is

typically more costly than the total tuition costs of €3,000. Students who move away often need to pay additional costs for housing and transportation because they cannot live with their parents. In addition, they incur a number of non-monetary costs such as living away from a familiar and supportive environment or studying at an institution that was not their first choice. Additionally, very few students could avoid tuition by substituting private for public higher education or by studying abroad. The private higher education sector in Germany is small and charges higher tuition. Almost all countries neighboring Germany charge some form of tuition for international students. To conclude, for most Abitur graduates avoiding tuition by moving to a non-tuition-state or abroad was not a viable option and few students pursued it. The introduction of tuition therefore *de facto* meant that the vast majority Abitur graduates from tuition-states receive the treatment and need to pay tuition if they wanted to enroll in college.

Abitur graduates from non-tuition-states were generally unaffected by the tuition policy. In some non-tuition states, individual government representatives suggested introducing tuition, which according to Quast et al. (2013) might have deterred some Abitur graduates from enrolling because of possible future tuition charges. Yet, it seems unlikely that suggestions from individual policymakers affected a significant number of students. First, the Social Democratic Party was strongly opposed to tuition, so introduction was highly unlikely as long as this party was part of the government. Second, in two states where the Social Democratic Party lost elections, Saxony and Thuringia, the conservative party had announced prior to the elections that it would only consider tuition in the distant future. Students in non-tuition-states thus form a valid comparison group that was generally unaffected by tuition. To test this conclusion, I use the non-tuition-state Rhineland-Palatinate as the only comparison state in an alternative specification. Students in this state could be even more certain than students in other states that tuition would not be introduced in the foreseeable future because all major political parties opposed introducing tuition. If all non-tuition-states form a valid comparison group, the results of these two analyses should not differ.

In sum, this overview indicates that the introduction of tuition in Germany can be analyzed as a natural experiment. The variation in tuition is exogenous to enrollment because it is driven by political factors. Almost all students in tuition-states received the same treatment,

that is the requirement to pay tuition, whereas students from non-tuition-states were not affected by the treatment. Finally, tuition was introduced almost simultaneously and nearly uniformly. The introduction of tuition therefore is a natural experiment, well suited for getting closer to the causal effect of moderate tuition on college enrollment. The next chapter will describe the data used in this dissertation.

Chapter 6

Data

This study is based on survey data of 35,529 high school students from Germany who graduated between 1999 and 2008. All students in the sample received the type of high school degree (Abitur)[14] which qualifies them to enroll in higher education. The data are representative of the population of Abitur graduates in Germany. The surveys were conducted by the survey institute HIS (now DZHW) on behalf of the German Ministry for Education and Research. The data contain information about students' educational history before and after high school graduation, as well as information about their demographic background and their career motivations such as striving for a high income, a secure job, or intellectual growth. The data were chosen because of the richness of information they provide and because they are currently the only nationally representative data from Germany which permit studying the effects of tuition by socioeconomic background.

High school graduates from the years 1999, 2002, 2004, 2005, 2006 and 2008 were surveyed (by paper) six months after high school graduation. The graduating cohorts from the years 2005 onward were also surveyed six months before high school graduation. The surveys are based on a stratified, random disproportional cluster sample. The data are stratified by state, school type, and year. Poststratification weights, which adjust for differences in response rates and attrition by gender, state, school type and type of high school degree are used in the analyses. These data are representative at the federal and state level as well as by gender, school type (general/vocational high school) and type of high school degree (Abitur/Fachabitur). The

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[14] The sample includes graduates from all types of general and vocational high schools where students can graduate with the general or the restricted academic high school degree (Abitur, Fachabitur or fachgebundenes Abitur). All students with these degrees are qualified to enroll in higher education. Those with the Fachabitur or fachgebundenes Abitur can only study at universities of applied science and only specific majors.

response rates were 47% on average. Two percent of the annual population of high school graduates participated in the surveys.

Only cases with complete data are included in the analysis. To ensure that missing data do not bias the findings, I also estimate the models with data where missing values were imputed using the multiple chained equations method (Van Buuren, Boshuizen & Knook, 1999). Missing data do not seem to be a concern because the results from these two analyses are very similar. Table 3 presents the means and standard deviations of the variables.

Table 3

Descriptive Statistics: Abitur Graduates 1999 to 2008

	Mean (SD)	Min-Max		Mean (SD)	Min-Max
Enrolled in college	37.3%	0-1	Service class	51.1%	0-1
Intention to enroll in later years	44.7%	0-1	Income and status	0 (1)	-3.3 - 2.6
No intention to enroll in later years	18.0%	0-1	Secure job	0 (1)	-5.8 - 3.5
Graduated between 2005 and 2008	29.3%	0-1	Social engagement	0 (1)	-3.5 - 3.1
Graduated between 1999 and 2004	71.7%	0-1	Working independently	0 (1)	-4.6 - 3.6
Tuition-state	38.6%	0-1	Acquiring skills	0 (1)	-5.3 - 4.5
Parents without college	47.4%	0-1	Learning	0 (1)	-4.1 - 3.4
Female	53.9%	0-1	Uncertain goals	0 (1)	-3.4 - 4.7
Type of high school degree (Abitur/Fachabitur)	75.3%	0-1	Number of Abitur graduates by state/year	0 (1)	-1.2 - 2.5
Abitur Grade (4.0 to 1.0 with 1.0 as the best grade)	2.4 (0.6)	1.0-4.1	Percentage of men age 18 to 21 who serve social service by state/year	21.0 (7.7)	8.0 – 37.0
Working class	15.6%	0-1	Unemployment rate by state/year	10.8 (4.5)	4.1 - 20.4
Intermediate class	33.3%	0-1			
Number of observations	35,529				

Sources. Higher Education Information Systems (HIS), Germany; Federal Office for Statistics, Germany; Federal Office for Employment, Federal Office for Family and Civil Society.

The outcome variable in this analysis is college enrollment, a binary variable which is coded one if high school graduates indicate that their current occupational status is pursuing a college degree in Germany or abroad, and zero if they indicate another occupational status, such as full-time employment or unemployed.[15] This measure for college enrollment captures whether an individual actually pursues a college degree. Formal registration, in contrast, is a distal proxy given that a number of high school graduates in Germany formally register at a higher education with no intention of pursuing a degree – instead they wish to take advantages of the side benefits offered to students in Germany, such as reduced-cost transportation and health care. Enrollment is measured six months after high school graduation and in this sample 37% of Abitur graduates have enrolled by this time. Transitions that take place after the six-month observation window are not considered in the main analysis because this information is not available. In order to get a first estimate about the effects of tuition on enrollment in later years after high school graduation, I use information about whether students intend to enroll in higher education in later years. About 44.7% of Abitur graduates plan to enroll in higher education in later years.

A number of student characteristics which affect college enrollment are held constant because student composition varies in these characteristics over time and between states. These characteristics include: gender, parental education, social class, Abitur grade, type of high school degree and career motivations such as striving for a high income or a secure job. Low parental education is measured with a binary variable that is set to one if neither of the students' parents graduated from a university or a university of technology.[16] About 47% of Abitur graduates have parents with low parental education. Unfortunately, the effects of tuition by parental income cannot be analyzed in this study because the data do not contain income information. In

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[15] Enrollment in higher education includes enrollment in colleges for the arts, music, theology or pedagogy (Kunst-oder Musikhochschulen, Theologische Hochschulen or Pädagogische Hochschulen). The relatively few students who enroll at a college which combines higher education with practical training (duales Studium) or at a military academy (Hochschule der Bundeswehr) or college of public administration (Verwaltungsfachhochschule) are not included in the analysis because students generally do not need to pay tuition at these institutions.

[16] Students whose parents graduated from a *Fachschule* in the GDR are included too.

Germany, education and income are, however, closely related (Autorengruppe Bildungsberichterstattung, 2014).

Social class is measured with an approximation of the EGP class scheme (Erikson, Goldthorpe & Portocarero, 1979). The EGP scheme measures social class using the occupational position, such as owner of a large business (class I) or manual worker (class VII). Members of the same social class are comparable in terms of their income, chances of economic advancement, and location in the systems of authority. I use the highest occupational position of students' parents as a measure for social class. As an approximation of the EGP class scheme, class is coded with binary variables for working class (classes V-VII), intermediate class (classes III, IV) service class (classes I and II) (Jackson et al., 2007).

The type of high school degree is a binary variable set to one if a student graduated with the general Abitur and zero if the student received the restricted Abitur which only qualifies for enrolling at a university of applied science.[17] Students' career motivations are captured using seven factor variables that measure the importance students assign to different goals. These motivational variables are: income, secure job, social engagement, working independently, acquiring skills, learning and uncertain goals. The factor variables were derived from a principal component factor analysis based on 39 items.[18]

In addition, I hold constant three time-varying state characteristics that are known to affect enrollment rates. They are held constant because changes in these characteristics that occurred in tuition-states and not in non-tuition-states would be an alternative explanation for differential changes in enrollment rates and thus threaten the internal validity of the results. I hold constant the annual number of Abitur graduates in the states because a growing number of high school graduates could negatively affect the enrollment rate in a state. Higher education institutions might not be able to immediately increase their enrollment capacities when faced with increasing numbers of high school graduates and applicants. A growing number of Abitur graduates in a state might thus lead to a decline in enrollment rates. A growing number of Abitur

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[17] The type of Abitur which only qualifies for enrolling in specific majors (*fachgebundenes Abitur*) is coded one.
[18] Students were asked in the surveys: "How strongly do you pursue these goals?"

graduates, therefore, lead to a larger share of Abitur graduates who are not prepared or do not plan to enroll in higher education, thus lowering enrollment *rates* in a state (Müller et al., 2009). Information about the annual number of Abitur graduates was obtained from the Federal Statistical Office of Germany (Statistisches Bundesamt).

Second, I hold constant the annual unemployment rate in each state because unemployment rates are likely to affect enrollment rates. The direction of the effect depends on the extent to which unemployment rates affect opportunity costs and risks of human capital investment in higher education. Unemployment rates might have a positive effect on enrollment rates because the opportunity costs of studying are lower when unemployment is high for low-skilled entry level positions. On the other hand, unemployment rates might also have a negative effect on enrollment rates because the risk of human capital investments in a college education is higher if unemployment rates among college graduates are high. Information about unemployment rates was obtained from the Federal Office for Employment (Bundesagentur für Arbeit).

Third, I hold constant the percentage of men between 18 and 21 who complete social service (Zivildienst) in the states. Until 2011, young men in Germany were required to complete military or social service. The percentage of young men who were drafted declined over time and varied between states. This state characteristic affects probability of enrollment half a year after high school graduation because young men who are required to complete social service need to delay college enrollment.[19] The data were obtained from the Federal Office for Family and Civil Society and the Federal Statistical Office of Statistics Germany.

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[19] The percentage of young men who are drafted to the military by state and year was not available from the Federal Statistical Office or from the German Federal Armed Forces. The percentage of young men in a state who are required to dosign up for social service is a good proxy for the share of men who complete social or military service because only those men who are drafted for military service and do not want to serve in the military need to provide social service as a substitute. There is evidence that the share of young men who choose social service does not vary between states (Kohr, 1993).

Chapter 7

Empirical Methodology

This analysis uses two strategies for estimating the effect of tuition on college access: A difference-in-differences approach (Card & Krueger, 1994) based on cross-sectional, individual-level enrollment data pooled over time, and a pre-post analysis based on individual-level longitudinal data.

In the difference-in-differences analysis (DD-analysis), I study the change in college enrollment probabilities between 1999 and 2008 in tuition-states, looking for a discontinuity at the time when tuition was announced and introduced, respectively. Secular trends, such as a positive trend in enrollment, could mask the effect of tuition. To net out enrollment trends, a comparison group is needed. I use states that did not introduce tuition as the comparison group. These states include: Berlin, Brandenburg, Bremen, Rhineland-Palatinate, Saxony, Saxony-Anhalt, Schleswig-Holstein and Thuringia.

The effect of the introduction of tuition is identified by the difference in the changes of enrollment probabilities between tuition-states and non-tuition-states after tuition was introduced. Thus the identifying assumption is that any relative decline in enrollment probabilities in tuition-states relative to non-tuition-states after 2004 is due to the introduction of tuition. As will be demonstrated below, non-tuition states are an appropriate comparison group because enrollment probabilities have developed almost identically in the state groups prior to the introduction of tuition. In addition, a range of sensitivity and falsification checks are conducted to test whether it is plausible to attribute a relative drop in enrollment to the tuition increase instead of to competing explanations.

The difference-in-differences estimate is obtained using the following logistic regression model:

$$ln\,(P_{ist}/1 - P_{ist}) = \alpha + \beta\,Tuition\,States_s \cdot After_t + \gamma_s + \tau_t + \delta\,X_{ist} + \mu\,S_{st} \qquad [1]$$

where P_{ist}, indicates whether student *i* in state *s* in year *t* of high school graduation has enrolled in college. *Tuition States$_s$* is a binary variable that is set to one if a high school student graduated in a tuition-state. *After$_t$* is a binary variable that is set to one if a student graduated in the years after tuition was announced (2005 onward).[20] The interaction term between the *Tuition States$_s$* and *After$_t$* captures whether the change in probability of enrollment after the policy change differs between tuition and non-tuition states.

The γ_s terms represent state-fixed effects which control for stable differences in college enrollment across states. The τ_t terms represent year fixed effects where the year 2004 is the reference category.[21] They hold constant unobserved factors in enrollment which change over time. X_{ist} is a vector of student level covariates including parental education, social class, Abitur grade, type of high school degree, gender and motivations. These covariates hold constant potential differences between states in the changes in the social and educational composition of Abitur graduates. S_{st} is a vector of year-specific state characteristics including unemployment rate, number of Abitur graduates and percentage of men age 18 to 21 who complete social service.

Given the binary nature of the outcome variable logit models are estimated. Probit and ordinary least squares models are estimated for comparison and provide similar results. To allow for heteroscedasticity and within state error correlation, cluster-robust standard errors (by state) are obtained.[22] One concern is that the asymptotic justification of cluster-robust standard errors assumes that the number of clusters goes to infinity. Cluster-robust standard errors can be

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[20] I use the years 2006 onward in order to test whether tuition began affecting enrollment after they were passed by the state legislatures.

[21] The year 2005 is the reference category when I test whether tuition only began affecting enrollment after they were passed by the state legislatures.

[22] The "cluster" command in STATA is used to calculate the standard errors.

downward biased if the number of clusters is low (Bertrand et al., 2004). To ensure that the standard errors are not downward biased in this analysis, I also employ a wild cluster bootstrap procedure developed by Cameron, Gelbach and Miller (2008). In simulations, this bootstrapping procedure was found to lead to improved inference when the number of clusters is as low as six.

To study whether the effect of tuition varies by parental education, I use a difference-in-difference-in-differences approach (DDD-analysis) (Dynarski, 2000; Bitler, Gelbach & Hoynes, 2005). I estimate whether the gap in probability of enrollment between students from low and high parental education increased in tuition states relative to non-tuition states after the tuition policy had been announced. The change in a difference, that is, the enrollment gap by parental education in non-tuition states, is thus used as a comparison change to net out secular trends in the enrollment gap by parental education. The identifying assumption is that any increase in the enrollment gap in tuition-states relative to non-tuition-states can be attributed to a stronger effect of tuition on students with low parental education. As will be demonstrated below, using non-tuition-states as a comparison group is appropriate because the gap in enrollment probability by parental education has developed almost identically in tuition and non-tuition states prior to the introduction of tuition. A key advantage of this triple-differencing approach compared to a simple difference-in-difference approach is that by identifying the effect off the changes in enrollment probability among students with high parental education in tuition-states, any within-tuition-state shocks in college enrollment can be netted out. The effect of tuition on students with low parental education is estimated with the following model:

$$ln\,(P_{ist}/1 - P_{ist}) = \alpha + \beta\,Fee\,States_s \cdot After_t \cdot LowPE_i + \gamma_s + \tau_t + \delta\,X_{ist} + \mu\,S_{st} + \theta LowPE_i +$$
$$\sigma_{fs,af} + \pi_{fs,lp} + \rho\,After_t \cdot LowPE_i \qquad [2]$$

where $LowPE_i$ is a binary variable that indicates whether a student's parents have no college degree. The coefficient β is the key variable of interest and identifies whether the gap in college enrollment by parental education level has increased in tuition-states relative to non-tuition states after the policy change. The terms $\sigma_{fs,af}, \pi_{fs,lp}$ and ρ represent the lower level

interaction terms between *Tuition States$_s$· After$_t$, Tuition States$_s$· LowPE$_i$* and $After_t · LowPE_i$ respectively.

While the difference-in-differences analysis takes a longitudinal perspective at the state level, the pre-post analysis expands the study by taking a longitudinal perspective at the individual level. The graduating cohort of the year 2005 was surveyed in December of 2004, six months before high school graduation, and again in December 2005, six months after high school graduation. As tuition policy was announced in January of 2005, the graduating cohort of 2005 thus indicated whether they planned to enroll in higher education for the first time when they did not know that tuition would be introduced soon, and for a second time when they were aware of the tuition policy. If tuition affects enrollment, a share of the students who had intended to enroll in higher education not knowing that tuition will be charged, should have given up their enrollment plans after tuition was announced. To study whether tuition affects enrollment, I restrict the analysis to students who had expressed the intention to enroll in higher education when surveyed in December of 2004. I estimate whether the probability of high school graduates following through with their enrollment intentions is lower among students in tuition-states than in non-tuition-states conditional on enrollment intentions in 2004. Students in non-tuition-states are thus used as a comparison group.

$$ln\ (P_{ist}/1 - P_{ist}) = \alpha + \beta\ Fee\ States_s · LowPE_i + \theta LowPE_i + \gamma_s + \delta\ \mathrm{X}_{ist} \qquad [3]$$

where all variables are as defined above.

The advantage of using two analytic approaches, that is examining changes in states over time and in individuals over time, is that they make different identifying assumptions. The conclusions about the effect of tuition are bolstered if both approaches lead to similar results. The difference-in-difference approach identifies the effect of tuition by comparing the changes in enrollment probabilities between graduating cohorts from tuition and non-tuition states. One validity threat is that the graduating cohorts of the different states might have developed differently in characteristics that affect enrollment but cannot be controlled for, e.g, motivation to study. These differential changes are an alternative explanation for state differences in the

changes in enrollment rates over time. The pre-post analysis addresses this concern because it examines the enrollment intentions of the same individuals over time, so that differences between cohorts are not a concern. Similarly, the pre-post analysis examines the effect of tuition by comparing the probability of high school graduates carrying through their enrollment plans in tuition and non-tuition states. A validity threat is that enrollment rates between tuition and non-tuition states might differ in general. The difference-in-difference approach addresses this concern because it demonstrates that enrollment developed similarly in tuition and non-tuition in the six years prior to the introduction of tuition.

Chapter 8

Results

Difference-in-Differences Analysis - Overall Results

The first part of the results section presents the findings about the effects of the introduction of moderate tuition on college enrollment in the population of high school graduates in general. To begin, I examine whether non-tuition-states are an adequate comparison group. Figure 2 demonstrates that enrollment rates developed very similarly in the treatment and comparison group for a period of eight years prior to the announcement of tuition. The percentage of high school graduates who enrolled in higher education directly out of high school increased from 30% in 1996 to about 39% in 2004 in both groups. This parallel trend suggests that non-tuition-states are an adequate comparison group for gauging how enrollment would have developed in tuition-states in the absence of tuition. The parallel trends assumption, which is key in difference-in-differences analyses, is therefore met in this natural experiment. Figure 2 also demonstrates that enrollment rates in the state of North Rhine-Westphalia, which also imposed tuition, increased less than in other tuition-states. For reasons which will be explained in detail below, the effect of tuition in this state will be analyzed separately.
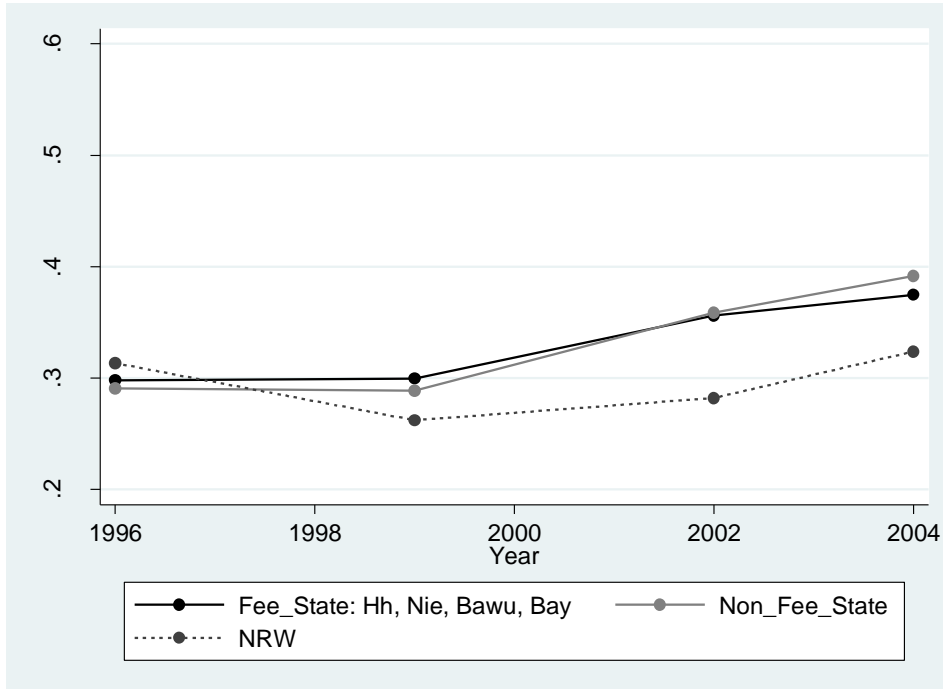
Figure 2. Enrollment rates in German states with and without tuition

Table 4 presents the results of the difference-in-difference analysis for high school graduates in general. Model 1 shows the results of a model without covariates. The estimate for the interaction term between Tuition States$_s$ and After$_t$ is very small and not significantly different from zero (log of the odds ratio 0.03 (0.09)).[23] A log of the odds ratio of 0.03 corresponds to an implied probability effect of 0.01 from a linear regression. College enrollment in tuition-states thus did not decline relative to non-tuition-states after tuition was announced. This result suggests that moderate tuition does not affect enrollment decisions in the population of high school graduates in general. The complete regression results for all analyses are displayed in Appendix A.

[23] Standard errors are provided in parentheses after the coefficient throughout the text.

Table 4

The Effect of Tuition on College Enrollment – Overall Results

	(1) Baseline Model	(2) Student Characteristics	(3) Year-specific State Characteristics	(4) Linear State Trends
2005	.20 (.07)**	.10 (.08)	.14 (.08)	.14 (.09)
2006	.13 (.06)*	.02 (.08)	.04 (.10)	.10 (.09)
2008	.16 (.06)*	.02 (.08)	-.01 (.18)	.09 (.16)
Tuition-states*After	.03 (.09)	.01 (.10)	.01 (.14)	.06 (.08)
NRW*After	.14 (.07)*	.11 (.08)	.05 (.17)	.11 (.07)
Individual characteristics: gender, Abitur grade, full/restricted Abitur degree, parental education, parental class, motivations (income, secure job, social engagement, working independently, acquiring skills, learning, uncertain goals)		X	X	X
Year-specific state characteristics: number of Abitur graduates, unemployment rate, percentage of young men in social service			X	X
Linear state trends				X
McFadden's R^2	.016	.148	.148	.149
Wald Test comparing with previous model		$\chi^2(13) =$ 9040.72 $p = .000$	$\chi^2(3) =$ 0.83 $p = .841$	$\chi^2(13) =$ 1.8×10^5 $p = .000$
Number of observations	35,529	35,529	35,529	35,529

Note. *p < .05, **p < .01, *** p < .001, coefficients are log of odds ratios, cluster robust standard errors in parentheses. The year 2004 is set as the pre-policy year.

As explained in the methodology chapter, differences in changes between the state groups in terms of student characteristics, state characteristics or enrollment trends could mask a potential effect of tuition. I therefore hold constant student characteristics including gender, Abitur grade, parental education, parental social class, type of Abitur degree, and students'

motivations. The results in Model 2 indicate that the interaction term remains very small and non-significant when individual level covariates are added to the model. Furthermore, adding year-specific state characteristics including the unemployment rate, number of high school graduates and percentage of young men doing social service does not change the results (Model 3).

In this analysis, any differences between states which are fixed over time are held constant using state-fixed effects. Furthermore, observed differential changes in student or state characteristics between tuition and non-tuition-states are held constant with a range of individual and state-level covariates. But any unobserved changes which affect college enrollment in tuition-states that did not occur in non-tuition states remain a threat to the internal validity of the results. Alleviating this concern, Figure 2 provides evidence that enrollment rates developed very similarly in tuition and non-tuition states prior to the announcement of tuition. This suggests that the states are not subject to differential changes. A formal strategy for controlling for potential differences in enrollment trends is to add state-specific trends in college enrollment (Dynarski, 2008). In Model 4, I add linear state-specific time trends so that the program effect is identified with deviations from those trends. The interaction term between Tuition-states$_s$ and After$_t$ only increases very slightly to a log of the odds ratio of 0.06 and remains non-significant. I also added quadratic trends that exhibit the same results. The robustness of the findings to adding state trends strengthens the supposition that the two state groups were on similar trends and that a potential effect of tuition is not masked by differential pre-treatment trends. The last row of coefficients in Table 4 displays the results for the tuition-state of North Rhine-Westphalia. Similar to the overall results, the estimate for the effect of tuition is very small and not significantly different from zero.

As explained in the methodology section, I additionally estimate the standard errors using a wild cluster bootstrap procedure developed by Cameron, Gelbach and Miller (2008) to ensure that the standard errors are not downward biased. This particular bootstrapping procedure can only be used for standard errors from linear regression models without weights. The wild cluster bootstrapped standard error for the States$_s$ and After$_t$ coefficient in Model 3 is 0.04 with an OLS

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coefficient of 0.02 compared to the cluster robust standard error of 0.03. The similarity of the results suggests that the use of cluster robust standard errors is appropriate in this analysis.

Robustness of the effect over time. So far, this analysis was based on the assumption that the effect of tuition is time invariant. However, the effect might vary if the introduction of tuition leads to a shock effect immediately after the policy change that disappears when students have time to prepare for paying tuition. To test this hypothesis I estimate the effects of tuition separately for the three years after the policy change. The results presented in Table 5 provide no evidence of an effect of tuition in the three years after the policy change. A Wald test indicates no significant difference in the effects between the years, suggesting that the effect of tuition remained stable over time ($\chi^2(2) = 1.92$ $p = .382$).

Effect of implementing tuition. So far, I examined whether the announcement of tuition charges in January of 2005 affected enrollment in Germany. It is, however, possible that the implementation of actual tuition policy beginning in 2006 – and not the announcement – affected enrollment. To examine this hypothesis, I set the year 2005 as the pre-policy year. As is noted in Table 5, there is no evidence that the implementation of the tuition policy affected the enrollment decisions of Abitur graduates in general.

Table 5

The Effect of Tuition by Post-Year and on Postponing and Ruling out College Enrollment

	B	McFadden's R^2
For comparison: Results from Model 3		
Tuition-states *After	.01 (.14)	.148
By Post-year		
Tuition-states*2005	-.08 (.15)	.148
Tuition-states *2006	-.02 (.15)	.148
Tuition-states *2008	.07 (.17)	.148
Effect of implementing tuition (2005 as the pre-policy year)	.02 (.11)	.149
Effect on postponing and ruling out enrollment		
Enrolled (2) vs. planning to enroll (1)	.03 (.12)	.184
Ruling out enrollment (3) vs. planning to enroll (1)	.09 (.14)	.184

Note. *p < .05 . **p < .01, *** p < .001, N = 35,529. Aside from estimating separate effects by years and setting a different year as the reference category respectively, the same regressors as in Model 3 are used. Coefficients are log of odds ratios. Cluster robust standard errors in parentheses.

Postponement effects. So far I examined whether tuition affects college enrollment half a year after high school graduation and found no effect. Yet tuition might lead students to postpone their enrollment, instead of giving up a college education altogether, for example in order to earn money first. Tuition might also lead students who had planned to enroll in later years to give up college education altogether. In order to test these hypotheses, I examine the effect of tuition on a nominal enrollment variable with three values. The variable is set to one if a student who is currently not enrolled plans to enroll in higher education in later years. It is set to two if a student is currently enrolled, and set to three if the student has ruled out enrolling in higher education. I estimate a multinomial logistic regression model where the same regressors are included as in Model 3. Planning to enroll in later years (category 1) is set as the reference group because I want to compare the other two enrollment categories to this one.

The results in Table 5 indicate that the probability of students actually enrolling compared to planning to enroll in later years has not decreased significantly in tuition-states relative to non-tuition-states following announcement of tuition policy (log of the odds ratio 0.03

(0.12)). Furthermore, the probability of ruling out college enrollment planning versus future enrollment has not increased significantly relative to the comparison group (log of the odds ratio 0.09 (0.14)). These findings suggest that for the general student population, tuition does not lead students to postpone enrollment or give up enrollment plans. The results need to be interpreted with caution because they are based on information about students' enrollment intentions and not on their actual enrollment behavior.

To conclude, there is no evidence that moderate tuition fees negatively affect enrollment decisions in the overall population of Abitur graduates. This finding is stable when a range of individual and state level covariates as well as time trends are held constant. It is also stable across the three years after the policy change. Furthermore, there is no evidence that tuition fees lead students to postpone their college education or to give up their plans to enroll in later years.

Difference-in-Difference-in-Differences Analysis – Effects on Students from Low Parental Education Backgrounds

This section presents the findings about the effects of moderate tuition on the enrollment decisions of students whose parents do not have a college degree. I identify the effect by examining whether disparities in college enrollment by parental education increased in tuition-states relative to non-tuition-states after the policy change. To begin, I examine whether non-tuition-states are an adequate comparison group. As displayed in Figure 3, enrollment rates of Abitur graduates from low and high parental education in tuition-states developed very similarly prior to 2005; social disparities neither decreased nor increased. In non-tuition-states, social disparities in college enrollment also remained stable. This suggests that the change in the enrollment gap in non-tuition-states is an adequate comparison change. After 2004, social disparities in the unadjusted enrollment rates increase slightly more in tuition-states than in non-tuition states (Figure not shown).
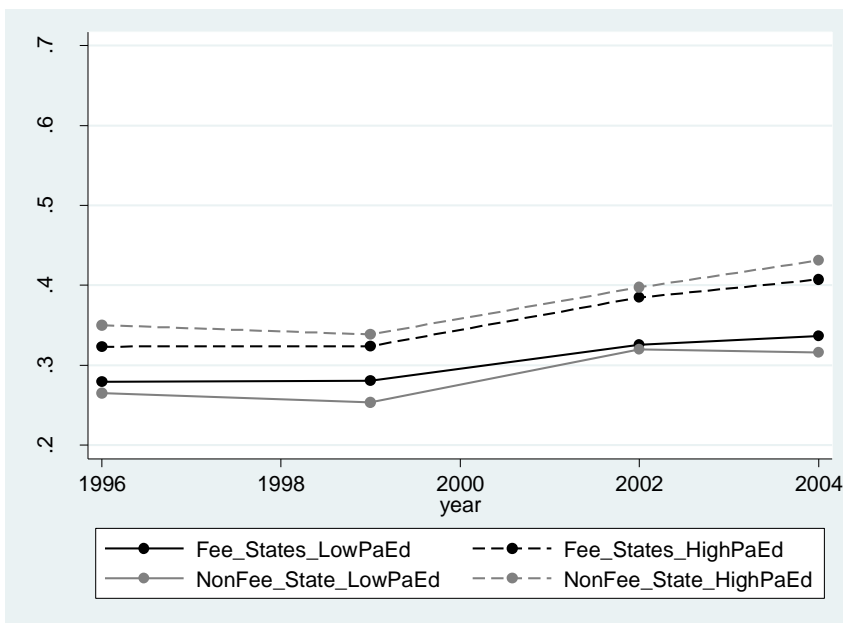
Figure 3. Enrollment rates by parental education in states with and without tuition

Table 6 presents the results of the difference-in-difference-in-differences analysis. The coefficients for the interaction terms between low parental education and the year fixed effects for 2005, 2006 and 2008 are not significantly different from zero indicating that social disparities in enrollment have remained stable in non-tuition-states after 2004. In the baseline model, the estimate for the triple interaction term between tuition-states$_s$, after$_t$ and low parental education$_i$ is very small and not significantly different from zero (log of odd ratio -0.02 (0.10)). When no covariates are held constant, social disparities in college enrollment have not increased after 2004 relative to non-tuition-states. The picture changes when the differential changes in student composition between tuition- and non-tuition-states are taken into consideration (Model 2).

When students' gender, Abitur grade, parental education, type of Abitur degree, and students' motivations are held constant, the coefficient for the triple interaction is negative and significantly different from zero (log of odd ratio -0.26 (0.12)) (p <.05). In a linear regression the coefficient is -0.05 (0.02) (p < .05). Social disparities in college enrollment increased significantly in tuition-states compared to non-tuition states after the introduction of tuition. This suggests that tuition, even when its amount is moderate, discourages a significant share of high school graduates from low parental education from enrolling in higher education. This finding is robust to adding year-specific state characteristics including unemployment rates, the number of high school graduates and the percentage of young men doing social service (Model 3). The result also remains stable when linear state-specific time trends are added to the model (Model 4). A likelihood ratio test indicated that Model 4 does not fit the data better than Model 3. The coefficients for the interaction terms between low parental education and the year fixed effects for 2005, 2006 and 2008 are not significantly different from zero in all models indicating that social disparities in enrollment have remained stable in non-tuition-states after 2004. There is no evidence of an effect of tuition on the enrollment decisions of students with low parental education in the state of North Rhine-Westphalia. The reasons for this will be discussed below. The wild cluster bootstrapped standard error for the triple interaction coefficient in Model 3 is 0.020 with a linear regression coefficient of -0.04. This is very similar to the cluster robust standard error from the linear regression coefficient of 0.018, suggesting that the use of cluster robust standard errors is appropriate in this analysis.

Table 6

The Effect of Tuition on College Enrollment by Parental Education

	(1) Baseline Model	(2) Student Characteristics	(3) Year-specific State Characteristics	(4) Linear State Trends
2005*Parents no college	-0.04 (.12)	-0.06 (.11)	-0.06 (.11)	-0.08 (.11)
2006*Parents no college	-0.03 (.14)	0.01 (.14)	0.01(.14)	-0.02 (.14)
2008*Parents no college	-0.01 (.10)	-0.02 (.14)	-0.01 (.14)	-0.06 (.13)
Tuition-states*After*Parents no college	-.02 (.10)	-.26 (.12)*	-.27 (.12)*	-.23 (.11)*
NRW*After*Parents no college	.15 (.09)	.12 (.11)	.11 (.11)	.15 (.11)
Individual characteristics: gender, Abitur grade, full/restricted Abitur degree, parental education, parental class, motivations (income, secure job, social engagement, working independently, acquiring skills, learning, uncertain goals)		X	X	X
Year-specific state characteristics: number of Abitur graduates, unemployment rate, percentage of young men in social service			X	X
Linear state trends				X
McFadden's R^2	.023	.150	.150	.151
Wald Test comparing with previous model		$\chi^2(10) =$ 2930.84 $p = .000$	$\chi^2(3) =$ 2.28 $p = .517$	$\chi^2(13) =$ 1.29 x 10^5 $p = .000$
Number of observations	35,867	35,867	35,867	35,867

Note. *p < .05 , **p < .01, *** p < .001, coefficients are log of odds ratios, cluster robust standard errors in parentheses. The first column shows the results of a model without covariates. The number of observations is slightly higher than in the overall model because parental class is not used as a covariate. The year 2004 is set as the pre-policy year.

In the following, I illustrate the magnitude of the effect displayed in Table 6 using predicted probabilities obtained from Model 3. I present the results of Model 3 because a likelihood ratio test indicated that Model 4 does not fit the data better than Model 3. Presenting the results in terms of predicted probabilities has been used in difference-in-difference analyses with dichotomous outcome variables for example by Chatterji and Meara (2010). Table 7 presents the predicted enrollment probabilities based on Model 3 when all covariates are held at the mean. As can be seen in the top row, the probability of college enrollment for students with low parental education in tuition-states dropped by five percentage points after tuition was introduced. In the same time period, the probability of enrollment of students of high parental education increased by two percentage points. The enrollment gap by parental education therefore increased by seven percentage points after tuition was introduced ($p < 0.001$). This increase in social disparities is unique to tuition-states. In non-tuition-states, the probability of enrollment of students with low parental education remained stable after 2004 and social inequalities in enrollment did not change significantly. The difference between the change of the enrollment gap by parental education in tuition-states and non-tuition states is six percentage points ($p < .05$). This estimate corresponds to the coefficient for the triple interaction between Tuition-states$_s$, After$_t$ and Low parental education$_i$ of a log of the odds ratio of -0.27 presented in Table 7.

Table 7

Predicted Enrollment Probabilities by Parental Education and State Group

	2004	2005/2006/2008	Difference 2004 - 2005/2006/2008
		Tuition-states	
Parents without college degree	.42	.37	-.05***
Parents with college degree	.42	.44	+.02
Change in enrollment gap by parental education between 2004 and 2005/2006/2008			+.07***
		Non-Tuition-states	
Parents without college degree	.53	.53	.00 ns
Parents with college degree	.60	.61	+.01 ns
Change in enrollment gap by parental education between 2004 and 2005/2006/2008			+.01ns
Difference in the changes of the enrollment gap by parental education between tuition- and non-tuition-states: .07 − (.01) = +.06 *			

Note. *p < .05 . **p < .01, *** p < .001. The predicted enrollment probabilities based on Model 3 when all covariates are held at the mean. Significance tests were conducted with the linear combinations command in STATA.

The findings of the DDD-analysis indicates that the introduction of moderate tuition leads to a relative decline in enrollment probability by six percentage points (from a baseline of 42%) among Abitur graduates from low parental education backgrounds. In other words, the probability of college enrollment drops by 14% (6/42) among Abitur graduates from low parental education backgrounds when tuition is charged. This result is compared to Abitur graduates of high parental education from tuition-states and compared to changes in the enrollment gap by parental education in non-tuition states. It is the effect of tuition on students from tuition-states after adjusting for the selection bias (Average treatment effect on the treated or ATT).

To illustrate the result from the DDD-analysis graphically, Figure 4 illustrates how the predicted enrollment probabilities changed between the years 1999 and 2008 (again, these probabilities are based on Model 3). The black solid line indicates that the enrollment probabilities for students with low parental education in tuition-states dropped after 2004 and remained at this lower level for the next four years. In the post-2004 time period, the enrollment probabilities for students with high parental education in tuition states increased, so that social disparities in college enrollments increased significantly (as indicated by the .07 probability gap). This increase in social disparities is unique to tuition-states. In non-tuition-states, enrollment probabilities grew slightly for students from low and high parental education, but the gap remained quite constant (.01).

Increase of social disparities (DD) in non-tuition states: 0.01

Increase of social disparities (DD) in tuition-states: 0.07***

Difference in the changes (DDD)
$0.07 - (0.01) = +0.06$ *
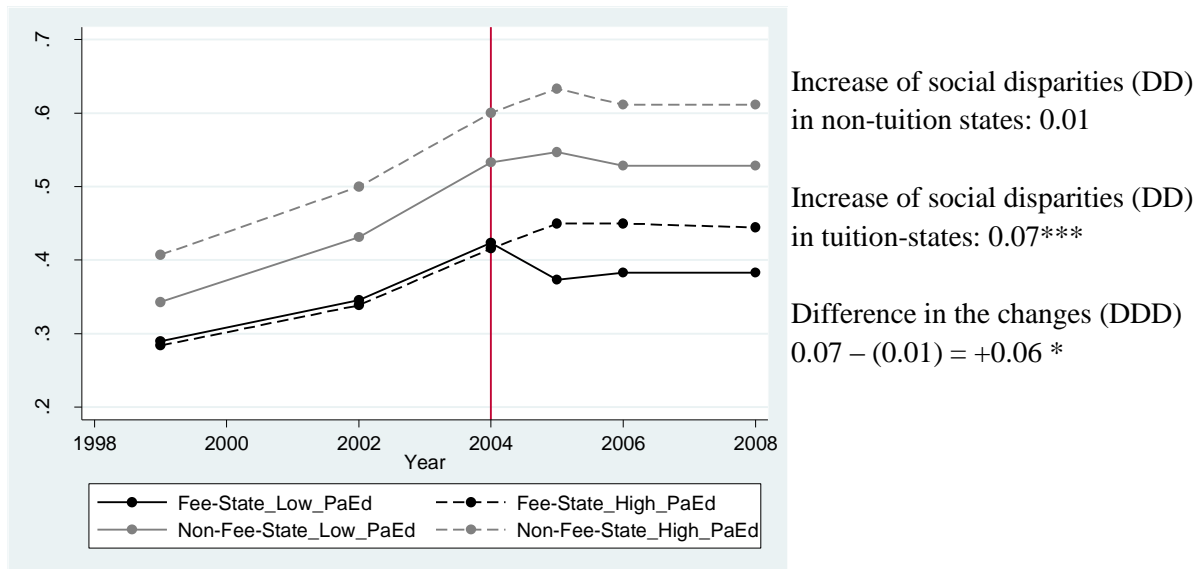
Figure 4. Predicted enrollment probabilities by parental education in states with and without tuition

Robustness of the effect over time. Below I examine the sensitivity of the results to a number of robustness and falsification tests. The predicted probabilities in Figure 4 suggest that tuition discouraged students with low parental education from enrolling in higher education in all years after the policy change. To formally test the stability of this effect, I estimate Model 3 with

separate results for each year after 2004. Given the smaller sample sizes, the standard errors are higher so that the effects of tuition by year are only statistically significant in the year 2005. Yet, the coefficients presented in Table 8 are negative and do not statistically differ in size ($\chi^2(2) = 1.02$ $p = .602$), suggesting that the effect of tuition is stable over time.

The results for each year indicate no negative effects of tuition in North Rhine-Westphalia in the years 2005 and 2008. In the year 2006, the coefficient is significantly positive, suggesting that the enrollment gap by parental education decreased in this state relative to non-tuition-states. The slightly positive, yet not statistically significant effect, found in North Rhine-Westphalia across years (see Table 6 above) is thus due to events in the year 2006.

Two higher education reforms in North Rhine-Westphalia in the year 2006 and 2007 led to exceptional narrowing of the enrollment gap by parental education in the year 2006. In 2006, the state government expanded enrollment capacities in higher education. As a consequence, more students, especially those with lower grades and lower socioeconomic status, were admitted into higher education and social disparities in probability of enrollment decreased. However, admissions reform in 2007 canceled out the effect of this capacity expansion. Beginning in 2007, universities were permitted to base admission decisions more strongly on subjective criteria, such as admission essays, and less on grades. Students of high parental education disproportionally benefitted from this admissions reform, thus leading to an increase in social disparities in enrollment probabilities. The reasons for the divergent changes in North Rhine-Westphalia in 2006 are explained in more detail in Helbig et al. (2011). I find no evidence for an effect of tuition, when the state of North Rhine-Westphalia and the other tuition-states are grouped together. This is not surprising, given that a potential effect of tuition in North Rhine-Westphalia in the year 2006 and 2008 cannot be examined due to the parallel changes in enrollment capacities.

Robustness of the effect by individual tuition-state. I also estimate the effects of tuition separately for the five tuition-states based on Model 3 to ensure that the overall effect is not due to effects in single states. The results in Table 8 indicate that a significant negative effect of tuition occurred in all tuition-states, with the exception of North Rhine-Westphalia. The effect is

significantly larger in Hamburg and Baden-Württemberg than in Lower Saxony and Bavaria ($\chi^2(3) = 771.03$ $p = .000$).

   Robustness of the effect to using alternative comparison groups. To ensure robustness of the results to the choice of comparison group, I limit the comparison group to the state of Rhineland-Palatinate and include Saarland as a tuition-state in alternative specifications. Rhineland-Palatinate is used as an alternative comparison group to address the concern raised by Quast et al. (2012) that the political debate about tuition might have also affected enrollment behavior of Abitur graduates in non-tuition states. As explained in Chapter 5, Abitur graduates in Rhineland-Palatinate could be even more certain than students in other non-tuition-states that tuition would not be introduced in the foreseeable future because all political parties in the state, including the conservative party, rejected tuition. In the other non-tuition-states, at least parts of the conservative parties favored the introduction of tuition. The results indicate that the effect of tuition is robust to using Rhineland-Palatinate as a comparison state, suggesting that using all non-tuition-states as a comparison group is appropriate.

   So far, Abitur graduates from the tuition-state Saarland were excluded from the analysis because the survey institute DZHW, which collected the data, advised against conducting state-level analyses for this small state. Weighting artifacts occur in this small state due to differences in response rates from students from the different types of high schools (personal communication from DZHW). In order to test whether the findings were affected by excluding students from Saarland, I included them in one specification. The results in Table 8 demonstrate that the results are stable when Saarland is included as a tuition-state, suggesting that having excluded students from Saarland did not affect the results.

Table 8

The Effect of Tuition by Post-Year, State, on Postponing Enrollment and Robustness Test

	B	N	Pseudo R^2
For comparison: Results from Model 3			
Tuition-states *After*Parents no college	-.27 (.12)*	35,867	.150
By post-year			
Tuition-states*2005*Parents no college	-.41 (.17)*	35,867	.150
Tuition-states *2006*Parents no college	-.23 (.21)	35,867	.150
Tuition-states *2008*Parents no college	-.20 (.18)	35,867	.150
NRW*2005*Parents no college	-.15 (.10)	35,867	.150
NRW*2006*Parents no college	.49 (.16)**	35,867	.150
NRW*2008*Parents no college	-.15 (.17)	35,867	.150
By tuition-state			
Hamburg	-. 37 (.11)**	35,867	.150
Lower Saxony	-. 26 (.10)*	35,867	.150
Baden-Württemberg	-. 37 (.11)**	35,867	.150
Bavaria	-. 26 (.10) *	35,867	.150
North-Rhine-Westphalia	. 11 (.11)	35,867	.150
Alternative comparison groups			
RHL used as only comparison state Tuition-states*After*Parents no college	-.32 (.07)***	23,742	.148
Saarland included as an additional tuition state Tuition-states*After*Parents no college	-.27 (.10)*	36,762	.150
Effect when the state NRW is grouped together With the other tuition states	-.13 (.14)	35,867	.149

Note. *p < .05 . **p < .01, *** p < .001. Aside from estimating separate effects by years and states and using different comparison groups, the same regressors as in Model 3 are used. Coefficients are log of odds ratios. Cluster robust standard errors in parentheses.

Placebo test - alternative pre-policy years. The identifying assumption of this analysis is that a relative decline in enrollment in tuition-states can be attributed to the introduction of tuition. It is assumed that the enrollment in tuition and non-tuition states would have developed similarly in the absence of the treatment. This assumption cannot be tested but its plausibility can

be examined with a placebo test. A placebo test, which is also called a falsification exercise, examines whether differential changes in the outcome between treatment and comparison groups only occurred immediately after the treatment started or whether differential changes also occurred at other points in time. If the latter is the case, it would cast doubt that the treatment (introduction of tuition) actually caused the differences in change in the outcome variable between the treatment and comparison group. To perform a placebo test, I estimate Model 3 from the DDD analysis and successively set all years as placebo pre-policy years. The results in Table 9 suggest that enrollment probabilities in tuition-states and non-tuition-states developed similarly in all years between 1999 and 2008. The only exception is the significant decrease in enrollment between 2004 and 2005, the year tuition was announced. Given that a differential change in the enrollment gap by parental education between tuition and non-tuition states uniquely occurred in the year tuition was announced, the placebo test bolsters the conclusion that there is a causal relationship between the announcement of tuition and the relative decline in enrollment probabilities for students from low parental education.

Table 9

Placebo Tests, Effects of Implementing Tuition and on Postponing and Ruling out College Enrollment

	B	Pseudo R^2
Placebo tests – Alternative pre-policy years		
1999 as pre-policy year	-.15 (.18)	.149
2002 as pre-policy year	.12 (.17)	.149
2004 as pre-policy year	-.47 (.18)**	.149
2005 as pre-policy year	.28 (.29)	.149
2005 as pre-policy year vs. 2006/2008 together	.25 (.20)	.149
2006 as pre-policy year	-.02 (.27)	.149
Effect on postponing and ruling out enrollment		
Enrolled (2) vs. planning to enroll (1)	-.18 (.12)	.185
Ruling out enrollment (3) vs. planning to enroll (1)	.20 (.13)	.185

Note. *p < .05 . **p < .01, *** p < .001. N = 35,867. Aside from setting different years as the pre-policy year, the same regressors as in Model 3 are used. Coefficients are log of odds ratios. Cluster robust standard errors in parentheses.

Effect of implementing tuition. As was true of the findings in Table 6, I find a significant negative effect of tuition on the enrollment of students with low parental education when 2004, the year before tuition was announced, is set as the pre-policy year. To examine whether the implementation of tuition, i.e. the beginning of charging tuition, affected enrollment, I set 2005 as the pre-policy year. As noted in Table 9, there is no evidence that the implementation of tuition policy affected the enrollment decisions of Abitur graduates from low parental education. In addition to examining the changes in enrollment probabilities from 2005 to 2006, I also study the changes from 2005 to 2006/2008 together to make the results comparable to the studies by Helbig et al. (2012) and Bruckmeier and Wigger (2014). This result suggests that students from low parental education gave up their enrollment plans as soon as state representatives announced tuition and did not wait until tuition was implemented. This finding is consistent with the phenomenon known as Ashenfelter's dip (1978) which suggests that individuals react to policy changes prior to their implementation if they can anticipate them. This finding is also one explanation for why previous studies (Bruckmeier & Wigger, 2014; Helbig et al., 2012) that set 2005 as the pre-policy year, found no evidence of a negative effect of tuition on enrollment.

Effects on postponing or ruling out college enrollment. Just as in the overall analysis, I estimate whether tuition leads students from low parental education to (a) postpone their enrollment instead of enrolling in the year of high school graduation or to (b) rule out college enrollment instead of planning to enroll in later years. The results in Table 9 provide no significant evidence of a postponement effect. The gap by parental education in the probability of being enrolled compared to the plan to enroll in later years decreased (yet not significantly) in tuition states relative to non-tuition states (log of the odds ratio -0.18 (0.12)). Similarly, the gap by parental education in the probability of ruling out college enrollment versus planning to enroll in later years has increased (yet not significantly) in tuition states relative to non-tuition states (log of the odds ratio 0.20 (0.13)). While the effects are not statistically significant in a multinomial analysis, the findings suggests that tuition charges lead some Abitur graduates from low parental education to rule out college enrollment instead of planning to enroll in later years. Furthermore, some Abitur graduates from low parental education seem to postpone their enrollment instead of enrolling in the year of high school graduation when tuition is charged.

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Unfortunately, there is not data to show whether these students actually enroll in later years when tuition is charged.

The findings of this multinomial analysis suggest that moderate tuition costs do not lead high school graduates from low parental education who had planned to enroll in higher education to postpone enrollment. Nor do tuition costs lead students from low parental education who had planned to enroll in higher education in the future to rule out college enrollment. Instead, as presented in Table 7, tuition leads students from low parental education who had planned to pursue higher education to give up their enrollment plans altogether.

Taken together, the results from the difference-in-difference-in-difference analysis suggest that the probability of college enrollment among Abitur graduates from low parental education backgrounds drops by 6 percentage points when tuition is charged. While causality cannot be proven, the use of a natural comparison group, the consistency of the findings across states and years, and the fact that a divergent change in the enrollment gap by parental education between tuition and non-tuition states uniquely occurred in the year in which tuition was announced support the conclusion that the introduction of tuition has caused the decline in enrollment probabilities among students with low parental education. Below I will examine whether similar results can be found in a pre-post analysis where I compare the probabilities of Abitur graduates from the year 2005 in tuition and non-tuition states follow through with their enrollment intentions.

Analysis of Longitudinal Data on the Graduating Cohort of 2005

In this analysis, I examine whether the probability that Abitur graduates of the year 2005 follow through with the enrollment intentions they had expressed in 2004 (before tuition was announced) is lower in tuition-states than in non-tuition-states. In this way, the pre-post analysis differs from the difference-in-difference analyses which examines whether the probability that students enroll in higher education changed differently in tuition in non-tuition states. As explained in Chapter 6, the graduating cohort of the year 2005 was surveyed longitudinally. They were first surveyed in December of 2004, six months before high school graduation, and again in December 2005, six months after high school graduation. As tuition policy was announced in January 2005, the graduating cohort of 2005 thus indicated their enrollment intentions for the first time, when they did not know that tuition would be soon introduced, and a second time when they were aware of the tuition policy. If tuition affects enrollment, some of the students who had intended to enroll in higher education not knowing that tuition will be charged, should have given up their enrollment plans after the tuition policy was announced. In the pre-post analysis, I restrict the analysis to students who had expressed an intention to enroll in higher education when surveyed in December of 2004. This group makes up 68.4% of the Abitur graduates in the year 2005. I estimate whether the probability of high school graduates carrying through their enrollment intentions in 2005 is lower among students in tuition-states than in non-tuition-states, conditional on enrollment intentions in 2004. Students in non-tuition-states are thus used as a comparison group.

The results are presented in Table 10. As displayed in the first two columns, there is no evidence of an overall effect of the introduction of tuition on enrollment. The probability that students carry out their enrollment plans does not differ significantly between tuition-states and non-tuition states (Model 1). This finding remains stable when student characteristics, such as gender, Abitur grade, parental education and motivations are added as covariates (Model 2). The analysis by parental education suggests, however, that tuition discourages students with low parental education from going through with their enrollment plans. In the baseline model, where no covariates are added, the probability of carrying out enrollment plans does not differ between tuition-states and non-tuition-states for students of high parental education (log of the odds ratio

0.09 (0.27)) and there is no evidence for a significant interaction effect by parental education (log of the odds ratio -0.15 (0.15)) (Model 3). The picture changes when student characteristics are added as covariates. The negative interaction term by parental education indicates that the difference in probability of enrollment between tuition-states and non-tuition states is significantly more negative for students with low parental education (log of the odds ratio -0.33 (0.15)) (Model 4). In terms of predicted probabilities, when all covariates are held constant at their means, the relative difference is minus 8.1 percentage points. Thus, the probability that Abitur graduates carry out enrollment plans is 8.1 percentage points lower for students with low parental education than for their counterparts from high parental education in tuition-states, relative to the corresponding social inequalities in non-tuition-states.

The size of this effect corresponds very closely to the findings from the difference-in-difference-in-differences analysis. The result in percentage points is larger in the pre-post analysis because enrollment probabilities are higher in the group of Abitur graduates who intended to enroll in higher education. When I adjust for this difference (8.1 percentage points multiplied by 0.684, the percentage of students who intend to enroll in higher education), the effect is 5.5 percentage points. This result is very similar to the findings from the difference-in-differences analysis, which suggests that tuition lowers the probability of enrollment among students with low parental education by 6 percentage points. One limitation in the present analysis is that no information is available on the enrollment plans while in high school of the cohorts prior to 2005. For this reason, it cannot be ruled out that the realization rates differed between tuition and non-tuition states prior to the introduction of tuition.

Table 10

The Effect of Tuition on College Enrollment among Students Who Had Intended on Enrolling

	Overall		By parental education	
	(1)	(2)	(3)	(4)
	Baseline Model	With student Characteristics[a]	Baseline Model	With student Characteristics[a b]
Tuition-states	-.12 (.23)	.002 (.26)	-.07 (.25)	.09 (.27)
Tuition-states* Parents no college	--	--	-.15 (.15)	-.33 (.14)*
Pseudo R^2	.003	.091	.003	.087
Number of observations	1,431	1,431	1,456	1,456

Note. *p < .05, **p < .01, *** p < .001, coefficients are log of odds ratios, cluster robust standard errors in parentheses. [a] Student characteristics are: gender, Abitur grade, full/restricted Abitur degree, parental education, parental class, motivations (income, learning, social engagement, uncertain goals). The motivations for a secure job and working independently are not included because they do not predict enrollment in this model. The number of observations is slightly lower in the overall model because parental class is used as a covariate and a few observations are missing. [b] In order to present the main effect for tuition-states, I show the results without state fixed effects. The findings do not change when fixed effects are added.

Taken together, the results of the difference-in-difference analysis and the pre-post analysis suggest that the way moderate tuition affects enrollment depends on students' parental educational background. Students whose parents have a college degree were not found to be sensitive to moderate tuition. Yet, the results demonstrate that moderate tuition significantly and negatively affects the enrollment decisions of students from low parental education backgrounds. Among high school graduates whose parents do not have a college degree, annual tuition in the amount of €1,000 is associated with a drop in their enrollment probability of about six percentage points from a baseline of 42%. The results furthermore suggest that some high school graduates give up their plan to pursue higher education altogether when tuition is charged and some delay enrollment and potentially enroll later.

While causality cannot be proven (Hume, 1784), the natural experiment design and the robustness tests support the conclusion that the introduction of tuition has caused the decline in probability of enrollment among students from low parental education backgrounds. This study uses a valid comparison group of non-tuition states where the pattern of enrollment rates was very similar to tuition-states for eight years prior to the policy change. The use of a comparison group allows ruling out that the observed enrollment decline after 2004 in tuition-states is due to

a general decline in enrollment in Germany. A divergent change in the enrollment gap by parental education between the two state groups also only occurred in the year in which tuition was announced and not in any other year after 1998. A causal interpretation is further bolstered by the fact that differences between the state groups are held constant with state-fixed effects. Moreover, many other potential causes for the differential change of the enrollment gap between tuition and non-tuition-states, for example different changes in state characteristics, such as high school graduation numbers or in social composition, can be ruled out because they are held constant with covariates. The differential change in the enrollment gap between tuition and non-tuition states is not due to the introduction of bachelor's and master's degrees because the new degree structure was introduced at a similar pace in the groups of tuition and non-tuition states (HRK, 2005, 2010). While many alternative explanations have been considered, it cannot be completely ruled out that another event in the year 2005 led to the differential changes in enrollment between tuition and non-tuition states. Last, but not least, the findings of this study are also consistent across states and across the years after the policy change. A causal relationship between tuition and enrollment decline furthermore seems likely because the findings are consistent in a difference-in-difference analysis based on enrollment probabilities in states over time and in an analysis based on individual-level longitudinal data.

Chapter 9

Discussion

In this concluding chapter I first provide a synopsis of the key aspects of this dissertation and recapitulate the relevance of research on tuition effects in Germany, the key findings of this dissertation, the robustness of the findings, and their limitations as well as the contributions of this dissertation to the existing research. Following this synopsis, I will discuss what conclusions can be drawn from this dissertation for theoretical perspectives on how tuition affects students' enrollment decisions as well as discuss the implications of the findings for tuition and financial aid policies in Germany. The dissertation concludes with an outlook on questions for future research about tuition and financial aid effects in Germany.

Key Aspects of this Dissertation

In many OECD countries outside of North America, free public higher education used to be an important tradition that was thought to guarantee equal access to higher education and to be an important cornerstone for building a more egalitarian society (Marcucci, 2013). Yet in recent years, due to growing enrollments, fiscal pressures and political objections to increased public spending for higher education, an international trend emerged to break with this longstanding tradition. The introduction of tuition is a very controversial policy. In many OECD countries, there is heated debate among policy makers and researchers about whether and how tuition affects postsecondary enrollments. An issue that receives particular attention among policy makers as well as the wider public is the question of whether tuition charges deter students from low socioeconomic backgrounds from enrolling in higher education and thus aggravate social inequalities in access to higher education.

Relevance of research on tuition effects

In the US, a large body of research documents that increases in tuition levels negatively affect college enrollment, in particular for students from low-income backgrounds. Yet, despite the salience of the issue and despite a number of studies on this subject, we still know relatively little about how the introduction of moderate tuition, and tuition in general, affects college enrollment in OECD countries outside of North America. We also know very little about the effects of tuition on students from low parental education and parental-income backgrounds.

The existing studies from England and Germany almost unanimously did not find that the introduction of moderate tuition negatively affected enrollment rates. Similarly, studies from the Netherlands did not find that small annual increases in tuition of about €40 significantly affect enrollment.

Yet, the existing tuition research from Europe is limited by some methodological challenges. Studies from England and the Netherlands could not use a comparison group that was unaffected by tuition because tuition was introduced or increased in the whole country at the same time. Given a pre-existing upward trend in enrollment rates, these studies might underestimate the effects of tuition. Furthermore, the effect of tuition on students from low socioeconomic status could not be studied in England because this group was exempt from tuition until 2006. The evidence from the Netherlands only permits conclusions about the effects on enrollments of very small tuition increases which may not have been powerful enough to exhibit any effect. Prior studies from Germany have the advantage that they use on a comparison group that was not affected by tuition, yet they are limited by the fact that they investigated how tuition affects whether students formally register or say they will enroll – not whether they actually enroll. There is thus very little evidence about how tuition affects actual college enrollment in Germany. Despite a number of studies, we still know relatively little about whether and to what degree the introduction of moderate tuition affects enrollment behavior in OECD countries outside of North America.

Expanding the empirical knowledge about the effects of (introducing) moderate tuition in OECD countries outside of North America seems important from a research as well as from a policy perspective. First, moderate tuition is common in OECD countries, and we know very

little about its effects. Second, policymakers in most OECD countries that currently offer free public higher education – such as Austria, Brazil, Denmark, France, Germany[24], Ireland, Mexico and the Czech Republic – are considering introducing or re-introducing moderate tuition in various forms, (Marcucci & Usher, 2014) but lack reliable information from outside the US on which to base their decisions. Further evidence is relevant for policy debates in Germany too given that political discussions about re-introducing tuition in Germany have already begun (HAZ, 2010; Preuß & Osel, 2014).

Findings of this dissertation

This dissertation examined how the introduction of tuition in the amount of €1,000 per year affects college enrollment in Germany. In particular, I studied whether the effect of tuition varies by students' parental education and whether the introduction of tuition leads students to postpone or to give up their enrollment plans. I found no evidence that the introduction of tuition affects enrollment behavior of high school graduates in Germany in general. However, the effect of moderate tuition does differ for students from different parental educational backgrounds. Whereas high school graduates from college-educated family backgrounds are not sensitive to the introduction of moderate tuition, their peers from low parental education backgrounds are, even when the tuition level is moderate compared to international levels. After tuition was introduced in Germany, the enrollment probabilities of high school graduates whose parents do not have a college degree dropped by six percentage points (from a baseline of 42%) relative to students from high parental education backgrounds in tuition-states and to the change in the enrollment gap by parental education in non-tuition-states. Among high school graduates whose parents do not have a college degree, tuition in the amount of €1,000 is associated with a drop in probability of enrollment of about six percentage points from a baseline of 42%. When putting the decline in probability of enrollment of 6 percentage points in relation to the baseline enrollment probability of 42%, the results suggest that the probability of college enrollment drops by 14% (6/42) among Abitur graduates from low parental education backgrounds when tuition is charged. The results suggest that between the years 2005 and 2008 about 38,000 Abitur

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[24] Austria and Germany abolished tuition but are considering its re-introduction.

graduates from low parental education backgrounds in Germany gave up their plan to pursue a college degree because of the introduction of tuition.[25] Furthermore, the results suggest that some high school graduates from low parental education backgrounds give up their plan to pursue higher education altogether when tuition is charged and some delay enrollment and potentially enroll later.

Unlike previous research on the effects of tuition in Germany, this dissertation suggests that tuition negatively affects the college enrollment of students from low parental education backgrounds. These diverging results are mostly due to the fact that prior studies examined the effects of tuition on whether students say they will enroll – not on whether they actually enroll. Unfortunately, the results cannot be compared to findings from England because there is no evidence about tuition effects on students from low parental education or parental-income background in England given that this group was exempt from tuition until 2006.

Somewhat surprisingly, the effect of introducing tuition in Germany is comparable in size to the effect of tuition increases from much higher tuition levels in the US. In the US, a $1000 increase in tuition was associated with a 7 percentage point decrease in enrollment for students from low-income families in the 1990s (Kane, 1994, 1996; McPherson & Schapiro, 1991). The sizes of the effects seem to differ, however, for students from college-educated backgrounds. Unlike their peers from the US, students of high parental education in Germany are not affected by tuition in their enrollment behavior.

Robustness of findings and limitations

While causality cannot be proven (Hume, 1784), the natural experiment design and the robustness tests support the conclusion that the introduction of tuition has caused the decline in probability of enrollment among students with low parental education. First, this study uses a valid comparison group of non-tuition states where the pattern of enrollment rates was very similar to tuition-states for eight years prior to the policy change. The use of a comparison group

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[25] This number is calculated based on the numbers of Abitur graduates from tuition states published by the Federal Office for Statistics. Students from the state of North-Rhine-Westphalia are not included because the effect is not consistent in this state.

allows ruling out that the observed enrollment decline after 2004 in tuition states is due to a Germany-wide declines in enrollment. Second, divergent change in the enrollment gap by parental education between the two state groups also only occurred in the year in which tuition was announced and not in any other year after 1998. Third, a causal interpretation is further bolstered by the fact that differences between the state groups are held constant with state fixed effects. Moreover, many other potential causes for the differential change of the enrollment gap between tuition and non-tuition-states, for example different changes in state characteristics, such as high school graduation numbers or in social composition, can be ruled out because they are held constant with covariates. The differential change in the enrollment gap between tuition and non-tuition states is also not due to the introduction of bachelor's and master's degrees because the new degree structure was introduced at a similar pace in the groups of tuition and non-tuition states (HRK, 2005, 2010). Fourth, a causal relationship between tuition and the enrollment decline seems likely because the findings are consistent in a difference-in-difference analysis based on enrollment probabilities in states over time and in an analysis based on individual-level longitudinal data. Last, but not least, the findings of this study are also consistent across states and across the years after the policy change. While many alternative explanations have been considered, it can of course not be completely ruled out that another event in the year 2005 has led to the differential changes in enrollment between tuition and non-tuition states.

Below, I address the limitations of the analysis conducted. One limitation of this analysis is that students from tuition-states could avoid tuition by enrolling in a non-tuition-state. As explained in Chapter 5, for a number of reasons very few students made use of this possibility. To the extent that students did move to avoid tuition, the estimates of this study identify a lower bound of the true effect of tuition. Another limitation is that the effect of tuition is unstable in the state of North-Rhine-Westphalia. I explained some of the reasons for a differential tuition effect in this state in Chapter 8. Further research about the fluctuations in enrollment rates in North-Rhine-Westphalia would, however, be desirable.

Furthermore, it should be stressed that this study only examined the effects of tuition on enrollment during the first four years after tuition was introduced. While the effect was stable during these years, it is possible that the effect diminishes over time because norms about not

paying for higher education and about not taking debt for college may lose influence. Research about the effects of tuition in Germany in the years 2009 to 2013 is, therefore, desirable. The possibility for studying tuition effects between 2009 and 2013 and for examining the long term effects of introducing tuition are limited in the German case, however, given that the tuition-states consecutively abolished tuition starting in 2009.

Contribution to research

This dissertation contributes to the existing research on tuition effects in several ways. First, the results contribute to the research on tuition effects, given that empirical evidence about the effects of introducing moderate tuition in general and on students from low parental education backgrounds in particular has been very scarce so far in OECD countries outside of the US. To my knowledge, this dissertation is the first study to examine the effects of tuition on actual college enrollment in Germany and to examine in detail the effects of tuition on the enrollment of students from low parental education backgrounds.

Secondly, this study contributes to the existing research by attending to two key methodological challenges discussed in the literature on tuition effects. As discussed above, one methodological challenge is taking into account the general trends in enrollment in a country or a state and distinguishing them from the effects of tuition (Dynarski, 2002; Long, 2007). Given the rare natural experiment that occurred in Germany, this dissertation could use students in the states without tuition as a comparison group, which allowed distinguishing the general enrollment trend from the effect of the newly introduced tuition.

Another methodological challenge in estimating tuition effects is taking into account the actual tuition amounts prospective students face, given that tuition amounts often vary, for example, by student achievement and social background and by institution type. Given that data on individual tuition costs is often unavailable, studies frequently use the mean increase in tuition costs in a state as a measure for tuition increases. Yet as Long (2007) notes, studying changes in mean tuition costs misrepresents the price increases students with different characteristics face and therefore might lead to distorted estimates. This dissertation was able to address this concern because tuition in Germany was set at €1,000 per year regardless of student

or institutional characteristics. On the whole, this dissertation thus contributes to the research on enrollment effects of tuition from a substantive as well as from a methodological perspective.

Conclusions for theoretical perspectives on tuition and enrollment decisions

In this section I discuss what conclusions can be drawn from the results for theoretical purposes. Given that this dissertation only examined the underlying mechanisms behind tuition effects based on the existing literature and did not formally test different theories, these conclusions should be considered merely as reflections on theory. As discussed in Chapter 3, prominent theoretical perspectives, such as rational choice theories, norm-based theories, and behavioral economics, suggest diverging hypotheses regarding the extent and the mechanisms through which tuition affects enrollment decisions. Rational choice theories, such as human capital theory (Becker, 1962; 1993) and sociological rational choice theory (Breen & Goldthorpe, 1997; Erikson & Jonsson, 1996) suggest that, given the German context, the introduction of moderate tuition has almost no negative effect on students from college-educated families and, potentially, a small negative effect on students from low parental education backgrounds. Norm-based theories and behavioral economics, on the other hand, suggest that the imposition of tuition discourages college enrollment to a larger extent, in particular among students from low parental education backgrounds. In the following, I discuss how close the predictions of these theoretical perspectives come to the observed empirical effects.

As explained above, rational choice theories suggests that tuition will only affect enrollment decisions in two situations: if (a) if students lack access to loans or (b) if students expect net monetary and non-monetary benefits from a college degree that they value positively but less than the total amount of tuition (€3,000 in Germany).Therefore, the key question for assessing the extent to which rational choice theories explain the observed tuition effects, is whether 14% of low parental education students who want to enroll in higher education are credit constrained or expect very low net benefits from a college. As said above, it is difficult to quantify how many students are credit constrained or expect very low net benefits from a college in Germany because subjective net benefits can ultimately only be assessed by an individual (DesJardins & Toutkoushian, 2005).

However, the empirical evidence from Germany overall suggests that these situations apply to rather few students from low parental education backgrounds in Germany. First, just like their peers from college-educated family backgrounds, students from low parental education backgrounds have access to sufficient student loans and are not credit constrained. Second, college graduates from this background, on average, receive high monetary benefits from a college degree. Their returns to a college degree are slightly higher than the returns of their peers from high parental education backgrounds, which might outweigh the higher monetary costs students from low parental education backgrounds face due to the cost of loans and working while in college. High school graduates from low parental education backgrounds also seem to be well informed about the benefits of a college degree in terms of future employment. There is also no evidence that they discount the future benefits of a college degree at a higher rate than students from college-educated families (Jordan et al., 2008; Kroth, forthcoming). Finally, contrary to the hypotheses of rational choice theories, the scarce empirical evidence suggests that Abitur graduates from low parental education backgrounds receive sizable non-monetary benefits from a college degree because they value the higher income and status that come with a college degree just as much as their peers from college-educated families.

A few factors do, however, reduce the monetary and non-monetary benefits Abitur graduates from low parental education backgrounds expect from a college degree and might lead to a higher sensitivity to the imposition of tuition. Abitur graduates from this social background are more uncertain about whether can complete a college degree than their peers from college-educated families even when high school grades are held constant. They thus tend to misperceive their probabilities of success. Students from low parental education backgrounds might also expect lower benefits from a college degree because they are concerned about not having a "financial safety net" in case they fail in higher education. Furthermore, the need to borrow money, the uncertainty about success in higher education and the more adverse consequences in case of failure might also be unpleasant and entail non-monetary costs for students. To conclude, for the reasons explained above, doubts remain about whether 14% of low parental education students, who planned to enroll in higher education, expect net benefits from a college degree that they value less than €3,000 and are sensitive to tuition as a consequence.

The finding that students from low parental education are sensitive to tuition despite the fact that they probably expect net benefits from a college degree that exceed the costs of tuition significantly, casts doubt on the argument of rational choice theory that students generally make educational decisions that maximize their lifetime monetary and non-monetary net benefits. The introduction of tuition might, therefore, be a policy intervention to which some high school graduates do not react in a rational way. They dismiss paying a moderate fee, although paying tuition would allow them to receive much higher gains in the long run. Sociological rational choice theory, which assumes that individuals make rational educational decisions which maximize their subjective net benefits in terms of income and minimize risk and downward class mobility under class specific constraints, might therefore not provide a complete explanation for students' reactions to the introduction of tuition.

In order to understand the rather strong sensitivity to tuition among students with low parental education, it seems valuable to also consider the role of social norms and psychological mechanisms. Norm-based theories argue that students are sensitive to the introduction of tuition, even when the amount is moderate, because they have internalized social norms that one should not pay for higher education (Callender 2003; Hesketh, 1999; Marcucci, 2013) or that one should not take on debt for a college degree (Callender & Jackson, 2005; Forsyth & Furlong, 2000; Perna, 2008). Given the empirical evidence, it seems likely that norms against paying for higher education and against taking out educational loans have contributed to the relatively strong reaction to the introduction to tuition in Germany. Free-of-charge higher education is an important tradition in Germany that seems to have become a strong social norm. The vehement student protests against tuition, based on the argument that higher education was a human right that the state has to provide, suggest that that tuition-free higher education is an important norm in Germany. Survey data also document that many young people have internalized a norm that it is the role of the state – and not their responsibility– to pay for higher education. For example, only 10% of the students in Germany agreed with the statement that tuition charges are appropriate in Germany and only 19% agreed that students should bear a part of the costs of higher education (Dreyer et al., 2006).

There is also evidence that students in Germany have internalized a norm that they should not take on debt for a college degree, in particular when they are from low parental education backgrounds. As mentioned above, only 9% of the students from low parental education backgrounds use loans outside of the BAFöG program despite the fact that the majority of them indicate to struggle in financing their college education (Isserstedt et al., 2010; Ebcinoglu & Gersch, 2008). Survey results suggest that students mostly reject loans for normative reasons. Ebcinoglu and Gersch (2008) found that 63% of the students from low parental education backgrounds reject loans because they feel the state should pay for their higher education while only 28% reject loans because they are concerned about not being able to repay them.

In summary, the empirical evidence suggests there are strong social norms in Germany against paying tuition for higher education and against borrowing for college. While these norms might be shared among students in general, they likely have stronger implications for students from low parental education backgrounds because students from this background more often need to pay tuition out of their own pocket or need to take out a loan to finance tuition costs (Kroth, 2013). Norms against paying for higher education and against taking out educational loans might thus be one explanation for the why a sizable share of students from low parental education backgrounds forgo higher education when tuition is charged.

The findings of this dissertation, furthermore, suggest that considering the role of psychological mechanisms is valuable for expanding our understanding about the effects of tuition on enrollment. Behavioral economics suggests that high school graduates, in particular those from low parental education and low income backgrounds, are deterred even by moderate tuition charges because of cognitive biases. Due to zero-price and unfairness effects, high school graduates are argued to systematically overestimate the monetary and non-monetary costs they will experience in their lifetime from paying a new fee that they consider as unfair. Furthermore, due to loss aversion and because students are inexperienced in making investment decisions, students are expected to overestimate the monetary and non-monetary costs they experience from paying tuition and underestimate the net benefits they will receive from a college degree in their lifetime because they are asked to forfeit tangible income for distant gains. It is important to note that behavioral economics suggest that students experience monetary and non-monetary costs

when paying tuition but that they *perceive* these costs of paying tuition over their lifetime as higher than the *costs they actual experience over their lifetime* from paying tuition. As a consequence, behavioral economics suggest that students are unwilling to pay tuition even though doing so would allow them to receive higher net benefits over their lifetime.

As of yet, there is little empirical evidence about the cognitive processes that take place when students think about whether to pay tuition. However, the high sensitivity to tuition that is low relative to the high returns of a college degree, suggest that psychological mechanisms such as zero-price effect, loss aversion, and debt aversion might play a role in how students react to the introduction of tuition. To my knowledge, concepts from behavioral economics have so far not been used for studying tuition effects. Behavioral economics might, therefore, be a valuable new perspective for understanding how students' react to tuition and merits attention in future research on this topic.

Implications for Tuition and Financial Aid Policies in Germany

The findings of this dissertation are disconcerting because they suggest that the introduction of moderate tuition has deterred a significant number of Abitur graduates from low parental education backgrounds from enrolling in higher education and has thereby widened the already stark social inequalities in college enrollment in Germany. In the following section I discuss the implications for tuition and financial aid policies in Germany that can be drawn from this dissertation's empirical findings and from the review of the literature. I also briefly discuss what policy lessons can be learned from the US findings about tuition and financial aid policies.

Waiving tuition for students from low-SES backgrounds

This dissertation found that students from low parental education backgrounds are quite sensitive to the introduction of tuition, even when tuition levels are low and loans are offered at favorable conditions. One strategy for counteracting the deterring effects of tuition is to offer tuition fellowships for students from low socioeconomic (low-SES) backgrounds. However, findings from US research caution that increases in tuition, even if they are fully compensated for with grant aid, direct low-SES students away from higher education or to cheaper institutions (McPherson & Schapiro, 1998). This phenomenon is frequently referred to as the "sticker price shock." For tuition and financial aid practice in Germany this finding suggests that even generous tuition fellowships or grant programs may not fully compensate for the negative effects of charging tuition on the college enrollment of low-SES students.

Another strategy for addressing the tuition-sensitivity among low-SES students is to exempt them from the tuition charges. England pursued this policy until 2006, where the empirical evidence suggests that it has spared low-SES students from a potentially deterring effect of tuition (Galindo-Rueda, Marcenaro-Gutierrez & Vignoles, 2004).

A third possibility for addressing the tuition-sensitivity among low-SES students is to charge tuition in a deferred-repayment scheme after students have graduated from college. Tuition might have less of a negative effect if charged in a deferred payment scheme, as it is currently implemented in England and Australia, compared to when they are charged up-front. The reason is that psychological mechanisms described in behavioral economics, such as

hyperbolic discounting, suggest that individuals are less deterred by costs that occur later and to loans which are taken-out by default without requiring an explicit application (default-effect).

The finding that even moderate tuition negatively affects the enrollment decisions of students from low parental education backgrounds might provide a useful reference point for policy makers in other countries that consider introducing tuition, especially for countries, such as Austria, that have a similar higher education system. A detailed consideration of the specifics of a country's higher education system is important, however, for assessing whether the findings of this study provide an indication.

Broadening financial aid eligibility and amounts

The findings of this dissertation suggest that students from low parental education backgrounds are quite sensitive to the costs of pursing a college degree and that costs are one reason for the lower enrollment rates among Abitur graduates from low parental education backgrounds. While the empirical evidence about the effects of the German financial aid program BAFöG is still somewhat inconclusive, the research overall suggests that financial aid positively affects the enrollment decision of low-SES students. Given that the current income cut-offs are relatively low, widening eligibility for the BAFöG program might be a promising strategy for increasing the college enrollment of students from low-SES backgrounds. The plans of the German government to increase BAFöG amounts and widening eligibility therefore seem promising.

Providing timely financial aid information and counseling

The review of the literature indicated that low-SES students in Germany are very hesitant to borrowing for higher education. While little empirical evidence is available low-SES students might be insufficiently informed about loans and financial aid or receive information too late in the decision making process. US research found that providing brochures about financial aid does not effectively encourage college enrollment unless combined with guidance counseling (Bettinger, Long, Oreopoulos & Sanbonmatsu, 2009). The advice of guidance counselors was found to play an important role in the college enrollment decisions and financial aid applications of low-SES students (McDonough & Calderone, 2006; Perna, 2008). Introducing financial aid

counseling in German high schools so that low-SES students learn early about the availability of financial aid might be a successful strategy for encouraging their college enrollment.

Simplifying financial aid applications

Another reason for the hesitation among students from low-SES backgrounds to take out loans and to enroll in higher education might be that the application process for financial aid is quite complex and time-consuming in Germany. This complexity of the application process might prevent some low-SES students from applying for financial aid. US research found that students' financial aid amounts could be determined quite accurately with only a few pieces of information about their family situation and family income, suggesting that there is room for simplifying financial aid applications (Dynarski & Scott-Clayton, 2006; 2008). Policy makers in Germany might, therefore, want to consider reducing the extent of information required for the BAFöG application. Another concern about the BAFöG program is that application process is very lengthy. Students often only learn about their aid amounts after having enrolled in higher education. One promising strategy discussed in the US is to inform parents annually about their children's financial aid eligibility based on information from the family's prior year, or even prior-prior year tax return. This reform proposal seems a promising and cost-effective strategy for improving financial aid information and for supporting the college degree among low-SES students.

Questions for Future Research about College Costs and Financial Aid in Germany

Empirical research about the effects of tuition and financial aid is still relatively scarce in Germany and in Europe as a whole; further research is desirable. Research from the US has pursued a wide range of research questions and used a variety of methods for studying the effects of college costs and financial aid. In this concluding section of this dissertation I will describe research questions which seem relevant in the German context and point to examples from US research.

Effects of tuition on college persistence and completion

This dissertation and other studies about tuition effects in Europe examined how tuition (increases) affect students' decisions to enroll in higher education. Beyond this, another important research question is how tuition affects students' persistence, likelihood of graduating and time to degree in higher education. This question seems important in Germany given that about 21% of the college students leave higher education without a degree (Heublein, Hutzsch, Schreiber, Sommer & Besuch, 2010). Once longitudinal data on students' enrollment patters becomes available, the effects of tuition on college persistence can be studied, for example, with event history modeling. The study by DesJardins and McCall (2010) from the US is an example of study which investigates the relationship between financial aid, persistence, and completion using event history modeling, a technique optimal for studying longitudinal processes, such as student departure from higher education. Future research in Germany might also study how tuition affects college enrollment in later years after high school graduation. Furthermore, more tuition research in other OECD countries, for example, about the effects tuition increases in England or the effects of the introduction of tuition in Austria would provide interesting points of comparison.

Effects of financial aid on college enrollment, persistence and completion

Another important research question is how financial aid affects enrollment and persistence in higher education. As described in the literature review, the existing findings about the effects of BAFöG program are somewhat inconclusive. One ongoing study by Katharina Spieß (German Institute for Economic Research) and Heike Solga from (Berlin Social Science

Center) investigates the effects of grant aid on college enrollment using an experimental approach. In this study, one randomly selected group of high school graduates are offered a monthly stipend if they enroll in higher education while the comparison groups is not offered additional financial aid. This study promises to provide new insights into the effects of grant aid. To study the effects of higher aid amounts than being used in this experiment, it would be interesting to study the effects of the BAFöG program with the use of a regression discontinuity design where the enrollment and persistence behavior of students whose family income lies just below and just above the BAFöG eligibility cutoff are compared. The studies by Scott-Clayton (2008) and by DesJardins, McCall, Ott, and Kim (2010) are examples from US research that used a regression discontinuity approach to study the effects of financial aid. Furthermore, it would be interesting to compare the effectiveness of loan aid and grant aid on enrollment, persistence, and college completion.

Financial aid information

Another interesting field of research is the role of information about financial aid and about college in general for students' enrollment decisions. High schools in Germany mostly provide very limited information to prospective students. Information deficits about loans, the returns to higher education and about higher education in general might thus be reasons for why Abitur graduates from low parental education backgrounds do not enroll in higher education even when they are prepared academically. It thus seems important to study whether information programs would be an effective intervention in Germany.

Internationally, the evidence about the effectiveness of information programs is mixed. Myers et al. (2004), for example, found that a mentoring program encourages the college enrollment of undecided high school students in the US. Similarly, an information program about educational returns and the availability of financial aid was found to positively affect the enrollment intentions in Canada (Oreopolous & Dunn, 2013). A less comprehensive program in the UK, however, only increased the likelihood of high school graduation but not enrollment intentions (McGuigan, McNally & Wyness, 2012). In studying the role of information in college access, German research can learn from experimental research conducted internationally. Bettinger, Long, Oreopoulos and Sanbonmatsu (2009), for example, conducted an experiment in

which high school students were either provided with financial aid information and financial aid counseling, only information, or neither of the two. The combined approach was found to be most effective.

To my knowledge, an ongoing study by Katharina Spieß and Heike Solga is the first one to investigate how information programs affect college enrollment in Germany. This study examines how a one hour presentation about the returns of post-secondary education and about college financing affects high school graduates probability of enrollment. An evaluation of the program *Arbeiterkind* (working class child), which informs and mentors low-SES students about higher education and financial aid, would be another promising approach for expanding our knowledge about the role of information in college enrollment decisions.

Concluding Remarks

To conclude, this dissertation was completed ten years to the day after policy makers in six German states announced the introduction of tuition and students responded with the most vehement student protests and strikes since the 1960s. The existing research so far had suggested that the introduction of tuition did not negatively affect college enrollment in Germany. Yet, this dissertation suggests contrary conclusions based on examining actual enrollment decisions and additional data. The results of this dissertation suggest that the enrollment probability among Abitur graduates from low parental education backgrounds dropped by 6 percentage points from a baseline of 42% after tuition was announced relative to valid comparison groups. A significant number of students from low parental-education, therefore, seem to be deterred by tuition costs that are very low compared to the high monetary and non-monetary benefits they most likely will receive from a college degree over their lifetime.

The findings of this dissertation might come as a surprise to policy makers and researchers who designed the German tuition policy or wrote about its effects. Following a rational choice logic, the majority of them had argued that students, regardless of their socioeconomic background, will be willing to pay moderate tuition given that a college degree offers them much higher monetary and non-monetary terms in the future. The findings of this dissertation suggest, however, that students' reactions to tuition do not solely depend on cost/benefit considerations but are also shaped in important ways by social norms and psychological processes. Given the likely influence of social norms and cognitive biases, the way a tuition policy communicated to the public in large and to individual students, the way it is designed and the pace at which it is introduced, might play a decisive role in how students react to tuition charges.

As tuition charges for public higher education will likely be re-introduced in Germany and introduced in a number of other OECD countries in the foreseeable future, the insight that cultural aspects and cognitive biases shape students' reactions to tuition will hopefully be useful to those in search for tuition policies which achieve two goals that often thought to be in contradiction, namely providing higher education with the financial resources it needs for

providing advanced training to an increasingly diverse student population *while* keeping higher education accessible to students from low socio-economic backgrounds.

Appendices

A.1

The effect of tuition on college enrollment among Abitur graduates-
Overall model

	(1) Baseline Model		(2) Student Characteristics		(3) Year-specific State Characteristics		(4) Linear State Trends		pval
Schleswig-Holstein	-.34***	(.00)	-.23***	(.01)	-.26	(.15)	-.22	(.17)	(.213)
Hamburg	-.61***	(.02)	-.63***	(.02)	-.67***	(.14)	-.67***	(.14)	(.000)
Lower Saxony	-.23***	(.03)	-.05	(.04)	-.20	(.21)	-.61	(.34)	(.076)
North Rhine-Westphalia	-.39***	(.02)	-.21***	(.03)	-.69	(.60)	-2.43*	(1.05)	(.020)
Rhineland-Palatinate	-.03***	(.01)	.12***	(.01)	.04	(.19)	.14	(.23)	(.549)
Baden-Württemberg	-.23***	(.03)	-.15***	(.03)	-.46	(.38)	-1.22*	(.54)	(.023)
Bavaria	.11***	(.03)	.22***	(.04)	-.01	(.33)	-.50	(.46)	(.281)
Berlin	-.14***	(.00)	-.07***	(.02)	-.06	(.12)	-.29	(.15)	(.054)
Brandenburg	-.28***	(.00)	-.29***	(.01)	-.23	(.13)	-.25	(.13)	(.052)
Mecklenburg West Pomerania	-.05***	(.01)	-.13***	(.02)	-.00	(.19)	.14	(.13)	(.295)
Saxony	-.26***	(.01)	-.27***	(.01)	-.31	(.16)	-.59**	(.21)	(.006)
Thuringia	-.13***	(.00)	-.19***	(.01)	-.16	(.10)	-.20	(.10)	(.058)
Saxony-Anhalt	.02***	(.00)	-.02*	(.01)	.07	(.19)	.08	(.13)	(.525)
1999	-.40***	(.05)	-.59***	(.05)	-.66***	(.10)	-1.01***	(.21)	(.000)
2002	-.23***	(.03)	-.32***	(.04)	-.36***	(.04)	-.52***	(.09)	(.000)
2005	.20**	(.07)	.10	(.08)	.14	(.08)	.14	(.09)	(.098)
2006	.13*	(.06)	.02	(.08)	.04	(.10)	.10	(.09)	(.297)
2008	.16*	(.06)	.02	(.08)	-.01	(.18)	.09	(.16)	(.585)
TuitionState x After2004	.03	(.09)	.01	(.10)	.01	(.14)	.06	(.08)	(.447)
NRW x After2004	.14*	(.07)	.11	(.08)	.05	(.17)	.11	(.07)	(.126)
Low parental education (LPE)			-.21***	(.03)	-.20***	(.03)	-.21***	(.03)	(.000)
Type of high school degree			.07	(.14)	.07	(.14)	.07	(.14)	(.638)
Abitur grade			-.05***	(.00)	-.05***	(.00)	-.05***	(.00)	(.000)

A.1 (continued)

	(1) Baseline Model		(2) Student Characteristics		(3) Year-specific State Characteristics		(4) Linear State Trends		pval
Female			1.32***	(.06)	1.32***	(.06)	1.32***	(.06)	(.000)
Middle class			-.05	(.04)	-.05	(.04)	-.05	(.04)	(.290)
Working class			.07	(.07)	.07	(.07)	.08	(.07)	(.250)
Income and status			.10***	(.02)	.10***	(.02)	.10***	(.02)	(.000)
Secure job			-.10***	(.02)	-.10***	(.02)	-.10***	(.02)	(.000)
Social engagement			-.05***	(.01)	-.05***	(.01)	-.05***	(.01)	(.000)
Working independently			-.06***	(.01)	-.06***	(.01)	-.06***	(.01)	(.000)
Acquiring skills			-.29***	(.02)	-.29***	(.02)	-.28***	(.02)	(.000)
Learning and research			.52***	(.02)	.52***	(.02)	.52***	(.02)	(.000)
Uncertain goals			-.33***	(.02)	-.33***	(.02)	-.33***	(.02)	(.000)
Number of Abitur graduates					.16	(.21)	.75*	(.34)	(.030)
Unemployment rate					-.01	(.03)	.01	(.03)	(.756)
Rate of men in social service					.01	(.01)	.03*	(.01)	(.023)
SH x year							-.06***	(.02)	(.000)
HH x year							-.05***	(.01)	(.000)
LS x year							-.04**	(.02)	(.009)
NRW x year							-.07*	(.04)	(.048)
RP x year							.06***	(.01)	(.000)
BW x year							-.02	(.03)	(.372)
BV x year							-.02	(.02)	(.438)
BE x year							-.09***	(.01)	(.000)
BB x year							-.02	(.02)	(.170)
MP x year							-.03	(.02)	(.166)
SX x year							.03***	(.01)	(.000)
TH x year							.04***	(.01)	(.000)
SA x year							-.00	(.01)	(.844)
Constant	-.22***	(.02)	.24	(.17)	.40	(.55)	.28	(.57)	(.621)
Mc Fadden's R^2	.016		.148		.148		.149		
Wald Test comparing with previous model			$\chi^2(13) =$ 9040.72 $p = .000$		$\chi^2(3) =$ 0.83 $p = .841$		$\chi^2(13) =$ 1.8 x 10^5 $p = .000$		
Number of observations	35529		35529		35529		35529		

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The effect of tuition on college enrollment among Abitur graduates-

By parental education

	(1) Baseline Model		(2) Student Characteristics		(3) Year-specific State Characteristics		(4) Linear State Trends		pval
Schleswig-Holstein	-.31***	(.01)	-.22***	(.01)	-.26	(.15)	-.37*	(.17)	(.028)
Hamburg	-.46***	(.02)	-.52***	(.03)	-.58***	(.15)	-.69***	(.14)	(.000)
Lower Saxony	-.21***	(.03)	-.13***	(.03)	-.05	(.23)	-.71	(.40)	(.076)
North Rhine-Westphalia	-.26***	(.03)	-.16***	(.04)	.23	(.51)	-2.14	(1.23)	(.081)
Rhineland-Palatinate	.03***	(.01)	.14***	(.01)	.10	(.20)	-.00	(.23)	(.996)
Baden-Württemberg	-.36***	(.03)	-.41***	(.04)	-.36	(.37)	-1.49*	(.61)	(.015)
Bavaria	.03	(.03)	.09*	(.04)	.14	(.34)	-.71	(.52)	(.174)
Berlin	-.17***	(.01)	-.08***	(.02)	.08	(.13)	-.34	(.19)	(.080)
Brandenburg	-.28***	(.01)	-.28***	(.01)	-.10	(.15)	-.35	(.19)	(.062)
Mecklenburg West Pomerania	-.06***	(.01)	-.12***	(.02)	.06	(.21)	-.05	(.21)	(.815)
Saxony	-.25***	(.01)	-.26***	(.01)	-.07	(.14)	-.52*	(.24)	(.031)
Thuringia	-.13***	(.01)	-.19***	(.01)	-.06	(.11)	-.25	(.14)	(.070)
Saxony-Anhalt	.01	(.01)	-.02*	(.01)	.19	(.20)	-.02	(.18)	(.912)
1999	-.38***	(.05)	-.60***	(.05)	-.66***	(.11)	-.72**	(.26)	(.006)
2002	-.23***	(.03)	-.33***	(.04)	-.38***	(.06)	-.38**	(.12)	(.002)
2005	.27*	(.13)	.14	(.12)	.15	(.11)	.13	(.13)	(.329)
2006	.16	(.10)	.03	(.11)	.00	(.13)	.02	(.13)	(.871)
2008	.12*	(.06)	-.00	(.07)	-.10	(.18)	-.09	(.18)	(.621)
Low Parental education (LPE)	-.41***	(.07)	-.29***	(.08)	-.29***	(.08)	-.28***	(.07)	(.000)
LPE ˣ 2005	-.04	(.12)	-.06	(.11)	-.06	(.11)	-.08	(.11)	(.444)
LPE ˣ 2006	-.03	(.14)	.01	(.14)	.01	(.14)	-.02	(.14)	(.872)
LPE ˣ 2008	-.01	(.10)	-.02	(.14)	-.01	(.14)	-.06	(.13)	(.664)
HH ˣ 2005	-.61***	(.11)	-.57***	(.11)	-.54***	(.12)	-.38***	(.09)	(.000)
LS ˣ 2005	-.25*	(.10)	-.01	(.11)	.04	(.12)	-.01	(.10)	(.928)
NRW ˣ 2005	.09	(.10)	.14	(.11)	.25	(.14)	.19	(.10)	(.051)
BW ˣ 2005	.09	(.11)	.18	(.11)	.23*	(.11)	.32***	(.09)	(.001)
BV ˣ 2005	-.06	(.11)	.16	(.11)	.21	(.12)	.20*	(.10)	(.046)
HH ˣ 2006	-.09	(.10)	-.31**	(.11)	-.26	(.17)	-.10	(.10)	(.326)
LS ˣ 2006	.02	(.11)	.12	(.12)	.17	(.14)	.11	(.09)	(.222)

A.2 continued

	(1) Baseline Model		(2) Student Characteristics		(3) Year-specific State Characteristics		(4) Linear State Trends		pval
NRW × 2006	.03	(.11)	.03	(.11)	.18	(.16)	.04	(.12)	(.764)
BW × 2006	-.08	(.11)	.05	(.11)	.13	(.13)	.18*	(.08)	(.030)
BV × 2006	.12	(.11)	.25*	(.11)	.31*	(.13)	.26**	(.10)	(.006)
HH × 2008	-.05	(.06)	-.12	(.08)	-.07	(.14)	.18**	(.07)	(.008)
LS × 2008	-.10	(.06)	-.07	(.08)	-.01	(.12)	.01	(.08)	(.922)
NRW × 2008	.07	(.06)	.04	(.08)	.22	(.17)	.12	(.09)	(.204)
BV × 2008	.26***	(.06)	.36***	(.08)	.48***	(.14)	.57***	(.11)	(.000)
BY × 2008	.26***	(.06)	.26***	(.08)	.35**	(.12)	.29*	(.13)	(.023)
HH × LPE	-.19**	(.07)	-.03	(.08)	-.03	(.08)	-.05	(.08)	(.536)
LS × LPE	.14*	(.07)	.24**	(.08)	.25**	(.08)	.24**	(.08)	(.002)
NRW × LPE	-.13	(.07)	-.05	(.08)	-.06	(.08)	-.07	(.08)	(.383)
BW × LPE	.33***	(.07)	.54***	(.08)	.54***	(.08)	.52***	(.08)	(.000)
BV × LPE	.18**	(.07)	.23**	(.08)	.23**	(.08)	.22**	(.08)	(.004)
TuitionState × After2004 × LPE	-.02	(.10)	-.26*	(.12)	-.27*	(.12)	-.23*	(.11)	(.044)
NRW × After2004 × LPE	.15	(.09)	.12	(.11)	.11	(.11)	.15	(.11)	(.156)
Type of high school degree			.07	(.14)	.07	(.14)	.07	(.14)	(.631)
Abitur Grade			-.05***	(.00)	-.05***	(.00)	-.05***	(.00)	(.000)
Female			1.32***	(.06)	1.32***	(.06)	1.32***	(.06)	(.000)
Income and status			.09***	(.02)	.09***	(.02)	.10***	(.02)	(.000)
Secure job			-.11***	(.02)	-.10***	(.02)	-.10***	(.02)	(.000)
Social engagement			-.05***	(.02)	-.05***	(.02)	-.05***	(.02)	(.001)
Working independently			-.06***	(.01)	-.06***	(.01)	-.06***	(.01)	(.000)
Acquiring skills			-.29***	(.02)	-.29***	(.02)	-.29***	(.02)	(.000)
Learning and research			.52***	(.02)	.52***	(.02)	.52***	(.02)	(.000)
Uncertain goals			-.33***	(.02)	-.33***	(.02)	-.33***	(.02)	(.000)
Number of Abitur graduates					-.16	(.17)	.63	(.41)	(.119)
Unemployment rate					-.02	(.03)	-.00	(.02)	(.830)
Rate of men in social service					.00	(.01)	.01	(.02)	(.509)
SH × year							-.05**	(.02)	(.007)
HH × year							-.03**	(.01)	(.010)
LS × year							-.01	(.02)	(.741)
NRW × year							-.06	(.04)	(.143)

A.2 continued

	(1)		(2)		(3)		(4)		pval
	Baseline Model		Student Characteristics		Year-specific State Characteristics		Linear State Trends		
RP ˣ year							$.06^{***}$	(.01)	(.000)
BW ˣ year							-.05	(.03)	(.073)
BV ˣ year							-.02	(.02)	(.376)
BE ˣ year							$-.08^{***}$	(.01)	(.000)
BB ˣ year							.00	(.02)	(.860)
MP ˣ year							-.00	(.03)	(.981)
SX ˣ year							$.03^{***}$	(.01)	(.000)
TH ˣ year							$.05^{***}$	(.01)	(.000)
SA ˣ year							.02	(.02)	(.359)
Constant	-.06	(.03)	.25	(.18)	.35	(.55)	.81	(.57)	(.154)
Mc Fadden's R^2	.023		.150		.150		.151		
Wald Test comparing with previous model			$\chi^2(10) =$ 2930.84 $p = .000$		$\chi^2(3) =$ 2.28 $p = .517$		$\chi^2(13) =$ 1.29 x 10^5 $p = .000$		
Number of observations	35867		35867		35867		35867		

Note. *p < .05 . **p < .01, *** p < .001, cluster robust standard errors in parentheses. The first column shows the results of a model without covariates. The number of observations is slightly higher than in the overall model because parental class is not used as a covariate. The year 2004 is set as the pre-policy year.

A.3

The effect of tuition on college enrollment among Abitur graduates who

had intended to enroll - Overall model

	(1)			(2)		
	Baseline Model		p value	With student Characteristics[a]		p value
Tuition-state	-.12	(.23)	(.615)	.00	(.26)	(.994)
NRW	.37	(.20)	(.060)	.55[*]	(.22)	(.014)
Low parental education				-.05	(.10)	(.631)
Type of high school degree				-.03	(.14)	(.806)
Abitur grade				-.05[***]	(.01)	(.000)
Female				1.20[***]	(.09)	(.000)
Middle class				.07	(.18)	(.687)
Working class				.35	(.18)	(.051)
Income and status				.15[*]	(.07)	(.036)
Social engagement				-.19[*]	(.08)	(.019)
Learning and research				.13	(.08)	(.093)
Uncertain goals				-.39[***]	(.06)	(.000)
Constant	.43[*]	(.20)	(.029)	.81[*]	(.34)	(.016)
Number of observations	1431			1431		

Note. *p < .05 . **p < .01, *** p < .001, cluster robust standard errors in parentheses. [a] Student characteristics are: gender, Abitur grade, full/restricted Abitur degree, parental education, parental class, motivations (income, learning, social engagement, uncertain goals). Secure job and working independently are not included because they do not predict enrollment in this model. The number of observations is slightly lower in the overall model because parental class is used as a covariate and a few observations are missing.

A.4

The effect of tuition on college enrollment among Abitur graduates who

had intended to enroll - By parental education

	(1)			(2)		
	Baseline Model		p value	With student Characteristics[a][b]		p value
Tuition-state	-.07	(.25)	(.782)	.09	(.27)	(.730)
NRW	.49[*]	(.22)	(.025)	.61[**]	(.22)	(.005)
Tuition-state x LPE	-.15	(.15)	(.338)	-.33[*]	(.14)	(.021)
NRW x LPE	-.31[*]	(.13)	(.016)	-.25[*]	(.11)	(.027)
Low parental education (LPE)	.14	(.13)	(.278)	.21[*]	(.10)	(.038)
Type of high school degree				-.08	(.12)	(.502)
Abitur grade				-.05[***]	(.01)	(.000)
Female				1.19[***]	(.09)	(.000)
Income and status				.15[*]	(.07)	(.026)
Social engagement				-.20[*]	(.08)	(.015)
Learning and research				.12	(.06)	(.061)
Uncertain goals				-.39[***]	(.06)	(.000)
Constant	.40	(.22)	(.070)	.80[**]	(.31)	(.010)
Number of observations	1456			1456		

Note. *p < .05 . **p < .01, *** p < .001, cluster robust standard errors in parentheses. [a] Student characteristics are: gender, Abitur grade, full/restricted Abitur degree, parental education, parental class, motivations (income, learning, social engagement, uncertain goals). Secure job and working independently are not included because they do not predict enrollment in this model. The number of observations is slightly lower in the overall model because parental class is used as a covariate and a few observations are missing. [b] In order to present the main effect for tuition-states, I show the results without state fixed effects. The results do not change when fixed effects are added.

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