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High achieving first-generation university students

Nikki Shure[1] **and Larissa Zierow**[2]

Abstract

First-generation university graduates have been found to face a series of disadvantages on their pathway to higher education and the labor market. We use unique, national level data on high achieving university graduates to attempt to disentangle the importance of lower prior attainment from parental educational background on a series of higher education and labor market outcomes. We compare first-generation and non-first-generation graduates who are recipients of a prestigious national scholarship program targeted at the top percentile of the student distribution in Germany. We find the first-generation high achievers are more likely to study at less prestigious institutions and at institutions that are closer to home even though they have the prior attainment to go further afield. They are also less likely to study subjects with high labor market returns and are more likely to work in jobs with high job security. We furthermore find evidence that especially female first-generation high achievers are less likely to see the value of the networking opportunities the scholarship provides.

Keywords: socio-economic gaps, first-generation, higher education
JEL Classification Codes: I24, J24

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1. Introduction

Social mobility has remained an issue of interest across OECD countries as policymakers continue to search for solutions to create fairer societies (OECD, 2018). A range of previous literature has highlighted the importance of access to higher education as a pathway to social mobility (Blanden and Macmillan, 2016; Chetty et al., 2017; Rothstein, 2019). This literature has also found that access to higher education is strongly graded by socioeconomic status, including parental education (Blanden and Machin, 2004). Importantly, those who would benefit the most from the higher labor market returns and other benefits from attending higher education also have the lowest probability of attending (Brand and Xie, 2010; Dearden et al., 2004). This includes young people whose parents do not have university degrees. This makes those young people who beat the odds and become 'first-generation' university graduates of particular interest.

Previous literature on first-generation university graduates has tried to explain how parental education shapes decisions about what and where they study for university (Anelli, 2020), whether they have differential experiences and outcomes whilst at university (Riehl, 1994; Schurer et al., 2020), and whether or not university serves as an equalizer once they enter the labor market (Adamecz-Völgyi et al., 2020). Henderson et al. (2020) show that first-generation students in England are more likely to study Law, Economics, and Management and less likely to study Other Social Sciences, Arts and Humanities than their peers who match their parents with a degree. They are also more likely to drop out and less likely to study at elite institutions (Henderson et al., 2020).

Even after graduating, female first-generation students in England face a wage penalty in the labor market, which seems to be partially driven by lower prior attainment and having a lower probability of studying at elite universities (Adamecz-Völgyi et al., 2020). This echoes a key finding from this literature that first-generation students tend to have lower prior attainment than their peers who match their parents with a university degree (Henderson et al., 2020; Schurer et al., 2020), which makes it difficult to disentangle the impact of prior attainment and family background.

In this paper we build on this previous literature using data on a cohort of extremely high achieving university students. These students are scholarship holders of a large German foundation ("Studienstiftung des deutschen Volkes") which supports the university studies of the top performers of secondary school as well as the top performers of the first semesters at university (more detail below on how young people are selected for this program). These students can choose to study any subject at any university or university of applied sciences, which makes the sample representative of high achieving students across Germany, not just at one institution. Importantly,

we use the data of the foundation as a unique data source on the study choices, university experiences and labor market outcomes of very high achieving students. We do not use the data, though, for evaluating the impact of the scholarship nor the selection into the scholarship.

By analyzing high achieving university students, we aim to get closer to answering the question of the mechanisms behind the barriers that first-generation students face. Since everyone in our sample is high-achieving, any first-generation gaps we observe should not be explained by observable prior attainment, but instead for example by unobservable ability, non-cognitive skills (Edwards et al., 2022), family support, role models, network (Pascarella et al., 2004), or understanding of societal rules and norms (Friedman and Laurison, 2019). Specifically, we ask whether educational disadvantage plays a role in university and labor market outcomes even for those at the top of the attainment distribution in terms of institution type, subject area, and studying abroad and networking while at university as well as earnings and types of jobs once they enter the labor market. This is important for understanding whether university serves as a means of social mobility, especially for those already at the top of the attainment distribution.

We run a series of linear regression models with a range of rich controls, to test the differences between the two groups of students: those who match their parents with a university degree (second or continuing generation students), and those who are the "first in their family" to attend university (first-generation university students). We explore a range of outcome variables that describe the decision around entering university (e.g. where and what to study), experiences of being at university (e.g. their perceptions of the foundation), and their early career labor market outcomes (e.g. where they work, the sector, and wages).

Our results show that even amongst the highest achieving students, educational disadvantage shapes decisions about where and what to study and some labor market outcomes. High achieving first-generation students are more likely to study at universities of applied sciences (considered less prestigious than traditional universities). Furthermore, first-generation scholars are nearly 10 percentage points less likely to study at one of the top 200 institutions ranked in the QS World Ranking. On average, they study 80km closer to home than their non-first-generation peers and have a nearly seven percentage point higher probability of studying in the same federal state as where they completed high school. In terms of subject choice, first-generation scholars are significantly less likely to study medicine and law as compared to their non-first-generation peers and that this cannot be explained by prior attainment. Our results also show that the first-generation scholars are more likely to study to become teachers and less likely to study art. There are also

important gender differences. Our results show that the lower probability of first-generation students to study medicine and law is driven entirely by male scholars, whereas the difference between first-generation and non-first-generation in terms of studying to become teachers is entirely driven by women. The high achieving first-generation students are also less likely to get funding for their studies from their parents and more likely to have a job during their studies (on top of the scholarship) than their non-first-generation peers.

High achieving first-generation students also have different perceptions of the foundation and its usefulness for their future. They are less likely to report that the foundation provided them with the networking opportunities and new perspectives than their peers who match their parents with a degree. These differences are entirely driven by female students. This is important since a large part of the foundation's work, apart from funding students, involves organizing training courses and opportunities for networking. It is a prestigious and influential network in Germany, so the fact that female first-generation graduates do not see its value for them may have longer term consequences.

In terms of labor market outcomes, there are differences in terms of where high achieving first-generation students work and in what kinds of jobs, but not their wages. High achieving first-generation students are less likely to live and work outside of Germany after finishing university and are more likely to say that their current job has high security even though they are more likely to work in the private sector. Unlike previous literature, we find no wage penalty for high achieving first-generation students: there is no difference in their log hourly wage even after controlling for a range of factors. Although these are early career labor market outcomes, it seems as though high prior attainment can serve as a compensating factor for individuals who might otherwise face the disadvantage of low parental education in the labor market.

This paper proceeds as follows. In the next section we discuss the theoretical considerations and mechanisms we expect to influence first-generation university students' selection into university and degree subject, their experience whilst at university, and their transition into the labor market. In section 3 we briefly introduce the foundation and the scholarship program. In section 4, we discuss the data used in this paper as well as some key descriptive statistics. In section 5, we present the empirical strategy. This is followed by section 6 with the results. Finally in section 7, we conclude.

2. Theoretical considerations

The outcomes we explore in this paper broadly fall into three key thematic areas: (1) university and subject choice; (2) experience of university and the foundation; and (3) labor market outcomes. Each of these themes allows us to explore potential inequalities based on parental educational background at different points along the journey into higher education and subsequently into the labor market. In this section we elaborate on the key concerns around each of these transition points and highlight existing empirical evidence. For each of the themes, we discuss which mechanisms could lead to a different result for high-achieving students than for the average student analyzed in the literature thus far.

2.1 Study choices

The students we observe are in the top percentile of the student distribution so they are highly likely to get accepted at any higher education institution for any subject. They are also selected for the scholarship based on their motivation and social engagement, which is important for university admission in some countries (e.g., the US, Oxford and Cambridge in England). Nevertheless, even very high-achieving young people whose parents did not attend university may face several barriers as they make their decisions about what to study at university and to which institutions they will apply. These barriers may be driven by several disadvantages that first-generation students face including lack of role models, lack of information, perceptions of not belonging, and financial constraints.

Lack of role models: Since first-generation students are the first generation in their family to apply to and attend university, they cannot rely on their parents to serve as role models in this process. Parental involvement often plays an important role in the university application process and could disadvantage those with parents without university experience that cannot provide the same guidance for the application process (Rowan-Kenyon et al., 2008). Parents who did not attend university may also try to steer their children towards more vocationally oriented subjects with which they are more familiar. This could result in first-generation studies choosing subjects with a more clearly defined career path or faster entry into the labor market (Hoxby and Avery, 2013; Smith et al., 2013). This means that even high achieving first generation students could choose less prestigious places for their studies in case they did not have any role model to adhere to when they are at the stage of deciding where to study.

Lack of information: In a similar vein, first-generation students may just lack information about the returns to different types of institutions and subjects, even if they are high achievers in school. In Germany, studying at a full university is generally considered more prestigious than studying at a university of applied sciences and there is some evidence of differential labor market returns (Kugler et al., 2017). It is also the case that studying at an elite institution, e.g., a QS World Ranking ranked university, which provides an indication of status and selectivity, has been linked to higher labor market returns (Walker and Zhu, 2018). Yet, in schools in Germany, students do not learn about differences in returns to certain degrees etc. (Flake et al., 2017). If first-generation students (independent of their achievement) are not aware of the differential returns to university courses because they lack information, this may impact their application behavior. Recent evidence from England has highlighted the differential labor market returns to subject studied at university even for students with similar prior attainment (Belfield et al., 2018). This makes the subject studied at university an important driver of future labor market success. If high-achieving first generation students make different university and subject choices than their high-achieving non-first generation peers, this could lead to lower labor market outcomes even if their abilities would allow them to generate higher labor market returns.

Perceptions of not-belonging: University may also be perceived as an unfamiliar place where first-generation students do not belong. They may feel that they lack the cultural or financial capital to participate in university life, e.g., participating in extracurricular activities or living in student housing. Previous research on students' choice of university found differences in selection criteria between students from different backgrounds. For instance, first-generation students were found to value more psychosocial factors (e.g., having friends present on campus, positive social climate) than their peers when choosing a university (Cho et al., 2008). This may mean that high-achieving first-generation students apply to institutions closer to home even if they have the grades to attend a high-ranking institution further away (Campbell et al., 2022). Comparing students with the same qualifications, Boliver (2013) finds that students with a lower socioeconomic background are less likely to apply to elite universities than their peers.

Financial constraints: First-generation students are more likely to come from lower income families (Dynarski et al., 2021; Kroher et al., 2023). This means that even in a country like Germany with no tuition fees, they may lack the income to live in student housing or support the other costs of living associated with university study (Bargel and Bargel, 2010; Kroher et al., 2023). They may also have to support their families financially, which again may limit the types of cities in which they

can afford to study and the distance between university and home. Even if they receive a scholarship to cover cost of living, they still may be deterred from high-cost cities or from moving out of their parents' home if they can instead commute.

2.2. University experience

Once high-achieving first-generation students get to university, they still may have very different experiences due to their lack of cultural or financial capital or role models. First-generation students may not have the time to participate in extracurricular activities because they work an additional job to support their studies or because they have a longer commute due to living at home with their parents.

High-achieving first-generation students may also feel that they hit a "class ceiling" at university and are excluded or exclude themselves from certain activities because they feel they do not belong due to their social background (Friedman and Laurison, 2019). They may, for example, choose not to engage in networking events. This may be particularly salient for women as has been shown for women from a working-class background in the UK (Friedman, 2022). Pascarella et al. (2004) and Soria and Stebleton (2012) find lower engagement in extracurricular activities for first-generation students in the United States. Given that first-generation students are expected to profit more from these types of engagement (Pascarella et al., 2004), it is of special interest to find the drivers of these gaps in involvement.

High-achieving first-generation students do not have parents who attended university with whom they can discuss which courses to take or whether to study abroad. The possibility to study abroad can affect future earnings depending on the subject choice and academic background. Netz and Grüttner (2021) find for the German labor market that studying abroad pays off more for vocationally unspecific fields of studies such as economics and that graduates with a higher socio-economic background profit slightly more from studying abroad. These different university experiences can not only affect their general satisfaction with university study, but also the long-term benefits.

2.3 Post-university outcomes

At the key transition point from university into the labor market, even high-achieving first-generation university students may face disadvantages that shape their pathways. This could include

a weaker network of family and friends, the "class ceiling", a higher degree of risk aversion, or financial pressures within the family.

First-generation graduates may face a more challenging job search even if they have very high grades because they lack a professional network through their parents. These networks are useful for finding out about jobs or employers, getting feedback on applications, and informal backchanneling during an application process. This may mean that high-achieving first-generation graduates end up at less prestigious firms or occupations.

The class ceiling describes the invisible barrier that even high-achieving first-generation students bump up against in their attempts to rise up the career ladder (Friedman and Laurison, 2019). Evidence for this has been found in the UK where Waltmann et al. (2021) estimate the returns to undergraduate degrees at the age of 30. They found undergraduate degrees to have an equalizing but not a big enough effect to close the unexplained earnings gap between socioeconomic groups. The class ceiling may manifest in lower chances of promotion or a lower probability of working at highly prestigious firms or in certain kinds of occupations as compared to their non-first-generation graduate peers.

High-achieving first-generation graduates may also be more risk averse in their job search because they do not have a family safety net. This means they may be more likely to work in stable jobs with a higher degree of job security, even if these jobs do not have the same potential for salary progression or have lower earnings on average.

Due to financial pressures within the family, first-generation graduates may be under more pressure to enter the labor market directly after studies instead of pursing a PhD, for example. They may also be less likely to work outside of Germany, despite the high earnings returns to acquiring international work experience, because they need to financially support their families.

Taken together these barriers highlight the disadvantages that high-achieving first-generation graduates still face along every transition from school to labor market via university despite their high prior attainment.

3. The foundation and its scholarship program

The German Academic Scholarship Foundation ("Studienstiftung des deutschen Volkes") supports the university studies of the top percentile of students in Germany. In 2018, it supported roughly 13,000 students and 1,000 PhD students, which corresponds to one percent of all students in

Germany. Its annual budget amounts to over 120 million Euro (2018). It is not affiliated with any political party or (religious) interest group.

The foundation aims to support students with pronounced intellectual capability, motivation, communication abilities, social skills, and social commitment. Based on this guiding principle, secondary schools, universities' examination offices, and university lecturers can recommend a limited number of students.

Admission into the scholarship program is decided upon during a three-day selection seminar. During this seminar, students have one-on-one meetings (focused on their technical knowledge in their field of study, as well as on their personality and personal experiences), hold a 10-minute presentation, and partake in discussions with five other students based on these presentations. The two meetings and the presentation and discussion block are graded by members of the selection committee. Students with a combined score above a certain threshold are admitted to the foundation.

Support by the foundation consists of two main pillars: financial support and non-material support. Financial support[1] consists of a monthly grant of 300 Euros, with an additional monthly supplement of up to 752 Euros for students facing financial hardship. It is worth highlighting that this supplementary grant is explicitly designed to address financial disadvantages arising from a student's family background, aligning with a 'needs-based' approach. The amount of this additional monthly grant is based on the same guidelines as the BAföG, a publicly subsidized loan to students in need. Importantly, unlike BAföG, the grants provided by the foundation are non-repayable. Students that are not included in the health insurance plans of their parents or their partner can also receive subsidies to health insurance payments. Students studying abroad can apply for additional monthly grants, with the rate depending on the country of residence. Scholarship holders can also apply for additional funding of tuition fees. Non-material support includes mentoring, language courses, summer schools, talks, and career guidance in form of networking events. Furthermore, the foundation provides various opportunities for students to network by organizing events in university cities.

Importantly, the foundation's primary goal is not exclusively supporting first-generation students, but nurturing the best students, regardless of family background. While its main mission is to aid high-achieving students, it actively works to bridge gaps in access and outcomes. Over the

[1] Please note that the scholarship's financial support we describe is what the cohort of scholars included in our study would have received, and is not exactly equal to the amounts the current cohort of scholars (2023) receives.

past twelve years, it has implemented measures to level the playing field for first-generation students, such as introducing 'Welcome Weekends' and addressing disparities. Additionally, the foundation introduced differentiated grants for international experiences based on recipients' income levels, aiming to reduce financial barriers.

Our research utilizes data from the foundation because of the possibility to gain insights on study choices, university experience as well as labor market outcomes of high-ability first-generation and high-ability non-first-generation students and compare students. However, our study does not evaluate the direct impact of the foundation's support on students. To address our research question, we compare first-generation and non-first-generation students who received the foundation's support, abstracting from the foundation's impact. This approach provides a lower bound estimate of the difference between the two groups, should the foundation have a greater effect on first-generation students.

4. Data and methods

4.1 Data

The data used in this paper comes from the 2017 *Absolventenpanel* (Graduate Panel, AP-2017), a longitudinal study led by German Center for Higher Education Research (DZHW), International Centre for Higher Education Research at the University of Kassel (INCHER-Kassel), and the Institute for Applied Statistics (ISTAT). In addition to the nationally representative data collected by these organizations, individual universities or institutions have the possibility to commission their own survey as part of the *Kooperationsprojekt Absolventenstudien* (KOAB project). In 2017, the foundation used this option to begin a longitudinal study of their scholars who finished their studies in 2017 (ISTAT, 2020).

A sample of 2,457 scholars participated in the AP-2017. Table 1 shows descriptive statistics for key variables of interest. A comparison with administrative data from the foundation (Table A1 in the Appendix), confirms the overall representativeness of this sample. Approximately 30 percent of survey respondents are first-generation university students, meaning their parents do not have a university degree or a degree from a university of applied sciences.[2] This is the same in Table A1, which shows that 30 percent of the overall population of the foundation's scholars are first-

[2] We cannot observe whether an individual's siblings also attended university because it was not asked and they are not part of the sampling frame; we are only interested in the intergenerational transmission of educational advantage, so this does not pose a problem.

generation students. Slightly less than half of respondents in the AP-2017 are women (45%) as compared to 47 percent in the overall population of scholars in 2014.

In terms of institution and subject area, there are some small differences between our data and the administrative data on the population of scholars. For example, 86 percent of our sample attend a university (the remaining 14 percent attend a university of applied sciences), but in the administrative data this is somewhat higher at 90 percent attending a university. The same is true for certain subject areas. In the administrative data 21% of scholars are studying medicine or medical sciences, but only eight percent of those scholars who completed their studies in 2017 studied medicine or medical sciences. This could be driven by cohort effects since our data captures all those individuals who finished their studies in 2017. In general, degrees at universities of applied sciences are shorter, which may explain why more scholars from those institutions finished their degrees in 2017. The opposite is true of medicine, which is a very long degree in Germany. Taken together, however, the descriptive statistics indicate that this sample of scholars reflects the population.

Due to incomplete responses and missing data, we have a somewhat smaller sample for our analysis. We address all missing data in our covariates of interest with missing flags or mean imputation for continuous variables.

Table 1. Summary statistics

	N	Mean	Std. Dev.	Min.	Max.
Year of Birth	1967	1991	3.015	1973	1997
Age (in years)	1967	25.657	3.015	20	44
Female	1955	0.447	0.497	0	1
First-generation student	1983	0.293	0.455	0	1
Immigrant to Germany	1980	0.049	0.216	0	1
German citizen	1981	0.984	0.124	0	1
Second generation immigrant	1975	0.075	0.264	0	1
High school GPA	1964	1.340	0.444	0.700	3.500
Attends a university	1983	0.864	0.343	0	1
Law, Economics, and Social Sciences	1964	0.337	0.473	0	1
Mathematics/Natural sciences	1964	0.217	0.413	0	1
Medicine/Medical sciences	1964	0.080	0.271	0	1

Language, Cultural studies, and Sport sciences	1964	0.142	0.349	0	1
Engineering	1964	0.166	0.373	0	1
Arts/Music	1964	0.045	0.208	0	1
Agricultural, Forestry, and Nutritional sciences	1964	0.012	0.110	0	1
GPA of University Degree	1640	1.338	0.359	0.700	3.500

Notes: Data source (ISTAT, 2020). 'First-generation' is defined as neither parent having a university degree or a degree from a university of applied sciences. Subject groupings from Ianiro-Dahm and Chwallek (2016) based on Statistisches Bundesamt (Destatis) (2021).

Our main group of interest is the first-generation students amongst the scholars. In Table 2, we present descriptive statistics for a range of variables comparing those who are the first in their family to attend university versus those whose parents already had a university degree.

Table 2. First-generation versus non-first-generation university graduates descriptives

	Non-first-generation			First-generation			
	N	Mean	SD	N	Mean	SD	Diff.
Age (in years)	1392	25.57	2.93	575	25.87	3.20	0.301**
Female	1380	0.44	0.50	575	0.47	0.50	0.030
Lives in Germany	1392	0.75	0.43	577	0.83	0.38	0.077***
Immigrant to Germany	1400	0.05	0.22	580	0.05	0.21	-0.001
German citizenship	1401	0.98	0.13	580	0.99	0.10	0.007
Second generation immigrant	1396	0.07	0.25	579	0.09	0.29	0.023*
Father has high-track degree (*Abitur*)	1378	0.89	0.31	577	0.21	0.41	-0.683***
Mother has high-track degree (*Abitur*)	1379	0.83	0.37	578	0.26	0.44	-0.570***
Father has vocational training	1386	0.08	0.28	582	0.87	0.33	0.788***
Father has no/ unknown occupational degree	1386	0.02	0.15	582	0.13	0.33	0.103***
Mother has vocational training	1397	0.22	0.41	582	0.88	0.32	0.669***
Mother has no/ unknown occupational degree	1397	0.02	0.15	582	0.12	0.32	0.094***
Highest school degree: high-track degree (*Abitur*)	1396	0.97	0.17	581	0.95	0.22	-0.025***
School type: *Gymnasium*	1399	0.91	0.29	582	0.85	0.35	-0.055***

High school GPA	1388	1.30	0.40	576	1.43	0.52	0.129***
HE institution: university	1401	0.88	0.32	582	0.82	0.38	-0.063***
Law, Economics, and Social Sciences	1389	0.34	0.47	575	0.32	0.47	-0.019
Mathematics/Natural sciences	1389	0.22	0.41	575	0.22	0.42	0.005
Medicine/Medical sciences	1389	0.09	0.29	575	0.06	0.23	-0.034**
Language, Cultural studies, and Sport sciences	1389	0.14	0.34	575	0.15	0.36	0.016
Engineering	1389	0.16	0.37	575	0.18	0.39	0.020
Arts/Music	1389	0.05	0.21	575	0.05	0.21	-0.000
Agricultural, Forestry, and Nutritional sciences	1389	0.01	0.09	575	0.02	0.14	0.012**
GPA of Final University Degree	1132	1.32	0.35	508	1.37	0.37	0.050***
Gross income at time of the interview (€)	741	2857.77	1767.00	333	2756.26	1733.84	-101.508
Log hourly wage	547	0.17	0.13	238	0.18	0.14	0.013
Hours worked (per contract)	584	60.24	23.47	250	57.46	24.80	-2.782
Hours worked (actual)	573	53.02	20.83	241	51.56	20.84	-1.461

Notes: Data source (ISTAT, 2020). 'First-generation' is defined as neither parent having a university degree or a degree from a university of applied sciences. Subject groupings from Ianiro-Dahm and Chwallek (2016) based on (Statistisches Bundesamt (Destatis), 2021).

The descriptives in Table 2 highlight key differences between the two groups that will be probed in more detail later on. The final column in Table 2 presents the results for a t-test of mean differences between the groups. The first-generation group is older than the non-first-generation group and unsurprisingly also tends to come from a more disadvantaged educational background. Their parents are less likely to have a high school diploma from the highest track in the German secondary system (*Abitur*) and more likely to have completed vocational training or not have any formal qualifications. They were also less likely themselves to attend the highest track in the German secondary system (*Gymnasium*) and have on average lower high school grades than their peers who match their parents with a degree.

Table 2 also highlights some raw differences in where and what these types of students study. The first-generation group is less likely to study at a full university as compared to a university of applied sciences and is also less likely to study medicine than the non-first-generation group. They

also tend to perform slightly worse at university as they have higher university GPAs than their non-first-generation peers (in Germany a higher GPA denotes lower performance). In the rest of this paper we will probe these raw differences between the two groups.

We use the following outcome variables. For university choice, we look at whether the student attended a university or a university of applied sciences and the distance from home to university in kilometers as well as whether the university is in the same federal state as their hometown. To explore selectivity, we use information on whether the students study at a QS World Ranking ranked university. For subject choice, we group subjects according to categories used in the German labor force survey: agricultural and nutritional sciences; architecture and civil engineering; medicine and dentistry; computer science, mathematics, and science; art; teacher education (without upper secondary or vocational schools), linguistics, and cultural studies; teacher education (upper secondary and vocational schools); political, social, and regional studies; law and legal studies; social work; management; and economics and business.[3] For each of these classifications, we are able to merge in data on average lifetime earnings estimated by Kugler et al. (2017), which provides an indication of whether a subject has high or low labor market returns.

For experience of university and the foundation we look at how the students financed their studies in addition to the scholarship and how they viewed the foundation. In terms of funding, we look at the share of money they received from their parents or from a job, which also provides an indication of whether the student worked during university. The questions on the views of the foundation and its program provide some indication of how they spent their time and how they viewed their participation in this elite program. The scholars were asked to agree with a range of statements using a Likert scale as to how valuable they found different aspects of the foundation and their scholarship program. It may also give us some indication of whether they plan to participate in the foundation's network moving forward, which may provide additional networking and labor market benefits. Although this gives us an incomplete picture of their experience at university, taken together these variables shed some light on time spent at university.

[3] In German the classifications are: *Agrar- und Ernährungswiss.; Architektur und Bauingenieurwesen; Human- und Zahnmedizin; Informatik, Mathematik, Naturwiss; Ingenieur- und Technikwiss., Maschinenbau; Kunst, -wiss.; Lehramt (ohne Gymn. /Berufssch.), Sprach- und Kulturwiss.; Lehramt an Gymnasien u. Berufsschulen; Politik-, Sozial-, Regionalwiss.; Rechtswiss., -pflege; Sozialarbeit; Verwaltungswiss.; and Wirtschaftswiss.* These are the categories used in the German Microcensus and Kugler et al. (2017), from which we draw the estimates of lifetime earnings. We combine the two teacher education categories *(Lehramt (ohne Gymn. /Berufssch.) and Lehramt an Gymnasien u. Berufsschulen)* due to the coding in our data.

For labor market outcomes we focus on earnings, job sector, job location, and job characteristics. Our main earnings models focus on log hourly wages.[4] In terms of job sector, we look at whether individuals work in the private, public, or NGO/charity sector. For job location we look at whether the individual is working outside of Germany at the point of survey. In terms of job characteristics, we look at whether the individual describes their current job as having high status, high income, career perspectives, or high security as well as whether they are on a fixed term or permanent contract.

4.2 Empirical strategy

In this paper we estimate a series of linear regressions to test the differences in outcomes between the first-generation and non-first-generation group of scholars. This allows us to begin with raw differences and then condition on various groups of variables that may explain any observed differences between the two groups. We do not claim that any of the estimates provided in this paper are causal, but rather robust estimates of the differences between two groups that may be partially attributed to their educational disadvantage.

Our models take the form:

$$Y_i = \alpha + \beta_1 FirstGen_i + X'_i\beta_2 + A'_i\beta_3 + Uni'_i\beta_4 + \varepsilon_i \quad (1)$$

where Y_i is our outcome of interest;

$FirstGen_i$ is a binary indicator for whether the individual is the first-generation to go to university;

X_i is a vector of demographic characteristics including gender, first or second generation immigrant, and age;

A_i is a vector of attainment related variables. In some models we control only for high school GPA and in some models, we also control for university GPA;

and Uni_i is a vector of control variables related to university type (university vs. university of applied sciences) and subject studied using a seven category variable based on the classification of the German Federal Statistical Office (Statistisches Bundesamt (Destatis), 2021). ε_i is the error term.

We are interested in the estimates of β_1, the coefficient on the binary variable for being a first-generation university graduate. For each outcome of interest, we will initially present a raw

[4] Using interval regression, we create a continuous measure of earnings from the banded income provided in our data. We then take the logarithm of the continuous measure to normalise the earnings distribution and divide by hours worked to account for differences in annual earnings due to part time vs. full time work.

estimate of β_1 and then condition on our sets of variables as relevant to the outcome. This will enable us to compare the unconditional difference with a series of conditional estimates that account for key demographic and other characteristics.

5. Results

We present our results by key themes. Each of these themes enables us to better understand if there are differences between very high achieving university graduates based on their parental educational background at various points throughout their higher education experience and transition into the labor market. These themes are: (1) university choice and subject choice; (2) experience of university and the foundation*;* and (3) labor market outcomes.

5.1 University and subject choice

We begin by presenting the results exploring university choice. Table 1 presents the regression results for university type (a binary variable for attending a university of applied sciences), whether the university attended is in the QS World Ranking, and whether the university attended is in the top 200 of the QS World Ranking.

Table 1: University type and ranking

VARIABLES	(1) Uni applied sciences	(2) Uni applied sciences	(3) QS World Ranking	(4) QS World Ranking	(5) QS Top 200	(6) QS Top 200
First-generation	0.063***	0.033**	0.064***	0.027	-0.113***	-0.091***
	(0.017)	(0.016)	(0.022)	(0.021)	(0.024)	(0.024)
Age		-0.013***		-0.014***		0.011***
		(0.003)		(0.003)		(0.004)
Female		0.045***		0.048**		-0.071***
		(0.015)		(0.019)		(0.022)
Migration background		-0.026		-0.048		0.031
		(0.028)		(0.036)		(0.041)
High school GPA		0.250***		0.318***		-0.191***
		(0.017)		(0.023)		(0.026)
Constant	1.118***	1.109***	0.248***	0.177**	0.412***	0.412***
	(0.009)	(0.064)	(0.012)	(0.083)	(0.013)	(0.094)
Observations	1,974	1,974	1,974	1,974	1,974	1,974
R-squared	0.007	0.108	0.004	0.102	0.011	0.045

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 All missing values are accounted for using missing flags and where applicable mean imputation.

These results show that high achieving first-generation students are more likely than their non-first-generation peers to study at the less prestigious universities of applied sciences (three percentage points in the conditional model), which may also lead to lower labor market returns in the future. In terms of prestige, in raw terms they are more likely to study at a university which is listed in the QS World Ranking, but this difference is no longer statistically significant once we control for demographic characteristics and prior attainment. What is significantly different, however, is their probability to study at a very elite institution. Compared to their high-achieving peers who are not first-generation, the first-generation scholars are nearly 10 percentage points less likely to study at one of the top 200 institutions ranked in the QS World Ranking. This is despite the fact that they are the highest achievers in Germany and would have the grades to attend in addition to the possibility to get funding from the foundation to study at the very top institutions. These results are supported by the distance to university results found in Table 2, which show that high achieving first-generation students are more likely to stay close to home for their studies. On average they study 80 km closer to home than their non-first-generation peers and have a nearly seven percentage point higher probability of studying in the same federal state as where they completed high school.

Table 2: Distance to university

VARIABLES	(1) Distance from uni to home	(2) Distance from uni to home	(3) School and uni same state	(4) School and uni same state
First-generation	-80.311***	-78.654***	0.060**	0.066**
	(15.703)	(15.743)	(0.027)	(0.027)
Age		11.463***		-0.022***
		(2.508)		(0.004)
Female		15.437		-0.049**
		(14.411)		(0.025)
Migration background		62.471**		-0.030
		(26.850)		(0.049)
High school GPA		-52.245***		-0.003
		(16.941)		(0.029)
Constant	319.063***	81.769	0.485***	1.081***
	(8.491)	(62.613)	(0.015)	(0.107)
Observations	1,946	1,946	1,611	1,611

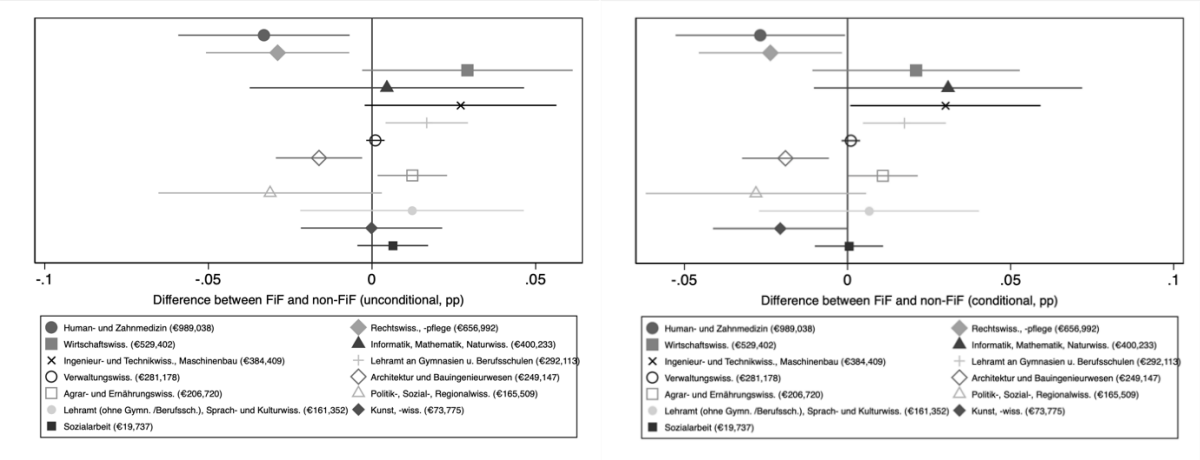
R-squared	0.013	0.032	0.003	0.024

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 All missing values are accounted for using missing flags and where applicable mean imputation. Distance from university to home measured in kilometers.

Turning our attention to subject choice, we present these results graphically in Figure 1 with full regression tables in Table A2 in the Appendix. Figure 1 shows the unconditional and conditional differences between first-generation and their non-first-generation peers in terms of subject choice. Panel (a) of Figure 1 shows the raw models and panel (b) of Figure 1 shows the conditional models. These results show that first-generation scholars are significantly less likely to study medicine and law as compared to their non-first-generation peers and that this cannot be explained by prior attainment (difference of three percentage points). This is important since medicine is considered the most competitive subject to study in Germany and has the highest entry grade requirement. Both subjects also have the highest lifetime earnings. Figure 1 also shows that the first-generation scholars are more likely to study to become teachers and less likely to study art.

Figure 1: Subject choice

(a) Unconditional models (b) Conditional models

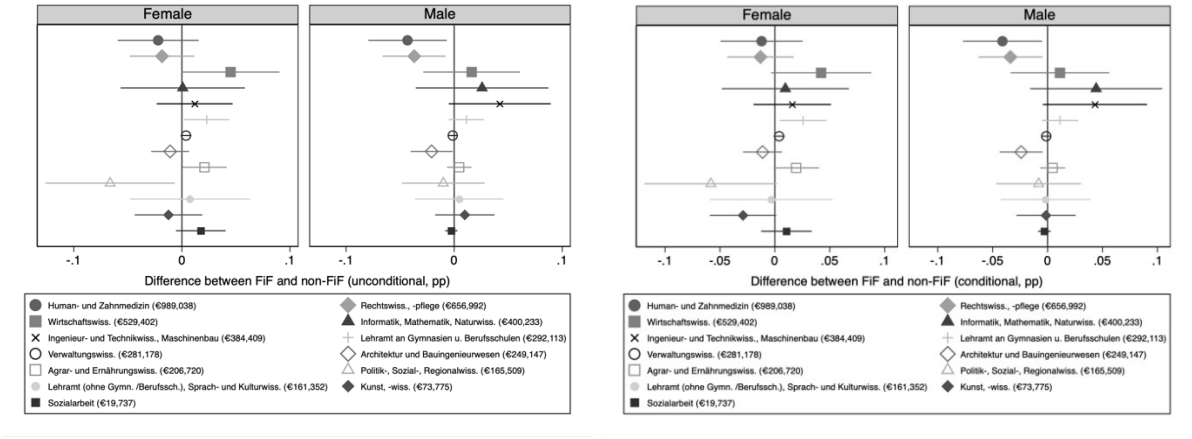


Notes: 95% confidence intervals presented. Subjects are listed with their average lifetime earnings following (Kugler et al., 2017). All missing values are accounted for using missing flags and where applicable mean imputation. Controls in the conditional models include age, sex, migration background, and high school GPA. Translations of the different subject groups, from top to bottom: medicine and dentistry; law and legal studies; economics and business; computer science, mathematics, and science; engineering; teacher education (upper secondary and vocational schools); administrative sciences; architecture and civil engineering; agricultural and nutritional sciences; political, social, and regional studies; teacher education (without upper secondary or vocational schools); art; social work

We probe these differences in subject choice separately by gender since there is a range of evidence that girls and boys make different decisions about what to study. These results are presented in Figure 2 below. These figures show that the lower probability of first-generation students to study medicine and law is driven entirely by male scholars (denoted by the circle and diamond markers in the graphs). This difference in the conditional model for male students is roughly four percentage points for each subject and statistically significant at the five percent significance level. There is no significant difference between the probability of female first-generation and non-first-generation students to study medicine or law. Similarly, the difference between first-generation and non-first-generation in terms of studying to become teachers is entirely driven by women (the difference is statistically significant for women, but not for men).

Figure 2: Subject choice by gender

(a) Unconditional models (b) Conditional models



Notes: 95% confidence intervals presented. Subjects are listed with their average lifetime earnings following (Kugler et al., 2017). All missing values are accounted for using missing flags and where applicable mean imputation. Controls in the conditional models include age, sex, migration background, and high school GPA. Translations of the different subject groups, from top to bottom: medicine and dentistry; law and legal studies; economics and business; computer science, mathematics, and science; engineering; teacher education (upper secondary and vocational schools); administrative sciences; architecture and civil engineering; agricultural and nutritional sciences; political, social, and regional studies; teacher education (without upper secondary or vocational schools); art; social work

5.2 Experience of university and the foundation

We now turn our attention to outcome variables that tell us something about how the first-generation students experience of university might differ from their non-first-generation peers even at the very top of the attainment distribution. Table 3 presents the results on how the scholars financed their studies. Even though these students receive a stipend from the foundation, they still may have other sources of funding including a job or money from their parents. Each of the outcome variables is a binary variable that captures whether the students receive more than one-third of their financing from that particular source.

The results in Table 3 highlight the socioeconomic disadvantage between these two groups of scholars. The first-generation students are nearly 30 percentage points less likely to have at least one third of their financing from their parents as compared to their peers who are not first-generation students. They are also 16 percentage points more likely to say that the scholarship constituted more than one-third of their financial support. This highlights how important the scholarship is to this group in financial terms. Interestingly, there is not a robust difference between the two groups of students in terms of relying on a job to finance a significant portion of their studies, but this may be due to the generosity of the scholarship.

Table 3: University financing source

	(1) Parents	(2) Scholarship	(3) Job
Unconditional model			
First-generation	-0.273***	0.165***	0.038*
	(0.023)	(0.024)	(0.022)
Constant	0.628***	0.492***	0.242***
	(0.013)	(0.013)	(0.012)
Observations	2,448	2,448	2,448
R-squared	0.079	0.043	0.086
Conditional model			
First-generation	-0.237***	0.160***	0.029
	(0.023)	(0.023)	(0.020)
Age	-0.002	0.036***	0.039***
	(0.004)	(0.004)	(0.003)
Female	-0.020	0.053**	0.008
	(0.021)	(0.021)	(0.018)
Migration background	-0.145***	0.109***	-0.031
	(0.038)	(0.038)	(0.033)
Constant	0.741***	-0.510***	-0.836***
	(0.103)	(0.103)	(0.090)

Observations	2,448	2,448	2,448
R-squared	0.174	0.167	0.290

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 All missing values are accounted for using missing flags and where applicable mean imputation. The conditional model also includes controls for university type, subject and attainment not presented in this table.

We now investigate how the scholars perceived the effect of the foundation on themselves. The scholars had to answer a series of questions on how the foundation, the scholarship, and its programming shaped them during their time at university. They answered these questions using a Likert scale, so we group agree and strongly agree into one category and create a binary variable for whether the scholars agreed with the following statements: the scholarship motivated them to be more ambitious, the scholarship broadened their horizons, the scholarship helped them build a network, the scholarship gave them new perspectives, the scholarship was important as a source of financing, and finally, the scholarship had no impact on them.

The results in Table 4 highlight key differences in how these two groups of scholars perceive the effects of the foundation and the scholarship. The first-generation scholars are eight percentage points less likely to say that the scholarship was important in building their network. This is important as the foundation's objective extends beyond merely establishing a robust alumni network; rather, it aims to harness the expertise and experiences of alumni to enrich the educational support for its scholars, foster broader career perspectives, and encourage collaborative knowledge sharing. Networking is also a crucial labor market skill that can have high returns. The first-generation scholars are also less likely to agree or strongly agree that the foundation opened new perspectives for them. Given the rich training program available to all scholars as part of the scholarship, the difference is surprising.

Table 4: Views of the foundation

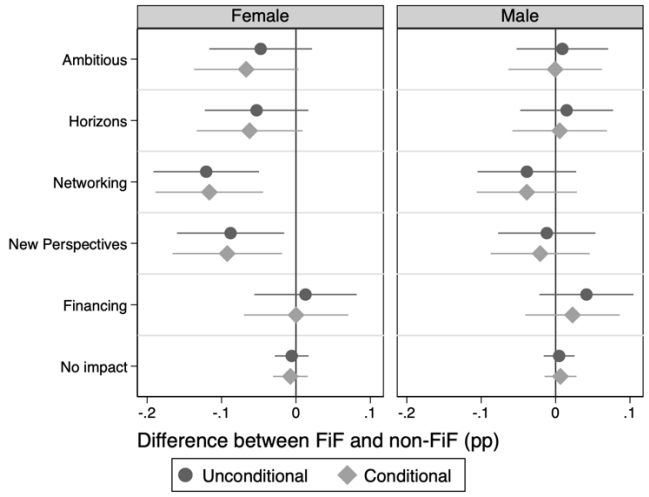
	(1) Ambitious	(2) Broadened horizons	(3) Networking	(4) New perspectives	(5) Financing	(6) No impact
			Unconditional model			
First-generation	-0.014	-0.014	-0.079***	-0.054**	0.027	0.001
	(0.023)	(0.023)	(0.024)	(0.024)	(0.023)	(0.008)
Constant	0.674***	0.657***	0.478***	0.567***	0.646***	0.027***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.004)

Observations	2,448	2,448	2,448	2,448	2,448	2,448
R-squared	0.088	0.080	0.039	0.053	0.069	0.001
			Conditional model			
First-generation	-0.025	-0.022	-0.077***	-0.057**	0.009	0.002
	(0.023)	(0.023)	(0.024)	(0.024)	(0.023)	(0.008)
Age	-0.003	0.001	-0.001	-0.001	0.007*	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)
Female	-0.051**	-0.047**	-0.064***	-0.082***	-0.018	0.000
	(0.021)	(0.021)	(0.022)	(0.022)	(0.021)	(0.007)
Migration background	0.044	0.048	0.072*	0.103***	0.043	-0.020
	(0.038)	(0.039)	(0.040)	(0.040)	(0.039)	(0.013)
Constant	0.799***	0.690***	0.581***	0.700***	0.433***	-0.002
	(0.105)	(0.106)	(0.109)	(0.109)	(0.105)	(0.036)
Observations	2,448	2,448	2,448	2,448	2,448	2,448
R-squared	0.134	0.123	0.067	0.095	0.127	0.006

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 The conditional model also includes controls for university type, subject and attainment. The outcome variables were statements with which the scholars either agreed or strongly agreed.

We probe these differences further by gender in Figure 3 and find that the difference between the two groups of scholars is driven entirely by female scholars. The female first-generation scholars are the ones who do not agree or strongly agree that the scholarship helped them build a network and gave them new perspectives. This may have important implications for future labor market outcomes since the foundation alumni network is large and those individuals who did not see its value during university may be less likely to engage once they finish university.

Figure 3: Views of the foundation by gender



Notes: The conditional model also includes controls for university type, subject and attainment. The outcome variables were statements with which the scholars either agreed or strongly agreed.

5.3 Labor market outcomes

As this survey data is collected once the scholars have finished university and entered the labor market, there are a range of questions around their current occupational situation. This is an especially interesting area for trying to understand if the socioeconomic penalty observed in the labor market in many other countries still exists at the very top of the attainment distribution.

We begin by looking at early career labor market earnings. Table 5 presents our regression models for log hourly wages. The coefficients on first-generation students are small in magnitude and not statistically significant, indicating no difference between the earnings of these two groups of scholars. This result is robust to the inclusion of a range of demographic and attainment control variables. Due to the small sample size, we are not able to run these regressions separately by gender; however, our control variable for gender in Table 5 is not statistically significant indicating there is no gender wage gap at this early career point.

Table 5: Log hourly wages

	(1) Log hourly wage	(2) Log hourly wage	(3) Log hourly wage	(4) Log hourly wage
First-generation	0.019	0.013	0.007	0.009
	(0.029)	(0.028)	(0.028)	(0.029)
Age		-0.204***	-0.206***	-0.197***

		(0.046)	(0.046)	(0.048)
Age squared		0.003***	0.003***	0.003***
		(0.001)	(0.001)	(0.001)
Female		0.010	0.008	0.005
		(0.026)	(0.026)	(0.026)
Migration background		0.045	0.042	0.043
		(0.048)	(0.048)	(0.048)
Constant	0.230***	3.307***	3.291***	3.210***
	(0.016)	(0.645)	(0.645)	(0.669)
Observations	834	834	834	834
R-squared	0.003	0.055	0.058	0.074

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 The conditional model in Column (2) includes age, age squared, female, and migration background. Column (3) also includes school GPA. Column (4) also includes controls for university type, subject and university GPA.

Although we do not observe differences in earnings between the two groups of scholars, there still may be other differences in their labor market outcomes. We examine where and in what kind of sector the scholars work at the point of survey as well as where they report living in Table 6. As we control for subject studied and attainment, this should not be driven by those factors. The first-generation group is also six percentage points less likely to live outside of Germany following university.

Table 6: Job sector and location

	(1) Private sector	(2) Public sector	(3) NGO	(4) Lives abroad
		Unconditional model		
First-generation	0.089***	-0.057	-0.032*	-0.077***
	(0.034)	(0.035)	(0.019)	(0.019)
Constant	0.389***	0.525***	0.086***	0.250***
	(0.019)	(0.019)	(0.010)	(0.010)
Observations	1,056	1,056	1,056	2,448
R-squared	0.006	0.003	0.003	0.047
		Conditional model		
First-generation	0.066**	-0.020	-0.046**	-0.061***
	(0.032)	(0.033)	(0.019)	(0.019)
Age	-0.006	0.003	0.004	-0.015***
	(0.005)	(0.006)	(0.003)	(0.003)
Female	-0.058*	0.033	0.025	0.009
	(0.030)	(0.031)	(0.017)	(0.017)
Migration background	0.123**	-0.051	-0.072**	0.008

	(0.055)	(0.056)	(0.031)	(0.032)
Constant	0.563***	0.499***	-0.062	0.723***
	(0.151)	(0.155)	(0.087)	(0.086)
Observations	1,056	1,056	1,056	2,448
R-squared	0.172	0.149	0.071	0.076

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Conditional models include controls for university type, university subject, and prior attainment.

Finally, in Table 7 we present the results of our models examining self-perceived job characteristics. This includes whether the scholars view their job as high status, providing a high income, offering longer term career perspectives, and providing job security. These results show very little difference between the first-generation and non-first-generation scholars except in terms of job security. Here the first-generation group is four percentage points more likely to agree or strongly agree that their current job provides them with job security. Taken together these labor market outcomes reveal small, but potentially important differences between the two groups of scholars.

Table 7: Self-perceived job characteristics

	(1)	(2)	(3)	(4)
	High status	High income	Career perspectives	Job security
Unconditional model				
First-generation	-0.005	0.025	-0.017	0.055***
	(0.022)	(0.019)	(0.020)	(0.020)
Constant	0.372***	0.234***	0.273***	0.257***
	(0.012)	(0.010)	(0.011)	(0.011)
Observations	2,448	2,448	2,448	2,448
R-squared	0.081	0.046	0.052	0.052
Conditional model				
First-generation	-0.009	0.025	-0.015	0.041**
	(0.021)	(0.019)	(0.020)	(0.020)
Age	0.039***	0.026***	0.022***	0.018***
	(0.003)	(0.003)	(0.003)	(0.003)
Female	-0.003	-0.055***	-0.045**	-0.003
	(0.019)	(0.017)	(0.018)	(0.018)
Migration background	0.001	0.023	0.006	0.004
	(0.035)	(0.031)	(0.033)	(0.033)
Constant	-0.663***	-0.413***	-0.300***	-0.341***

	(0.095)	(0.086)	(0.089)	(0.090)
Observations	2,448	2,448	2,448	2,448
R-squared	0.188	0.126	0.121	0.127

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Conditional models includes controls for university type, university subject, and prior attainment.

6. Conclusion

In this paper we compare first-generation university graduates with non-first-generation graduates from the very top of the ability distribution. The data used is unique in that it does not rely on a sample of graduates from one specific elite institution, but instead includes the top performers nationally. The individuals in our sample are supported by a prestigious national scholarship foundation ("Studienstiftung des deutschen Volkes"), which requires academic performance at the very top and offers them a unique slate of training opportunities and a long-term network. This allows us to disentangle the relationship between prior attainment and socioeconomic status on university and labor market outcomes, which much of the literature in this field cannot.

Our findings show that being a high achieving first-generation student compensates for much of the disadvantage this group faces in the broader population, but some of it still remains. Like Henderson et al. (2020), we find differences in what first-generation students study at university and the types of institutions they choose as compared to their non-first-generation peers. They find that first-generation students are less likely to study at elite Russell Group universities and we find that the first-generation students in our data are less likely to study at an elite institution ranked in the top 200 of the QS World Ranking and more likely to stay close to home. This is striking since the first-generation students in this sample are not completely constrained by the cost of university or poor academic performance. They comprise part of the top 1% performers of Germany's high school graduates, so they have the grades for these elite institutions. The foundation will also cover tuition costs up to 10,000 Euros and give them a stipend, which should make mobility less of a concern. This tuition support would not fully cover study at an elite US or UK institution, which may explain some of the difference in the probability of studying at a QS World Ranking top 200 university. It could also be the case that these students have financial or other caring responsibilities at home, which should be probed further to better understand their decision-making process.

We also find that first-generation scholars in this sample are less likely to study medicine and law. Since doctors and lawyers are amongst the highest earners in Germany, this may have long term

implications inequality in labor market outcomes (Kugler et al., 2017). This is different from Henderson et al. (2020), who find that first-generation students were actually more likely to study law, economics, and management, some of the higher earning subjects in England. We also find that high-achieving female first-generation students are more likely to study to become teachers. This may be driven by a role model effect, i.e. teachers during their schooling may have been the closest role model with a university degree. Interestingly, this choice does not appeal to first-generation men in the same way as they are no more likely than their non-first-generation male peers to study to become teachers.

In terms of other labor market outcomes, it seems as though the high attainment of this particular group of first-generation graduates limits some of the socioeconomic disadvantage traditionally faced by this group. We do not find any evidence that the first-generation group of scholars earns less money once they enter the labor market. This is different from Adamecz-Völgyi et al. (2020) who find that first-generation women earn eight percent less than their non-first-generation peers. In that paper they find that attending a high status, Russell Group institution and prior attainment can explain part of the first-generation wage penalty for women. It may be the case that since everyone in our sample is high achieving, we do not observe a wage gap.[5]

Of course, these are very early labor market outcomes collected within one year of graduation, so it may be too early for gaps to emerge. Some of the differences that emerge in other labor market outcomes between the first-generation and non-first-generation group in our sample point to this. We find that the first-generation group are more likely to work in the private sector, but are also more likely to say their current role has high job security. Jobs with high job security (e.g. civil servants) may have smaller earnings growth over the lifetime.

At the same time, there was some evidence that the first-generation scholars may be less likely to use the foundation's network. In particular, female first-generation graduates were less likely to have seen the value in the foundation's network and have built their network this way. This may limit them from taking part in the foundation's alumni network in the future, which may have important career benefits.

Taken together these findings indicate that not all of the disadvantage faced by first-generation graduates can be accounted for by prior attainment, and that family background still plays

[5] Additionally, if the scholarship itself has a positive impact on first-generation students and impacts first-generation students differently than non-first-generation students, part of finding a smaller socioeconomic disadvantage in this study could be driven by the scholarship's impact.

a role for the very high achieving students. We observe differences in the decisions and outcomes of high achieving first-generation graduates, which may have lifelong consequences. From a social mobility perspective, this means that improving the achievement of individuals from disadvantaged backgrounds may not be enough. The gaps in knowledge about university and the labor market that arise by not having a parent who attended university or the potential 'class ceiling' faced by those from disadvantaged backgrounds cannot be fully overcome by high academic achievement. Consequently, bridging these knowledge gaps remains a challenge that universities and scholarship foundations are faced with if they aim to increase social mobility.

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Appendix

Table A1. Administrative data on the foundation's scholars (2014)

		Share in total population of foundation scholars
Women		0.47
First-generation student		0.30
Type of university	University	0.90
	University of applied sciences	0.07
	Arts or music institution	0.03
	Other institution type or missing	-
Subject group	Law, Economics, and Social Sciences	0.24
	Mathematics/Natural sciences	0.20
	Medicine/Medical sciences	0.21
	Language, Cultural studies, and Sport sciences	0.18
	Engineering	0.11
	Arts/Music	0.05
	Agricultural, Forestry, and Nutritional sciences	0.01

Notes: Data source is Table 1 in Ianiro-Dahm and Chwallek (2016). N=10,725

Table A2. Conditional subject choice models

	(1) Agricultural and nutritional sciences	(2) Architecture and civil engineering	(3) Medicine and dentistry	(4) Computer science, mathematics, and science	(5) Engineering	(6) Art	(7) Teacher education (without upper secondary or vocational schools), linguistics, and cultural studies
First-generation	0.011**	-0.019***	-0.027**	0.031	0.030**	-0.021*	0.007
	(0.005)	(0.007)	(0.013)	(0.021)	(0.015)	(0.011)	(0.017)
Age	0.001	0.001	0.014***	-0.022***	-0.010***	0.005***	0.011***
	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Female	0.012**	-0.007	-0.001	-0.116***	-0.092***	0.000	0.082***
	(0.005)	(0.006)	(0.012)	(0.019)	(0.013)	(0.009)	(0.015)
Migration background	-0.015	0.007	0.017	0.015	-0.025	0.025	-0.000
	(0.009)	(0.011)	(0.022)	(0.035)	(0.025)	(0.018)	(0.029)
High school GPA	0.003	0.017**	-0.063***	-0.071***	-0.005	0.079***	0.082***
	(0.006)	(0.007)	(0.014)	(0.021)	(0.015)	(0.011)	(0.018)
Constant	-0.022	-0.010	-0.182***	0.978***	0.389***	-0.207***	-0.260***
	(0.021)	(0.026)	(0.051)	(0.081)	(0.057)	(0.041)	(0.066)
Observations	2,416	2,416	2,416	2,416	2,416	2,416	2,416
R-squared	0.011	0.008	0.041	0.063	0.035	0.111	0.011

	(8) Teacher education (upper secondary and vocational schools)	(9) Political science, social and regional studies	(10) Law and legal studies	(11) Social work	(12) Management	(13) Economics and business
First-generation	0.017***	-0.028	-0.024**	0.000	0.001	0.021
	(0.006)	(0.017)	(0.011)	(0.005)	(0.001)	(0.016)
Age	0.000	-0.000	0.007***	0.002**	-0.000	-0.007***
	(0.001)	(0.003)	(0.002)	(0.001)	(0.000)	(0.002)
Female	0.006	0.130***	-0.003	0.020***	0.000	-0.033**
	(0.006)	(0.016)	(0.010)	(0.005)	(0.001)	(0.015)
Migration background	-0.014	-0.074***	0.028	0.006	-0.001	0.033
	(0.011)	(0.029)	(0.019)	(0.009)	(0.002)	(0.027)
High school GPA	0.001	0.013	-0.048***	0.001	-0.001	-0.009
	(0.007)	(0.018)	(0.011)	(0.005)	(0.001)	(0.017)
Constant	0.011	0.108	-0.054	-0.059***	0.005	0.304***
	(0.025)	(0.066)	(0.043)	(0.021)	(0.006)	(0.063)
Observations	2,416	2,416	2,416	2,416	2,416	2,416
R-squared	0.006	0.043	0.023	0.083	0.002	0.047

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 All missing values are accounted for using missing flags and where applicable mean imputation.