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Does Ignorance of Economic Returns and Costs Explain the Educational Aspiration Gap? Representative Evidence from Adults and Adolescents

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The gap in university enrolment by parental education is large and persistent in many countries. In our representative survey of German adults, 74% of university graduates, but only 36% of those without a university degree, favour university education for their children. The latter are more likely to underestimate returns and overestimate costs of university. Similarly, 75% of adolescents with university-educated parents, but only 51% without university-educated parents aspire to a university degree. Experimental provision of general return and cost information does not close the aspiration gap as treatment effects are at least as strong for individuals with a university background as for those without. Differences in economic preference parameters also cannot account for the educational aspiration gap.

I. INTRODUCTION

A key rationale for government involvement in the education sector is to provide all citizens with the opportunity to obtain the professional qualifications that they have the ability and passion to pursue. In reality, however, gaps in educational attainment between individuals from different family backgrounds are substantial (Black and Devereux 2011; Björklund and Salvanes 2011; Holmlund *et al.* 2011) and contribute to the persistence of inequality across generations (Corak 2013; Autor 2014; Alvaredo *et al.* 2017). These gaps exist not just in outcomes, but—as our data show—already in individuals' aspirations for higher education. One potential reason for gaps in aspirations is that individuals from families without a background in higher education may underestimate its returns and overestimate its costs. Indeed, evidence indicates that informing about the returns and lowering application costs can increase the aspirations and attainment of specific groups of students.¹ This has substantial policy relevance: if the lack of awareness of educational returns and costs differs by socioeconomic background, then information campaigns about the returns to higher education and the options to receive student aid might help to reduce educational inequality. In this paper, we study the extent to which differences in the knowledge of average returns and costs of university education contribute to the socioeconomic gap in educational aspirations of adults and adolescents.

We conduct our analysis in representative samples of the German adult and adolescent population. We first elicit beliefs about the returns and costs of university education.² We then provide random treatment groups with different types of information about the average returns and costs of university education before eliciting everyone's educational aspirations. The survey experiments allow us to estimate how information provision affects educational aspirations compared to a control group that does not receive the information. On this basis, we evaluate the extent to which information provision is able to close the educational aspiration gap. In our adult sample with over 7000 respondents, we focus on the gap between individuals with and without a university degree in their aspirations for the ideal educational degree for their child. As

children's own aspirations and expectations are another key component of their educational choices, we complement the analysis of the adult population by experimentally studying how information provision affects educational aspirations of adolescents with and without university-educated parents in a representative sample of over 1000 youths aged 14 to 17 years.

We choose to focus on educational aspirations because they are a necessary condition for, and a strong predictor of, actual future educational choices.³ By asking adults which educational degree they consider ideal (rather than realistic) for their hypothetical child, and by asking adolescents whether they would like to (rather than expect that they will) study, we obtain measures of respondents' educational aspirations that abstract from possible institutional or child-specific factors that may constrain actual educational choices (see also Bleemer and Zafar 2018).⁴ Since such constraints might lead to aspirations not translating into actual educational outcomes, our treatment effects should be interpreted as an upper bound on the potential impact of this type of information on gaps in actual educational outcomes. That is, if information affects aspiration gaps, then it is not entirely clear whether these changes in aspirations would translate into actual attainment. If, on the other hand, information does not affect aspiration gaps, then it is unlikely that it would affect gaps in actual educational outcomes. Furthermore, as ideal aspirations can be elicited from the whole population rather than only from parents or students who currently face educational decisions, the focus allows us to gain a representative assessment of the nationwide inequality in aspirations.

Our findings indicate that aspirations do indeed differ strongly by educational background. In the control group of the adult sample, 74% of university graduates but only 36% of those without university education consider a university degree (rather than an apprenticeship degree) the ideal educational outcome for their child. Intriguingly, this aspiration gap of 38 percentage points is similar to the gap in actual university enrolment decisions by family background (Middendorff *et al.* 2013). In the adolescent sample, we find an aspiration gap of 24 percentage points between adolescents with and without university-educated parents. Adults without a university degree tend to underestimate the average returns (i.e. earnings and employment) and overestimate the costs (i.e. tuition fees and available student aid) of university education more than those with a university background. Similarly, adolescents without university-educated parents overestimate the earnings returns to a significantly lesser extent than adolescents with university-educated parents. In principle, these informational asymmetries suggest that ignorance among those without a university background could contribute to the educational aspiration gap.

Our experimental results show that informing about the actual average returns and costs of university education indeed tends to increase the educational aspirations of respondents. However, the information treatment effects are at least as strong among individuals with a university background as among individuals without. As a consequence, if anything, the provided information increases rather than decreases the gap in educational aspirations.

Specifically, informing adult participants how much higher the earnings of people with a university degree are compared to those without raises the share of respondents aspiring to a university degree by 11 percentage points among university graduates and by 5 percentage points among those without university education. Informing about the magnitude of available government student aid raises educational aspirations by 8 percentage points among university graduates but does not affect aspirations of those

without a university degree. Providing information on the lower unemployment rates of university graduates or on the fact that German universities currently do not charge tuition fees does not significantly affect educational aspirations.⁵ These experimental results persist in a follow-up survey about two weeks later.⁶ The results are also prevalent in the subsample of parents.

Strikingly, the same qualitative results emerge for the educational aspirations of adolescents. Informing about the average earnings returns of university education increases university aspirations of adolescents with at least one university-educated parent significantly, by 8 percentage points, but has a small and insignificant effect of 2 percentage points on those without a university-educated parent. Our consistent experimental findings among adults and adolescents cast doubt that ignorance of average economic returns and costs of university education among persons without a university background can explain the educational aspiration gap in Germany.⁷

Finally, we investigate whether differences in economic preference parameters can account for the educational aspiration gap. While costs of education are immediate, benefits are realized in the uncertain future. Therefore differences in intertemporally relevant preferences between respondents with and without a university background could be a complementary explanation for the educational aspiration gap. Our descriptive analysis shows that time preferences, risk preferences and overconfidence do indeed differ by educational background, but that these differences account for only a small part of the gap in aspirations among both adults and adolescents. In sum, our results suggest that consideration of average economic returns, costs and preferences does not add to an understanding of the educational aspiration gap in Germany. These findings suggest that alleviating informational asymmetries through simple information interventions might not be sufficient to enhance equity in Germany.

Our paper contributes to the literature on how expectations of college returns and costs relate to educational choices.⁸ In particular, we add to a range of experimental studies mostly from the Americas that investigate the effects of information provision on students' educational aspirations and choices.⁹ While most related studies are based on small, self-selected student samples, often from disadvantaged backgrounds, our samples are representative of the German adult and adolescent populations, respectively. Intriguingly, we show that effects are strongest among higher-educated families, a margin that has received little attention in the literature so far. Our focus allows us to provide a representative assessment of the educational aspiration gap in society and to scrutinize the distributional implications of information provision. Appreciating the fact that educational choices are often made jointly by parents and children, a unique contribution of our paper is that we conduct the experiments among adults *and* adolescents. Reassuringly, we find the same qualitative results in both samples, raising confidence in the general validity of the findings.

Methodologically, our paper is part of the growing literature that uses survey responses on educational preferences, expectations and aspirations to study educational choices.¹⁰ Compared to the existing literature, a unique feature of our analysis is that it draws on representative samples. To our knowledge, it is the very first to experimentally study aspirations in a representative sample of adolescents, as well as the first representative assessment of adults outside the USA. Focusing on a representative sample of US household heads (but not adolescents), Bleemer and Zafar (2018) find positive effects from informing about college returns (but no effects for costs) on educational aspirations for (hypothetical) children in a way that reduces socioeconomic aspiration gaps. As discussed further in the Conclusion (Section VII), the fact that we

find different results in our setting may reflect institutional differences between the USA and Germany, such as differences in university costs or in the availability of alternative career paths, but this may also reflect the fact that treatment effects on college aspirations of higher-educated individuals in the USA may be subject to ceiling effects. In this sense, our German results may be particularly relevant for many countries in Europe and other parts of the world where aspirations for university attendance are not yet close to universal.

The remainder of the paper is organized as follows. Section I introduces the survey that we use for our analysis. Section II describes our experimental designs. Section III presents the empirical model. Section IV presents the results for adults—including the socioeconomic gap in educational aspirations and in beliefs about the returns and costs of university education—as well as our experimental results on the effects of providing information about educational returns and costs on educational aspirations. Section V shows equivalent results for adolescents. Section VI adds descriptive evidence on the extent to which differences in economic preferences can account for the educational aspiration gap. Section VII concludes.

II. THE IFO EDUCATION SURVEY

We conduct our analyses within the framework of the ifo Education Survey, an annual opinion survey on education policy that we have implemented in Germany (see Lergetporer *et al.* 2021). The adult sample covers a total of 7270 respondents aged 18 and above, with 3302 respondents sampled in 2016, and 3968 respondents sampled in 2017. The adolescent sample covers 1085 respondents aged 14–17 years, sampled in 2018. We describe the adult sample here and return to the adolescent sample in the first subsection of Section V.

The adult sample is drawn in two parts to ensure representativeness of the German adult population. To represent the population that uses the internet, 82% of respondents are sampled and surveyed via an online platform. In each of the two waves, internet-using participants are drawn from a non-probabilistic online access panel using quota sampling based on the national marginal distributions of gender, age and region. The remaining 18% of respondents are persons who report that they do not use the internet; they are polled at their homes by trained interviewers as part of a household survey drawn by probability-based random sampling.¹¹ To ensure that the sample represents the German adult population in terms of observables, we weight our analyses using official statistics from the German Microcensus on age, gender, educational attainment, region of residence and municipality size throughout. In both waves, the survey contains a total of more than 30 questionnaire items on different topics of education policy, and collects respondents' sociodemographic background characteristics, including time and risk preferences. The median respondent spent 18 (17) minutes answering the survey in 2016 (2017). Item non-response is low, for example at 2% for the main outcome measure of educational aspirations. Treatment status does not predict the share of missing answers for any outcome measure.

To assess whether treatment effects persist beyond the immediate horizon of the survey, we invited respondents in the online sample of the 2017 survey wave to participate in a later follow-up survey that re-elicits some outcomes, but does not comprise any information treatment. A total of 2300 respondents (62% of the 2017 online sample) participated in the follow-up survey, a relatively high re-contact rate compared to the literature.¹² The median time lag between the main survey and the follow-up is 12 days, ranging from 5 to 41 days.

Our main analysis focuses on differences by respondents' educational background (rather than, for example, income), which is particularly relevant in the German context because: (i) direct costs of university education are very low as university studies generally include free tuition and generous student aid is available; and (ii) educational inequality measured as the influence of parents' education on children's educational attainment is particularly pronounced (e.g. Schuetz *et al.* 2008; Middendorff *et al.* 2013; Woessmann *et al.* 2019; Lergetporer *et al.* 2020).¹³ As indicated by participants' sociodemographic characteristics described in Table 1, 19% of respondents hold a university degree, 68% hold an apprenticeship degree, and 12% do not hold any professional degree.¹⁴ Among all respondents, 59% have children, and 28% have children who have not yet completed their education.

III. EXPERIMENTAL DESIGN

The goal of our experimental investigation is to evaluate whether ignorance of the returns and costs of university education can contribute to an explanation of the socioeconomic gap in educational aspirations. To this end, we randomly provide information about the average returns and costs, and estimate whether this affects participants' educational aspirations for their children. Since our samples comprise respondents from all educational backgrounds, including a significant share of respondents with a basic school degree or less, we deliberately designed our survey instruments to be as simple as possible to minimize the possibility of comprehension problems.¹⁵ In what follows, we first describe how we elicit participants' beliefs about returns and costs. We then present the different experimental information treatments, which form the basis of our empirical analysis. Next, we describe how we elicit educational aspirations. Finally, we describe our follow-up survey. The description here focuses on the adult sample; respective adaptations for the adolescent sample are described in the first subsection of Section V.

Elicitation of beliefs about returns and costs

The basic idea of our experiments is that information provision affects educational aspirations by correcting respondents' prior beliefs about the average returns and costs of a university degree. To assess the extent to which respondents with different educational backgrounds misperceive the returns and costs of a university degree, we measure beliefs about the returns and costs of university education early in the survey, before providing information and eliciting aspirations. This enables us to test whether different levels of ignorance are a relevant mechanism through which the information treatments may affect educational aspiration gaps.¹⁶

To elicit baseline beliefs about the returns to pursuing university education, we ask respondents to estimate the monthly earnings and the unemployment rates of university graduates and of those without any professional degree.¹⁷ To anchor respondents' estimates, the questionnaire items inform them that current monthly earnings of those with an apprenticeship degree are about 1850 euros, and that their unemployment rate is about 5%.¹⁸ The answers allow us to estimate the university premium perceived by respondents in comparison to apprentice graduates. Respondents report their answers using an open-ended field. After answering, respondents are asked to report how sure they are that their answer is close to correct on a 7-point scale (from 1 = 'Very unsure' to 7 = 'Very sure').

TABLE 1
SUMMARY STATISTICS OF BACKGROUND VARIABLES AND BALANCING TESTS FOR ADULT SAMPLE

	Covariates predicting treatment status for experiment with information on					
	Mean [SD] (1)	Earnings differential (2)	Unemployment differential (3)	Tuition fees (4)	Student aid (5)	Tuition fees and student aid (6)
Age	50.5 [18.7]	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001* (0.001)	-0.001* (0.001)
Female	0.513	-0.021 (0.025)	0.016 (0.026)	-0.016 (0.026)	-0.011 (0.026)	-0.019 (0.026)
Monthly household income (euros)	2221.4 [1392.0]	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Education						
No degree	0.123	-0.030 (0.043)	-0.054 (0.046)	-0.048 (0.046)	-0.015 (0.043)	0.024 (0.043)
Apprenticeship degree	0.684	0.050* (0.029)	0.042 (0.030)	0.066** (0.028)	0.013 (0.027)	0.027 (0.028)
University degree	0.193	-0.050 (0.034)	-0.020 (0.035)	-0.058* (0.030)	-0.008 (0.030)	-0.054* (0.030)
Employment status						
Student	0.090	-0.078 (0.058)	-0.035 (0.060)	0.045 (0.043)	0.072* (0.042)	0.056 (0.044)
Active	0.503	-0.008 (0.025)	-0.021 (0.026)	0.022 (0.026)	0.007 (0.026)	0.044* (0.026)
Not active	0.408	0.033 (0.025)	0.034 (0.026)	-0.037 (0.027)	-0.032 (0.027)	-0.065** (0.027)
Born in Germany	0.948	0.061 (0.060)	-0.037 (0.057)	-0.005 (0.063)	-0.056 (0.060)	0.047 (0.061)
Living in West Germany	0.800	-0.001 (0.031)	0.036 (0.032)	0.018 (0.031)	0.004 (0.030)	0.012 (0.031)
Municipality size (7-point scale)	4.330 [1.770]	-0.019*** (0.007)	-0.008 (0.007)	0.000 (0.007)	0.002 (0.007)	-0.001 (0.007)
Partner in household	0.549	0.010 (0.026)	0.023 (0.026)	-0.029 (0.026)	0.008 (0.026)	-0.017 (0.027)
Has children	0.588	0.020 (0.026)	0.024 (0.027)	-0.024 (0.027)	-0.022 (0.026)	-0.027 (0.027)
Parent of child currently in school	0.283	0.007 (0.028)	-0.006 (0.028)	0.003 (0.029)	-0.005 (0.029)	0.003 (0.029)
Offline	0.182	0.020 (0.037)	0.051 (0.036)	-0.035 (0.041)	-0.047 (0.040)	-0.057 (0.042)
Risk tolerance (11-point scale)	4.230 [2.509]	0.002 (0.005)	0.000 (0.005)	-0.002 (0.005)	0.001 (0.005)	0.002 (0.005)
Patience (11-point scale)	5.978 [2.487]	-0.002 (0.005)	0.002 (0.005)	-0.001 (0.005)	0.011** (0.005)	0.001 (0.006)
Item non-response on aspirations for child	0.023	0.062 (0.083)	0.083 (0.082)	-0.106 (0.152)	0.002 (0.146)	-0.070 (0.145)

TABLE 1
CONTINUED

	Covariates predicting treatment status for experiment with information on					
	Mean [SD] (1)	Earnings differential (2)	Unemployment differential (3)	Tuition fees (4)	Student aid (5)	Tuition fees and student aid (6)
<i>p</i> -value of <i>F</i> -test for joint significance		0.499	0.372	0.204	0.903	0.309
Observations	7270	2701	2616	2001	2051	1996

Notes

Data source: ifo Education Survey 2016 and 2017.

Column (1): sample means, standard deviations in brackets (for non-binary variables). Columns (2)–(6): each cell reports the coefficients from estimating equation (4) for the respective experiment (standard errors in parentheses). *p*-values of *F*-tests for joint significance are based on regressions of treatment status on all covariates jointly. Regressions weighted by survey weights.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

To elicit baseline beliefs about the costs of pursuing university education, we ask respondents to estimate what level of tuition fees students in their state are generally required to pay. The instructions explicitly mention that respondents should enter a value of zero if they think no tuition fees are charged. We also ask respondents to estimate the level of public financial aid (BAföG) for which students are eligible, asking them to imagine the example of students with two non-working siblings whose parents earn 50,000 euros per year (see Table A1 of the Appendix for details). After answering, respondents again indicate how sure they are about their answers.

Randomized information treatments on returns and costs

To test whether respondents' educational aspirations for their children depend on their knowledge of the returns and costs of university education, we devise two survey experiments that randomly assign respondents to a control group and to different information treatment groups. In the first experiment, conducted in the 2016 wave of the adult survey (as well as in the adolescent survey in 2018), we provide participants with information on the average economic returns to university education. In the second experiment, conducted in the 2017 wave of the adult survey, we provide participants with information on the costs—tuition fees and available student aid—of obtaining a university degree.

The first experiment focuses on the return side of economic considerations of whether or not to pursue university education. In the 2016 wave, the adult sample is randomly split into three groups, one control group and two treatment groups. Respondents in the control group answer the question on educational aspirations (described below) without any further information. Before answering the same question, the first treatment group is informed that, on average, full-time employed university graduates earn about 2750 euros after taxes per month, compared to about 1850 euros for those with an apprenticeship degree and 1400 euros for those who do not hold any professional degree

(own calculations based on the German Microcensus).¹⁹ Respondents in the second treatment group are informed that the average unemployment rate of university graduates is 2.5%, while the unemployment rates of those with an apprenticeship degree and those without any degree are 5% and 20%, respectively (IAB 2015).

The second experiment, in the 2017 wave of the adult survey, focuses on the cost side of pursuing university education. The sample is split into one control group and three treatment groups. The first treatment informs respondents that university students in all of Germany currently do not have to pay any tuition fees before asking them the same question on educational aspirations as the uninformed control group. While university education tended to be free of charge in Germany, several states had introduced tuition fees of 500 euros per semester during the time period between 2006 and 2014, and people may not be aware that tuition fees have been abolished again throughout Germany since then (Lergetporer and Woessmann 2019). Respondents in the second treatment group are informed that comprehensive public student aid (known as ‘BAföG’) is available to university students in Germany, only half of which has to be paid back later at most.²⁰ The treatment also includes the example that students with two non-working siblings whose parents’ gross annual income does not exceed 50,000 euros would generally be eligible for student aid payments of 649 euros per month.²¹ The third treatment group receives both pieces of information, on the lack of tuition fees and on the availability of student aid.

Elicitation of educational aspirations

In Germany, people have two main options for their educational careers: they can pursue either an apprenticeship or university education. At the end of lower secondary school (10th grade), the majority of students in Germany choose either to start vocational training (usually in the form of a dual apprenticeship that combines formal schooling with in-company training) or to continue on an academic track in upper secondary school that leads to the university entrance certificate (*Abitur*).²² The share of students on the academic path increased over the past decades. While school graduates’ enrolment in apprenticeship education was more than twice as high as university enrolment in 1999, the latter exceeded the former by 2013 (Autorengruppe Bildungsberichterstattung 2016; Thies *et al.* 2015).

Our main outcome of interest in the adult sample is the aspiration that adults have for the educational outcome of their child. Participants answer the following question: ‘Irrespective of whether you have any children and of which educational degree your child holds or is likely to attain in the future: Which educational degree would match your personal ideal conception for your child?’ (literal translation; see Table A1 of the Appendix for the German original). Respondents are asked to choose one of the two general degree categories available in Germany, either ‘apprenticeship degree’ or ‘university degree’.²³ This design allows us to estimate the effect of providing information on respondents’ educational aspirations for the generation of their children.

Follow-up survey

The follow-up survey, conducted in the 2017 wave of the adult survey, again asks respondents to estimate the level of tuition fees and available student aid, and to state the educational aspirations for their children. In the follow-up survey, all respondents

answer the control-group version of the question, that is, without any information provision.

This design allows us to speak to the persistence of information effects and to test whether information provision does indeed improve respondents' knowledge of the returns and costs of university education in a way that is still observable after a time period of about two weeks.

IV. EMPIRICAL MODEL

The experimental design allows us to estimate the causal effect of information provision on educational aspirations in the simple linear probability model

$$(1) \quad y_i = \alpha_0 + \sum_k \alpha_1^k T_i^k + \delta' X_i + \varepsilon_i,$$

where y_i is a dummy equal to 1 if respondent i prefers university education, T_i^k is an indicator of whether respondent i received the information treatment k , X_i is a vector of control variables, and ε_i is an error term. The coefficients of interest, α_1^k , are identified by the random assignment of treatment status. Adding control variables should therefore not alter the estimated treatment coefficients, although it might increase the precision of the estimates. We therefore estimate versions of equation (1) with and without covariates.

As we are ultimately interested in the extent to which information provision is able to close the socioeconomic gap in educational aspirations, we also estimate treatment effect heterogeneities with respect to respondents' university background. For this purpose, we extend the model in equation (1) to

$$(2) \quad y_i = \beta_0 + \sum_k \beta_1^k T_i^k + \beta_2 E_i + \sum_k \beta_3^k (T_i^k E_i) + \eta_i,$$

where E_i equals 1 if respondent i does not have a university background (i.e. holds a university degree in the adult sample and has university-educated parents in the adolescent sample, respectively). The estimate of β_2 represents the educational aspiration gap, that is, the association between respondents' educational background and their aspirations in the control group. The estimates of β_1 and $\beta_1 + \beta_3$ reflect the effect of information provision for respondents with and without a university background, respectively. These are our parameters of interest as they show whether information provision affects the gap in educational aspirations.

While equations (1) and (2) test whether information provision affects respondents' educational aspirations, we are also interested in the extent to which respondents' prior beliefs about the returns and costs of university education can account for the educational aspiration gap. Therefore we also estimate the regression

$$(3) \quad y_i = \gamma_0 + \gamma_1 E_i + \sum_k \gamma_2^k B_i^k + \tau_i,$$

where B_i^k is the belief of respondent i about the information provided in treatment k (i.e. the belief about earnings and unemployment rates across educational groups, tuition fees

and available student aid). The main parameter of interest is γ_1 , which represents the educational aspiration gap that remains after accounting for differences in beliefs. The parameters γ_2 capture the association between beliefs and educational aspirations.

Balance across control and treatment groups If the randomization procedure worked as intended, then it provides balance between treatment and control groups on all observable and unobservable characteristics. To assess the balance of observable characteristics, we estimate the equation

$$(4) \quad T_i^k = \theta_0 + \theta_1 X_i + \omega_i$$

for each covariate X and each treatment group k .

Results indicate that covariates are indeed balanced across the different groups and do not predict treatment status. Of 90 estimates of θ_1 in the adult sample, eleven are significant at the 10% level, four at the 5% level, and one at the 1% level (see columns (2)–(6) of Table 1). Similarly, in the adolescent sample, only one out of fourteen estimates of θ_1 is significant at the 10% level (see column (2) of Table 6 below). Thus the observed differences match very closely the differences that we would expect to observe by chance.

We also test the joint significance of all covariates in predicting treatment status (see the p -values of the joint F -tests reported at the bottom of Tables 1 and 6). For our experiments, no covariates are jointly significant in predicting treatment status. Item non-response on our main outcome measure is zero. In conclusion, we are reassured that randomization worked as intended, which allows the identification of causal treatment effects.

V. RESULTS FOR ADULTS

This section presents our empirical results for the adult sample. As background for the experimental analysis, we start by documenting the gaps in educational aspirations and in beliefs about returns and costs of university education between respondents with and without a university background. Then we analyse the extent to which alleviating the described biases in beliefs through randomized information provision affects educational aspirations. We provide evidence on the effects of providing information on the returns to and costs of university education, respectively. We also report results for the subgroup of parents.

The educational aspiration gap

The first question of interest is which share of the German adult population aspires to university education for their children, and how this share varies with respondents' university background. As indicated in Figure 1, on average 43% of adults consider a university degree the ideal educational outcome for their children. The majority of 57% of the population prefer their children to pursue an apprenticeship degree. Compared to other countries, the share of those aspiring to university education is relatively low in Germany. For instance, about 80% of respondents in a US survey aspire to college education for their children (Bleemer and Zafar 2018). This difference likely reflects the availability and dominant role of the apprenticeship system in Germany that provides a

well-appreciated alternative—despite the substantial average earnings differences indicated above.

Importantly, the population average masks substantial heterogeneity in aspirations by respondents' own educational background. While only about a third of respondents (36%) without a university degree aspire to university education for their children, this share is nearly three-quarters (74%) among respondents who themselves hold a university degree. This difference of 38 percentage points is the educational aspiration gap that we try to explain in the experiments with the adult sample.²⁴

In principle, adults' aspirations for their (hypothetical) children might differ because they expect that returns to education differ for children from different family backgrounds. For example, respondents without a university degree might not aspire to university education for their child because they think that the child would profit less from it than a child of a university-educated parent. To test this, we ran an additional experiment on a new representative adult sample in the ifo Education Survey 2018. In the spirit of Bleemer and Zafar (2018), we asked respondents which educational degree they would recommend for the child of an acquaintance (see Table A1 of the Appendix for question wording).²⁵ Randomly varying the acquaintance's own educational degree, we find that 62% of respondents with a university degree would recommend a university degree for the child of an acquaintance who holds a university degree (see Table A2 of the Appendix). This share is only 3 percentage points lower (difference not significant) if the acquaintance holds an apprenticeship degree instead. Similarly, the share of respondents without university education who recommend a university degree to an acquaintance's child does not differ significantly by whether the acquaintance holds a

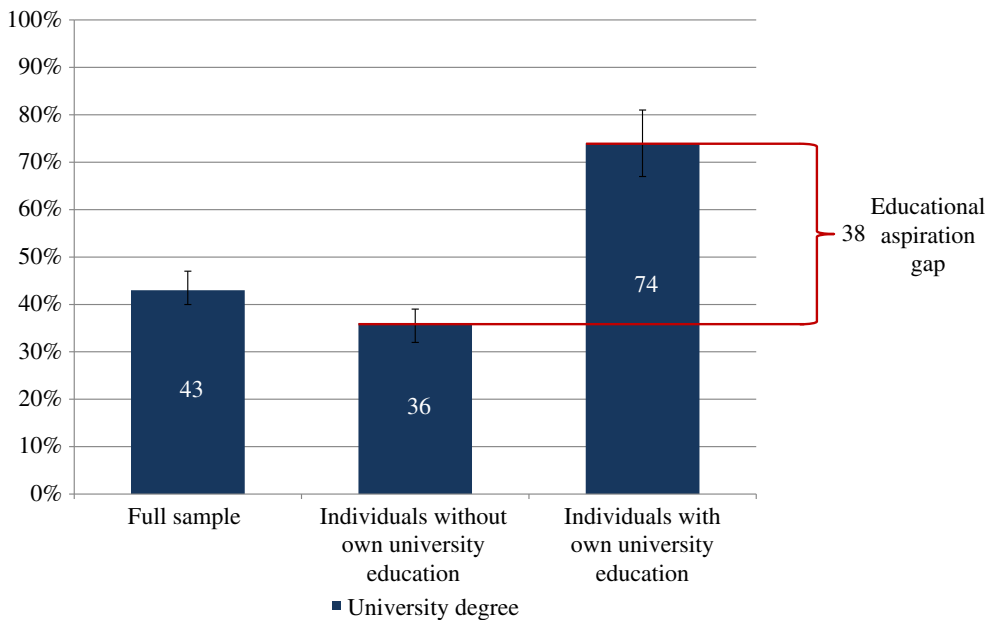


FIGURE 1. The educational aspiration gap: adults' aspirations for the education of their child. *Notes:* Response to the question: 'Irrespective of whether you have any children and of which educational degree your child holds or is likely to attain in the future: Which educational degree would match your personal ideal conception for your child?' Control group, weighted means. Data source: ifo Education Survey 2016 and 2017. [Colour figure can be viewed at wileyonlinelibrary.com]

university degree (43%) or not (41%). This suggests that the educational aspiration gap is not due to respondents expecting returns to differ by children's background.

Gaps in beliefs about returns and costs of university education

A commonly hypothesized explanation for gaps in educational aspirations is that individuals without a university degree underestimate the returns and overestimate the costs of university education. In this subsection, we investigate the prevalence of imperfect information and informational asymmetries regarding earnings and unemployment rates by respondents' university background, as well as regarding the level of tuition fees and available student aid. We regress respondents' expressed beliefs about these measures on an indicator for individuals who do not have a university background. To facilitate interpretation, we centre respondents' beliefs at the correct value of the respective variable and express them in relative terms by dividing through by the respective correct value:²⁶

$$\frac{\text{estimated value} - \text{correct value}}{\text{correct value}}$$

The results in panel A of Table 2 indicate that even university graduates are not fully aware of the economic returns to university education. As indicated by the regression constant, on average respondents with a university degree estimate the earnings of university graduates roughly correctly (column (1)). However, they overestimate the unemployment rate of university graduates by more than 280% (column (2)). That is, even the average university graduate is partially ignorant about the labour market returns to a university degree.

Importantly, the gap between beliefs and true values is significantly larger for respondents without university education. The significant coefficients on the indicator for not having university education show that people without university education underestimate the earnings differential by an additional 4%, and the unemployment differential by an additional 130%, compared to university graduates.²⁷ Consistent with their less correct beliefs, respondents without university education are also significantly less certain that their answers are close to correct (columns (3) and (4)).²⁸

Panel B of Table 2 shows equivalent estimates for beliefs about tuition fees and student aid. Adults with a university degree turn out to overestimate tuition fees by 206 euros per semester on average, and underestimate student aid by 62%. Again, this pattern is significantly more pronounced for respondents without university education. They overestimate tuition fees by an additional 75 euros, and underestimate student aid by an additional 4%. As before, respondents without university education are less certain about the accuracy of their answers, particularly for beliefs about tuition fees (columns (3) and (4)). Next, we investigate to what extent these biased beliefs determine the socioeconomic gap in university aspirations.

Experimental results on the effects of returns information on aspirations

Our experimental interventions show that providing participants with information about the respective average earnings levels of people with different educational degrees increases their aspiration for their children to obtain university education. The first

TABLE 2
DIFFERENCES IN BELIEFS ABOUT RETURNS AND COSTS OF UNIVERSITY EDUCATION BY ADULT RESPONDENTS' EDUCATIONAL BACKGROUND

	Beliefs on		Certainty of beliefs on	
	(1)	(2)	(3)	(4)
<i>Panel A: Beliefs on earnings and unemployment differentials</i>				
	Earnings differentials	Unemployment differentials	Earnings differentials	Unemployment differentials
No university education	-0.043*** (0.016)	-1.328*** (0.366)	-0.217*** (0.080)	-0.153** (0.077)
Constant	-0.010 (0.014)	-2.809*** (0.339)	3.808*** (0.073)	3.497*** (0.070)
Observations	3106	3096	3205	3185
R ²	0.0040	0.0076	0.0034	0.0018
<i>Panel B: Beliefs on tuition fees and student aid</i>				
	Tuition fees	Student aid	Tuition fees	Student aid
No university education	0.753*** (0.123)	-0.044** (0.018)	-1.407*** (0.084)	-0.638*** (0.071)
Constant	2.056*** (0.095)	-0.615*** (0.016)	4.700*** (0.073)	3.569*** (0.062)
Observations	3762	3782	3835	3838
R ²	0.0085	0.0023	0.0874	0.0252

Notes

Data source: ifo Education Survey 2016 and 2017.

OLS regressions. No university education: dummy equal to 1 if respondent does not hold a university degree. Dependent variable columns (1) and (2): beliefs as indicated in the column header, expressed as difference from the correct value, divided by the correct value (tuition fees: divided by 100 euros). Dependent variable columns (3) and (4): certainty that belief is close to correct on 7-point Likert scale. Top and bottom 2% of the belief distribution trimmed in the belief samples. Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

column of Table 3, which is based on equation (1), shows that the provided earnings information increases the share of respondents who aspire to university education for their children by 5 percentage points. Informing respondents about average unemployment rates across educational groups yields a smaller, statistically insignificant increase of 2 percentage points. The inclusion of standard covariates in column (2) does not affect the qualitative results.²⁹

Estimating treatment effects by participants' own educational background reveals that providing information about the average returns to university education does not, however, reduce the socioeconomic gap in educational aspirations. Quite to the contrary, the estimates in column (3) of Table 3—based on equation (2)—indicate that the treatment effects of earnings and unemployment information tend to be even stronger for the group of university graduates, although the difference is statistically insignificant and needs to be interpreted with caution because of limited statistical power. The provided earnings information significantly increases university aspirations among respondents with university education by 11 percentage points, and without university education by 5 percentage points. A similar, albeit statistically insignificant, pattern emerges for information on unemployment rates, which increases aspirations of the two groups by 8

TABLE 3
EFFECTS OF INFORMATION ABOUT RETURNS TO UNIVERSITY EDUCATION ON
EDUCATIONAL ASPIRATIONS OF ADULTS

	Aspiration for child: university degree		
	(1)	(2)	(3)
Information on earnings differentials	0.047*	0.059**	0.106**
	(0.025)	(0.024)	(0.047)
Information on unemployment differentials	0.019	0.018	0.075
	(0.026)	(0.025)	(0.053)
No university education			-0.382***
			(0.042)
Information on earnings differentials × No university education			-0.058
			(0.054)
Information on unemployment differentials × No university education			-0.063
			(0.060)
Control mean		0.433	0.740
Covariates	No	Yes	No
Observations	3229	3128	3223
R^2	0.0015	0.0836	0.1085
Information effects for 'No university education':			
Earnings differentials			0.048*
Unemployment differentials			0.012

Notes

Data source: ifo Education Survey 2016.

OLS regressions. Information was provided to a random subgroup of respondents. Dependent variable: dummy variable coded 1 if respondent prefers a university degree as ideal educational outcome for her child. No university education: dummy equal to 1 if respondent does not hold a university degree. Covariates: age, gender, income, employment status, born in Germany, living in West Germany, municipality size, living with a partner, parent status, risk tolerance, and patience. Bottom rows show estimates of Wald tests for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

and 1 percentage points, respectively. While the differences between the two groups do not reach statistical significance, the point estimates indicate that treatment effects are substantially larger in the higher-educated group.³⁰ If anything, it is the university graduates who respond most strongly to the provided information by raising the educational aspirations for their children. The results clearly show that the educational aspiration gap cannot be attributed to the underestimation of returns to university education among respondents without a university degree.³¹

Experimental results on the effects of costs information on aspirations

In the second experiment, we investigate whether incorrect beliefs about the costs of university education can account for the difference in educational aspirations across educational backgrounds. While the benefits of university education accrue over long time horizons, its costs are more immediate. Hence costs of university education might be more salient when stating educational aspirations, which in turn might render cost information more effective for mitigating the educational aspiration gap, in particular

given the fact described above that respondents overestimate tuition fees and underestimate student aid.

Our results indicate, however, that informing about the costs of university education also does not reduce the aspiration gap. As shown in Table 4, informing respondents that universities in Germany generally do not charge tuition fees does not affect the expressed aspirations in the entire sample (columns (1) and (2)). It also does not have heterogeneous effects on respondents with and without a university degree (column (3)).³²

Providing information on the level of student aid does in fact widen the educational aspiration gap. While there is no effect on university aspirations on average (column (1) of Table 4), this information treatment significantly increases the aspirations of respondents with a university degree by 8 percentage points, but does not affect

TABLE 4
EFFECTS OF INFORMATION ABOUT COSTS OF UNIVERSITY EDUCATION ON EDUCATIONAL ASPIRATIONS OF ADULTS

	Aspiration for child: university degree		
	(1)	(2)	(3)
Information on tuition fees	0.006 (0.026)	0.002 (0.025)	-0.003 (0.042)
Information on student aid	0.008 (0.026)	0.004 (0.025)	0.076** (0.037)
Information on both	-0.013 (0.026)	-0.020 (0.025)	0.027 (0.040)
No university education			-0.406*** (0.034)
Information on tuition fees × No university education			0.030 (0.051)
Information on student aid × No university education			-0.082* (0.047)
Information on both × No university education			-0.033 (0.050)
Control mean		0.493	0.806
Covariates	No	Yes	No
Observations	3939	3848	3934
R^2	0.0003	0.0963	0.1216
Information effects for 'No university education':			
Tuition fees			0.027
Student aid			-0.006
Both			-0.006

Notes

Data source: ifo Education Survey 2017.

OLS regressions. Information was provided to a random subgroup of respondents. Dependent variable: dummy variable coded 1 if respondent prefers a university degree as ideal educational outcome for her child. No university education: dummy equal to 1 if respondent does not hold a university degree. Covariates: age, gender, income, employment status, born in Germany, living in West Germany, municipality size, living with a partner, parent status, risk tolerance, and patience. Bottom rows show estimates of Wald tests for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

aspirations of those without a university degree (column (3)). This suggests that information about student aid affects the extent to which respondents with a university degree think that they are eligible for student aid. As a consequence, informing participants about the availability of student aid widens the gap in aspirations by 8 percentage points (marginally significant). For the third treatment, where respondents receive both pieces of information on tuition fees and student aid, there are again no significant effects.³³

Drawing on the follow-up survey that was conducted about two weeks after the main survey in the 2017 wave, we find that the information treatments lead to persistent improvements of belief accuracy and certainty among both respondents with and without a university background (see the Appendix for details). This suggests that differences in information processing across educational backgrounds cannot explain why information provision does not close the educational aspiration gap.

Finally, in an additional robustness analysis we re-estimate treatment effects differentiating between individuals with above- and below-median household income instead of university background. The baseline aspiration gap between the two income groups is economically and statistically significant at 17 percentage points, but much smaller than the one between respondents with and without a university background. Most importantly, providing information about average returns and costs does not close this aspiration gap, which is in line with our main results (detailed results available on request).³⁴

Overall, our results suggest that a lack of information on neither the pecuniary benefits nor the pecuniary costs of university education can account for the gap in educational aspirations in Germany. This is in contrast to recent US findings that information on college returns decreases the educational aspiration gap by 20–30% (Bleemer and Zafar 2018).³⁵

Treatment effects on parents

The fact that our sample is representative for the German adult population enables us to assess the nationwide educational aspiration gap. A potential concern with the above results, however, is that the inability to close the aspiration gap through information provision might be driven by respondents who do not have children and hence might perceive the question as inconsequential. If information updating is costly (Benabou and Tirole 2016), these respondents might fail to respond to new information in a hypothetical scenario, even though they would consider the information in an actual choice situation. To rule out that our results are driven by such inertia in expressed aspirations, we repeat the analysis for the subsample of parents whose children are still in the education system ($N=920$ in the returns experiment and $N=1058$ in the costs experiment).

The results for the subgroup of parents are very similar to the full adult population. There is a positive treatment effect from providing parents with earnings information, although this effect does not reach statistical significance at conventional levels on average (Table 5). However, investigating heterogeneous treatment effects by respondents' educational background reveals a positive, significant, and large effect of 20 percentage points on parents who are university graduates themselves, and a small and insignificant effect on parents without university education. Consequently, the educational aspiration gap among parents, if anything, tends to increase with information provision on earnings. A similar picture emerges for providing information

on the costs of university education: information on tuition fees and student aid does not close the aspiration gap among parents (Table A3 of the Appendix). Information on student aid significantly increases the educational aspirations of parents with a university degree by 12 percentage points, whereas the point estimate is smaller and statistically insignificant for parents without a university degree.

Taken together, the finding that information on average economic returns and costs of university education does not account for the educational aspiration gap in the German population is mirrored in the subsample of parents. Thus our results are not driven by respondents without children who might perceive the question on educational aspirations as less relevant.

While aspirations for ideal—as opposed to realistic—educational degrees have the advantage that they are, in principle, less constrained by real-life institutional or child-specific factors (and thus are potentially more responsive to information treatments), another potential concern could be that parents internalize observed constraints into their ideal aspirations (Manski 1999). This could in principle account for our finding that treatment effects for respondents without a university degree are rather limited. To assess this possibility, we use data from an oversample of parents in the 2015 wave of the ifo Education Survey. Among parents of children who had not yet completed their

TABLE 5
EFFECTS OF RETURN INFORMATION ON EDUCATIONAL ASPIRATIONS OF PARENTS

	Aspiration for child: university degree			
	All respondents (1)	Parents (2)	All respondents (3)	Parents (4)
Information on earnings differentials	0.047* (0.025)	0.066 (0.046)	0.106** (0.047)	0.196** (0.089)
Information on unemployment differentials	0.019 (0.026)	0.066 (0.046)	0.075 (0.053)	0.115 (0.098)
No university education			−0.382*** (0.042)	−0.277*** (0.087)
Information on earnings differentials × No university education			−0.058 (0.054)	−0.158 (0.102)
Information on unemployment differentials × No university education			−0.063 (0.060)	−0.063 (0.110)
Control mean	0.433	0.454	0.740	0.690
Observations	3229	920	3223	920
R^2	0.0015	0.0038	0.1085	0.0721
Information effects for ‘No university education’:				
Earnings differentials			0.048*	0.039
Unemployment differentials			0.012	0.053

Notes

Data source: ifo Education Survey 2016.

OLS regressions. Sample restriction for parents includes only respondents who state that at least one of either their oldest or youngest child is still in formal education. Information was provided to a random subgroup of respondents. Dependent variable: dummy variable coded 1 if respondent prefers a university degree as ideal educational outcome for her child. No university education: dummy equal to 1 if respondent does not hold a university degree. Bottom rows show estimates of Wald tests for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

educational career, we elicited parents' subjective likelihood that their child would graduate from university, as well as their ideal educational aspiration for their child (both measured on a 5-point Likert scale).

As expected, parents without university education report lower likelihoods that their children will graduate from university. Table A4 of the Appendix shows that the gap in educational aspirations between parents with and without a university degree decreases from -0.194 (column (1)) to -0.071 (column (3)) when conditioning on the subjective expectation that the child will eventually obtain a university degree. Put differently, there is a strong correspondence between educational aspirations and expectations. At the same time, note that the educational aspiration gap remains non-negligible and significant after controlling for expectations, which shows that respondents' aspirations are not entirely determined by the realistic likelihood of what degree a child will obtain. Thus the complete internalization of real-life constraints is unlikely to account for the rigidity of the ideal educational aspiration gap with respect to information provision. At the same time, the question of what exact real-life constraints respondents abstract from when stating idealistic aspirations is an interesting topic for future research.

VI. RESULTS FOR ADOLESCENTS

This section presents our empirical results for the adolescent sample.³⁶ We describe first the survey and adaptations of the experimental design, followed by results on gaps in educational aspirations and in beliefs about returns to university education and by our experimental results how randomly providing information on average educational returns affects adolescents' educational aspirations.

While the analysis of the adult sample allows us to conduct a thorough analysis of inequality in aspirations for children in the society at large, the results so far do not inform about the educational aspirations that adolescents themselves have. The aspirations of adults have been shown to be an important determinant of the educational attainment of children and presumably have particular relevance in Germany where children are tracked at age 10 into school types that differ in expectations of university preparation. Still, children's own aspirations and expectations are obviously another key component of their educational choices. In fact, we asked adolescents and adult respondents with children who in the family decides whether the child takes up an apprenticeship or university studies.³⁷ We find that 54% of parents and 39% of adolescents state that parents and children have equal weight in children's educational decisions. Thus it is insightful to study both groups in order to fully understand the effects of information on educational decisions.

The adolescent survey and experimental design

Our representative survey of adolescents, fielded in 2018 as an online survey, covers 1085 adolescents aged 14–17 years. The recruitment of adolescents was operationalized in two ways. First, 318 adolescents who were registered at online-access panels were recruited directly. Second, 767 adolescents were recruited indirectly via their parents who were registered at online panels. These parents were first asked for their permission to survey their adolescent child, and, if accepted, received a survey link to be shared with their child.³⁸ The adolescent survey contains 28 questions, and median response time was 14 minutes. The adolescent sample is weighted using official statistics on age, gender, region of residence, and municipality size.

Table 6 presents sociodemographic characteristics of the adolescent sample. Average age in the adolescent sample is 15.5 years, and 48% are female. 37% of adolescents have at least one parent with a university degree.

We focus the experimental design in the adolescent sample on the provision of information on the economic returns to university education, randomly allocating respondents between the control group and the earnings-information treatment. For reasons of statistical power, we restrict the number of experimental groups in the adolescent sample to these two groups.

In the adolescent sample, we elicit educational aspirations twice, once before treatment administration and once afterwards.³⁹ In the first elicitation, we use the same question as in the adult survey to elicit respondents' unconditional aspirations with two answer categories (apprenticeship degree or university degree). Given the limited sample size in the adolescent survey, we decided to pose this question to all respondents in order to retain relatively precisely aspiration measures of adolescents that can be directly compared to the one elicited in the adult sample. In the second elicitation (after treatment administration), we adjusted the question on aspirations in two dimensions. First, we record adolescents' aspirations on an 11-point Likert scale ranging from taking up university studies under no circumstances (= 0) to taking them up for certain (= 10). Second, we ask adolescents to imagine that they have just received their *Abitur* (university entrance qualification) when reporting their aspiration. Given that the *Abitur* is an important hurdle for pursuing university education, and that children from lower-educated families are much less likely to obtain the *Abitur* (see the first subsection of Section IV), this experimental design makes it less likely for us to detect a significant aspiration gap. While treatment effects between the adult and the adolescent sample would be most easily comparable had we used the same outcome question in both samples, we refrained from asking adolescents the same aspirations question pre- and post-treatment in order to avoid potential confusion and irritation by asking the exact same question twice.

Gaps in educational aspirations and in beliefs about educational returns

We find a strong educational aspiration gap also among adolescents. There is surprising similarity in adults' and adolescents' aspirations. Among adolescents with at least one university-educated parent, 75% state that—irrespective of their currently attended school and their grades—their preferred educational degree is a university degree (see Figure 2). This share is lower by 24 percentage points among adolescents without a university-educated parent. Thus while somewhat smaller than in the adult population (38%) and in the parent population (28%), the educational aspiration gap between respondents from different socioeconomic groups is also prevalent among adolescents.

There is also a gap in the expected *actual* degrees, which were measured at the end of the adolescent survey. Adolescents' aspirations and expectations correlate very strongly (at 0.823). This correlation is almost identical for adolescents with and without a university-educated parent (0.821 vs. 0.813).

We also find marked misperceptions about the earnings returns to university education among the adolescents. The regression constant of column (1) in Table 7 shows that adolescents with a university background *overestimate* the earnings returns to university education significantly by 11%. Importantly, while also adolescents without a university background tend to somewhat overestimate the earnings returns, their earnings beliefs are significantly lower by 8% (see the coefficient on the indicator 'no

TABLE 6
SUMMARY STATISTICS OF BACKGROUND VARIABLES AND BALANCING TEST FOR ADOLESCENT SAMPLE

	Mean [SD] (1)	Covariates predicting treatment status (2)
Age	15.541 [1.118]	-0.000 (0.015)
Female	0.479	-0.026 (0.032)
(Expected) school degree		
Basic school degree	0.075	0.091 (0.064)
Middle school degree	0.338	-0.059* (0.035)
University entrance qualification	0.587	0.029 (0.033)
Born in Germany	0.972	0.085 (0.105)
Municipality size (7-point scale)	4.184 [1.733]	-0.000 (0.009)
Has no sibling(s)	0.222	-0.045 (0.038)
Parent(s) with university education	0.366	-0.001 (0.034)
Parental employment status		
Both parents non-employed	0.028	-0.048 (0.100)
One parent in employment	0.297	0.005 (0.036)
Both parents in employment	0.675	0.001 (0.035)
Risk tolerance (11-point scale)	5.246 [2.423]	-0.001 (0.007)
Patience (11-point scale)	6.289 [2.350]	0.002 (0.007)
<i>p</i> -value of <i>F</i> -test for joint significance		0.792
Observations	1085	1085

Notes

Data source: ifo Education Survey 2018.

Column (1): sample means; standard deviations in brackets (for non-binary variables). Column (2): each cell reports the coefficients from estimating equation (4) (standard errors in parentheses). *p*-value of *F*-test for joint significance is based on a regression of treatment status on all covariates jointly. There is no item non-response on the aspiration question. Regressions weighted by survey weights.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

parent with university education’).⁴⁰ This significant gap between adolescents with and without university-educated parents suggests leeway for correcting these beliefs through information provision, which might potentially mitigate the university aspiration gap. In contrast to the adult sample, we find no difference in how certain respondents are about their beliefs by their university background.

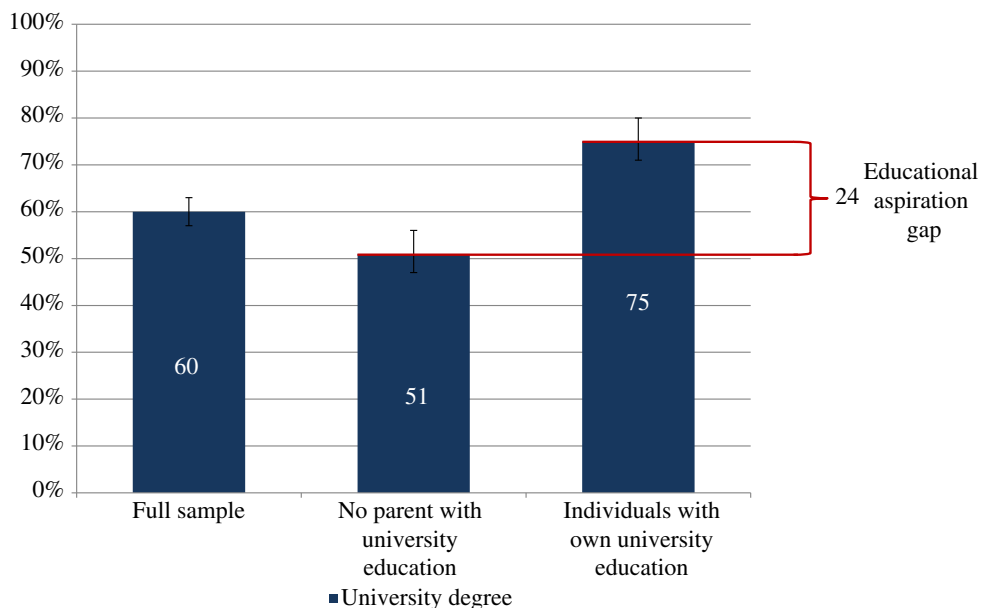


FIGURE 2. The educational aspiration gap: adolescents' aspirations for their education. *Notes:* Response to the question: 'Irrespective of which school you are currently attending and how good your grades are: Which educational degree would you prefer to complete?' Weighted means. Data source: ifo Education Survey 2018. [Colour figure can be viewed at wileyonlinelibrary.com]

Experimental results on the effects of returns information on aspirations

Our experimental results on the effect of providing earnings information on adolescents' aspiration gap mirror those among adults. Table 8 presents the adolescent results using a dichotomized outcome variable (coded 1 for the top five answer categories on the 11-point scale). The regressions in columns (1) and (2), based on equation (1), show that, irrespective of whether including controls or not, providing information on average returns to university education (in the same way as in the adult sample) has a positive, but statistically insignificant effect of about 4 percentage points on the university aspirations of adolescents overall.

Again, we find important heterogeneities by respondents' university background. The treatment increases aspirations of adolescents with at least one university-educated parent significantly by 8 percentage points (column (3) of Table 8). By contrast, it has a small and insignificant effect of 2 percentage points on adolescents without a university-educated parent. These patterns are similar if we use the continuous measure across the 11-point Likert scale, with both the treatment effect for adolescents of parents with university degree and the difference in treatment effects among the two groups with different backgrounds reaching marginal significance (results available on request).⁴¹

In sum, just as in the case of adults, there is an educational aspiration gap among adolescents. Informing about average returns to university education raises aspirations significantly among adolescents with university-educated parents, but not among adolescents without university-educated parents, thereby raising rather than closing the educational aspiration gap. Thus despite using a different outcome variable in the adolescent sample, our main findings from the adult population are mirrored in the adolescent population which is still to go through the final educational stages.

TABLE 7
DIFFERENCES IN BELIEFS ABOUT RETURNS OF UNIVERSITY EDUCATION BY EDUCATIONAL BACKGROUND OF ADOLESCENTS

	Beliefs on earnings differentials (1)	Certainty of beliefs on earnings differentials (2)
No parent with university education	-0.084*** (0.022)	-0.111 (0.090)
Constant	0.111*** (0.018)	3.875*** (0.072)
Observations	1019	1062
R^2	0.0153	0.0016

Notes

Data source: ifo Education Survey 2018.

Sample: adolescents aged 14–17. OLS regressions. No parent with university education: dummy equal to 1 if respondent does not have a parent with a university degree. Dependent variable column (1): beliefs as indicated in the column header, expressed as difference from the correct value, divided by the correct value. Dependent variable column (2): certainty that belief is close to correct on 7-point Likert scale. Top and bottom 2% of the belief distribution trimmed in the belief samples. Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

VII. DESCRIPTIVE EVIDENCE ON GAPS IN ECONOMIC PREFERENCES AND ASPIRATIONS

We complement our experimental analysis by providing descriptive evidence on the extent to which differences in economic preferences by educational background can account for the persistent gap in educational aspirations. So far, our analysis has focused on the role of asymmetric information regarding the returns and costs of university education. However, the costs of university education have to be incurred early on whereas the returns accrue only much later, so that in classic human capital investment theory, educational decisions depend on the present discounted value of education (Becker 1964). Thus a potential alternative explanation for the gap in aspirations is that respondents with and without a university background differ in time preferences and other economic preferences that determine the expected present discounted value of educational choices.

We evaluate the role of three such traits for the educational aspiration gap. In addition to time preferences, we investigate risk preferences and overconfidence. Our focus on risk preferences is motivated by the notion that educational decisions are characterized by uncertainty about whether a degree will be completed and whether returns will materialize. Individuals with lower levels of risk tolerance might therefore prefer lower levels of education (Altonji 1993). Relatedly, overconfidence might affect educational aspirations because of its link to the expected success of degree completion (Koch *et al.* 2015; Reuben *et al.* 2017).⁴²

In both the adult and adolescent samples, we measure respondents' time and risk preferences at the end of our survey using experimentally validated survey questions from Falk *et al.* (2016). Patience is elicited by the question: 'In comparison to others, are you a person who is generally willing to give up something today in order to benefit from that in the future or are you not willing to do so?' Respondents record their answers on an 11-point Likert scale from 0 ('Completely unwilling to give up something today') to 10

TABLE 8
EFFECTS OF INFORMATION ABOUT RETURNS TO UNIVERSITY EDUCATION ON
EDUCATIONAL ASPIRATIONS OF ADOLESCENTS

	Aspiration for university degree		
	(1)	(2)	(3)
Information on earnings differentials	0.039 (0.028)	0.040 (0.027)	0.082** (0.040)
No parent with university education			-0.080* (0.042)
Information on earnings differentials × No parent with university education			-0.059 (0.055)
Control mean		0.756	0.801
Covariates	No	Yes	No
Observations	1085	1054	1062
R^2	0.0022	0.0976	0.0202
Effect of information on earnings differentials for 'No parent with university education'			0.023

Notes

Data source: ifo Education Survey 2018.

Sample: adolescents aged 14–17. OLS regressions. Information was provided to a random subgroup of respondents. Dependent variable: dummy variable coded 1 if respondent prefers a university education, indicated by choosing one of the top five answer categories on an 11-point scale ranging from 0 = willing to take up university studies 'Under no circumstances' to 10 = 'For certain'. No parent with university education: dummy equal to 1 if respondent does not have a parent with a university degree. Covariates: age, gender, born in Germany, expected school-leaving degree, parental employment status, having any siblings, municipality size, risk tolerance, and patience. Bottom row shows estimate of a Wald test for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

('Very willing to give up something today'). Similarly, respondents answer the question on risk tolerance—'How do you see yourself: are you a person who is generally willing to take risks, or do you try to avoid taking risks?'—on an 11-point Likert scale from 0 ('Completely unwilling to take risks') to 10 ('Very willing to take risks').

To obtain a measure of relative overconfidence, we apply the method described by Ortoleva and Snowberg (2015), which compares the accuracy of respondents' beliefs with how sure they are that their beliefs are close to correct. In particular, the ifo Education Survey contains a number of questions that measure beliefs about different educationally relevant parameters, each followed by a question about the respondents' certainty that their expressed belief is close to correct (from 1 = 'Very unsure' to 7 = 'Very sure').⁴³ For each question, we regress certainty on a fourth-order polynomial of belief accuracy. Next, we subtract the predicted certainty for each respondent from her actual reported certainty. In a final step, using principal component analysis we aggregate these relative measures of overconfidence over all questions into our final measure of overconfidence.⁴⁴

A necessary condition for the three economic preference parameters to be able to account for the educational aspiration gap is that they differ between respondents with and without a university degree. Panel A of Table A5 in the Appendix shows that adult respondents without university education indeed have significantly lower values of patience, risk tolerance and overconfidence.⁴⁵ Similarly, in the sample of adolescents we observe that those without a university-educated parent are less patient, risk tolerant and overconfident, with only the first difference capturing statistical significance (coefficient

estimate -0.627 , standard error 0.156 ; see panel B). These results, which are well in line with previous studies (e.g. Dohmen *et al.* 2011; Golsteyn *et al.* 2014), set the stage for analysing the extent to which differences in these economic preferences are able to account for the gap in educational aspirations.

It turns out that conditioning on the three economic preference parameters does not close the educational aspiration gap. Table 9 shows results from regressions analogous to equation (3). In the adult sample (columns (1)–(5)), whether considered individually or jointly, risk tolerance and overconfidence do not enter the model significantly, whereas patience is significantly positively associated with educational aspirations. Still, accounting for differences in patience reduces the educational aspiration gap only by a tiny amount, from 39.7 to 38.5 percentage points. Again, we find similar patterns in the adolescent sample (columns (6)–(10)): patience is the only preference parameter that correlates significantly with aspirations, and accounting for all preference parameters jointly reduces the educational aspiration gap only by a small amount, from 22.2 to 18.8 percentage points.

In sum, we find differences in time and risk preferences and overconfidence by respondents' educational degrees that are consistent with the previous literature. However, these differences cannot account for the large gap in educational aspirations.

VIII. CONCLUSION

As in many other countries, there is a large gap in actual and aspired university enrolment by parents' educational background in Germany. In our representative surveys, the share of the adult population that aspires for their children to go to university is 38 percentage points lower among those without a university degree than among those with a university degree. Similarly, in the adolescent population, the university aspiration gap is 24 percentage points between adolescents with and without university-educated parents. This paper investigates whether lack of information on the average returns and costs of university education among persons without a university background can explain these educational aspiration gaps. Using experiments with randomized information provision, we find that although respondents without a university background estimate the returns of university education to be lower, and the costs to be higher, compared to respondents with university background, alleviating these informational asymmetries does not close the educational aspiration gap among adults or adolescents. If anything, those with a university background respond more strongly to the provided information by raising their educational aspirations, widening rather than closing the gap. Intriguingly, results are very similar between adults and adolescents. Furthermore, economic preferences that are important for educational decisions—time preferences, risk preferences and overconfidence—differ by respondents' educational background but also cannot account for the gap in educational aspirations.

Our results indicate that consideration of the standard parameters of the traditional economic model of educational choices—returns, costs, time preferences, and other traits relevant for intertemporal choices—does not seem to add to an understanding of the educational aspiration gap in Germany. Consequently, there appears limited scope for policy interventions aimed at alleviating imperfect information of the kind investigated in this paper, such as general information campaigns to close the gap in educational aspirations.⁴⁶ Several other studies have shown that informing (prospective) students about returns and costs can raise educational aspirations and choices in specific subgroups of the population such as low-income students or students who self-selected

TABLE 9
ECONOMIC PREFERENCES AND THE EDUCATIONAL ASPIRATION GAP

	Adults					Adolescents				
	Aspiration for child: university degree					Aspiration for university degree				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No university education	-0.397*** (0.027)	-0.385*** (0.027)	-0.393*** (0.027)	-0.389*** (0.028)	-0.385*** (0.028)	-0.222*** (0.045)	-0.188*** (0.045)	-0.219*** (0.045)	-0.222*** (0.045)	-0.188*** (0.045)
No parent with university education		0.011** (0.005)			0.014*** (0.005)		0.041*** (0.010)			0.040*** (0.010)
Risk tolerance			0.000 (0.005)		-0.006 (0.005)			0.015 (0.009)		0.008 (0.009)
Overconfidence				0.010 (0.007)	0.010 (0.008)				0.004 (0.016)	-0.003 (0.016)
Constant	0.776*** (0.022)	0.677*** (0.044)	0.747*** (0.036)	0.756*** (0.028)	0.694*** (0.048)	0.748*** (0.032)	0.471*** (0.073)	0.668*** (0.059)	0.748*** (0.032)	0.441*** (0.082)
Observations	2067	2061	2065	1940	1940	531	531	531	531	531
R ²	0.1060	0.1102	0.1070	0.1116	0.1160	0.0497	0.0889	0.0553	0.0498	0.0903

Notes

Data source: ifo Education Survey 2016, 2017 and 2018. OLS regressions. Control group only. Columns (1)–(5): dependent variable—dummy variable coded 1 if respondent prefers a university degree as ideal educational outcome for her child. Includes wave fixed effects. No university education: dummy equal to 1 if respondent does not hold a university degree. Columns (6)–(10): sample—adolescents aged 14–17. Dependent variable: dummy variable coded 1 if respondent prefers a university education. No parent with university education: dummy equal to 1 if respondent does not have a parent with a university degree. Regressions weighted by survey weights. Robust standard errors in parentheses. ***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

into an academic track. While these information effects on marginal students clearly carry policy relevance (and are in line with our results), they are uninformative about how information affects overall educational inequality in society. Still, our evidence on universal information provision does not rule out that tailored information campaigns that affect only persons without a university background may in fact reduce the educational aspiration gap.

In contrast to our findings, the study by Bleemer and Zafar (2018) that focuses on a representative sample of adults (but not adolescents) in the USA finds that information about average college returns decreases the gap in intended college attendance. Several differences between the USA and Germany might account for the diverging effect of information provision on the aspiration gap in the two countries. First, tuition fees and thus university costs are substantially higher in the USA than in Germany and most continental European and Nordic countries (OECD 2017). While one might thus expect that short-term credit constraints are perceived as higher in the USA, the effects of cost information are in fact quite similar in the two countries. Second, differences may arise from differing earnings returns to a university degree, but returns are in fact only slightly larger in the USA (Hanushek *et al.* 2015; OECD 2017). Third, the US and German populations may differ in economic preference parameters. However, again, time and risk preferences appear quite similar in the two countries (Falk *et al.* 2018). Fourth, university enrolment rates are traditionally lower in Germany, where a large apprenticeship sector offers an alternative career path that is valued highly by large parts of the population. Consequently, baseline university aspiration among adult respondents is much higher in the USA than in Germany. In fact, the median likelihood that a US respondent would recommend college education to a friend in the Bleemer and Zafar (2018) study is 100%, and the mean is 82%. Among college graduates, this mean is as high as 90%. Thus the closing of the aspiration gap in the US study may at least partly reflect ceiling effects in that college aspirations can hardly be raised any more in the higher-educated subgroup. In line with this explanation, recent work by Cheng and Peterson (2019) does not find that providing return and cost information closes the educational aspiration gap in the USA when aspirations for two-year and four-year degrees are considered rather than undifferentiated college attendance. Interestingly, similar to our paper but different from Bleemer and Zafar (2018), the wording in Cheng and Peterson (2019) also focuses on aspirations (rather than on the likelihood of college attendance of one's own child) and they find no evidence that information provision closes the gap, so that results may also partly depend on the focus on aspirations versus expectations.

Independent of the exact reasons for why the provided information does not close the educational aspiration gap in our German samples, our results have important implications for understanding the mechanisms of the intergenerational persistence of educational attainment. They show that providing information on average university returns and costs is not sufficient for aligning the aspirations of those with and without university backgrounds. Thus the large and persistent inequalities in university access by parental education in Germany do not seem to be due to market failure induced by asymmetric information regarding pecuniary consequences of educational choices. This is consistent with the literature emphasizing the importance of non-pecuniary reasons for educational choices (e.g. Beffy *et al.* 2012; Wiswall and Zafar 2015b; Boneva and Rauh 2017). One such non-pecuniary reason might be the identity of parents and their children: parents without a university degree might not aspire to university education for their children because university studies might lead to an alienation of the children from

family identities (Akerlof and Kranton 2002). For the same reason, children without university-educated parents may not aspire to a university education. Similarly, educational aspiration gaps might emerge from differences in the expected consumption value of university education or its cognitive costs (Belfield *et al.* 2016). We consider investigation of the empirical relevance of these non-pecuniary explanations for the educational aspiration gap to be an important area for future research.

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NOTES

1. See, among others, Jensen (2010), Bettinger *et al.* (2012), Hoxby and Turner (2013), Oreopoulos and Dunn (2013), Wiswall and Zafar (2015a,b), Pekkala Kerr *et al.* (2015), McGuigan *et al.* (2016), Baker *et al.* (2018), and Delavande and Zafar (2019).
2. Throughout the paper, we refer to differences in earnings and unemployment by educational degree as 'returns' to education without implying that these differences necessarily reflect a causal effect of university education (see, for example, Bleemer and Zafar 2018). In our experiments, we merely inform about average earnings and unemployment rates by educational degree but never suggest that the differences are causal returns (see the second subsection of Section II).
3. See, for example, Jacob and Linkow (2010), Beaman *et al.* (2012), Spangenberg *et al.* (2011), and Attanasio and Kaufmann (2014). Decomposition analyses show that the aspirations of parents account for a substantial share of educational outcomes of children of school-leaving age (e.g. Chowdry *et al.* 2011; Polidano *et al.* 2013). Also, in domains other than educational decisions, there is growing interest in the relevance of aspirations for economic outcomes (e.g. Genicot and Ray 2017; La Ferrara 2019) and growing evidence that hypothetical choices are closely linked to actual choices (e.g. Mas and Pallais 2017; Wiswall and Zafar 2018). Since students in Germany are tracked at age 10 into school types that differ in whether or not they lead to a university entrance certificate (*Abitur*), parents' aspirations are arguably particularly relevant in determining children's educational outcomes in Germany. Recent German evidence indeed shows a close correspondence between increased educational aspirations and subsequent increases in educational attainment (Azmat and Kaufmann 2020).
4. One concern with asking respondents to abstract from possible constraints when eliciting choice expectations is that respondents might be unable to follow this instruction (e.g., Manski, 1999). In the final subsection of Section IV, we discuss the relationship between educational aspirations and expectations in a complementary oversample of parents, and show that respondents in fact appear to be able to abstract from real-life constraints.
5. The fact that university education includes free tuition in Germany, and the result that information about tuition fees and student aid does not shrink the aspiration gap, suggests that (perceived) short-term credit constraints (e.g. Lochner and Monge-Naranjo 2012) are unlikely to drive unequal university access in Germany.
6. In particular, information provision persistently improves belief accuracy and certainty for respondents with and without a university degree. The time lag between the main survey and the follow-up survey ranges from 5 to 41 days (median 12 days) and is comparable to the follow-up time lag in other recent studies using survey experiments (e.g. one month in Kuziemko *et al.* (2015) and one week in Alesina *et al.* (2018) and in Haaland and Roth (2020)).
7. Consistent with our experimental findings, additional descriptive analyses show that while beliefs about the earnings and unemployment differentials by university education are significantly correlated with university aspirations, they do not account for substantial parts of the educational aspiration gap.

8. See, for example, Arcidiacono (2004), Arcidiacono *et al.* (2012), Kaufmann (2014), Abramitzky and Lavy (2014), Hoxby and Turner (2015), and Belfield *et al.* (2016).
9. See Bettinger *et al.* (2012), Hoxby and Turner (2013), Oreopoulos and Dunn (2013), Dinkelman and Martínez (2014), Wiswall and Zafar (2015a), Hastings *et al.* (2015), and Baker *et al.* (2018). In the German context, Peter and Zambre (2017) and Peter *et al.* (2018) show for a sample of students in 27 high-track schools in Berlin that information about labour market benefits and funding opportunities increases college intentions, applications and enrolment, with longer-run effects not differing by whether students' families have a university background.
10. See, for example, Dominitz and Manski (1996), Zafar (2011, 2013), Arcidiacono *et al.* (2012), Wiswall and Zafar (2015a,b), Belfield *et al.* (2016), Boneva and Rauh (2017), Reuben *et al.* (2017), Baker *et al.* (2018), and Delavande and Zafar (2019).
11. These respondents are provided with a tablet device for answering the survey to minimize any survey mode effects. The survey was conducted by the polling firm TNS Infratest (now called Kantar Public) in the spring of 2016 and 2017. See <https://www.ifo.de/bildungsbarometer> (accessed 17 March 2021) for additional details.
12. For instance, the re-contact rates in Kuziemko *et al.* (2015), Alesina *et al.* (2018), and Haaland and Roth (2020) are 14%, 24% and 66%, respectively.
13. In robustness analyses in the fourth subsection of Section IV, we also report results by respondents' incomes.
14. Throughout, university degrees include so-called universities of applied sciences (*Fachhochschulen*).
15. As a consequence of aiming to design the questions to be as simple as possible, we use binary scales, Likert scales and open questions to elicit aspirations, beliefs and certainty. Of course, there are trade-offs involved when choosing specific question formats. For instance, Likert scales have the advantage that they are easy to comprehend, but they are criticized for lacking interpersonal comparability (e.g. Bond and Lang 2019). Binary answer categories (e.g. university degree versus apprenticeship degree) are interpersonally comparable, but do not inform about how sure respondents are about their answers. Probabilistic outcomes (that we do not use in the present study) are generally regarded interpersonally comparable (Manski 2004), but they are susceptible to comprehension problems since large fractions of the population have difficulties understanding them (Tversky and Kahneman 1974). Furthermore, interpersonal comparability of stated probabilities can be questionable, for instance, when different people use different reference points (Kahneman and Tversky 1979). Haaland *et al.* (2020) provide an excellent discussion of the pros and cons of different elicitation methods. Reassuringly, our main result that the provided information does not close the educational aspiration gap holds irrespective of whether aspirations are measured on a binary scale or an 11-point scale. This consistency makes it very unlikely that our main finding is an artefact of the specific way in which the survey items are designed.
16. We elicited beliefs of respondents in both control and treatment groups. This implies that potential information treatment effects on aspirations later in the survey are unlikely to represent pure priming effects, since both control and treatment groups were asked to think about returns and costs early on. For all experiments, prior beliefs are balanced across treatment and control groups (results available on request).
17. In line with the previous literature on information effects on educational aspirations and choices, we focus on information about average returns, a relevant policy-action parameter that can be verified and corrected through information campaigns. Of course, returns can be heterogeneous, so that average returns will differ from the individually relevant returns. Wiswall and Zafar (2015b) and Bleemer and Zafar (2018) provide an extensive treatment of the relationship between perceived population averages and beliefs about individual returns that implies that under plausible assumptions, information on population averages shifts beliefs about individual returns.
18. Importantly, we follow the literature and elicit prior beliefs from the treatment groups and the control group, which minimizes the risk that information treatment effects reflect priming effects (e.g. Grewenig *et al.* 2020). Our design choice to anchor respondents' estimates comes with some potential benefits and costs. On the one hand, the anchor makes it easier for respondents to come up with an estimate, which might reduce both noise in the data and the risk of item non-response. Similarly, it eases the interpretation of potential information treatment effects: without the anchor, it would be unclear whether eventual treatment effects on aspirations stem from information about apprenticeship graduates' average earnings, university graduates' average earnings, or the difference between the two. At the same time, a potential cost is that we effectively compare respondents that are informed about average earnings with an apprenticeship degree and a university degree, respectively, in the treatment group, to individuals informed about average earnings with apprenticeship degrees in the control group. This needs to be kept in mind when interpreting our findings. We consider studying experimentally whether anchoring prior belief elicitation affects information treatment effects on aspirations to be an interesting question for future research.
19. From Research Data Centres of the Federal Statistical Office and the Statistical Offices of the Federal States, Microcensus, census year 2013. In calculating average earnings, we did not differentiate by gender, and restricted the sample to persons aged between 25 and 60 years. Our treatment informs about monthly earnings because these figures are presumably most tangible for respondents. Note, however, that university degrees in Germany also dominate apprenticeship degrees in terms of lifetime earnings: university

- graduates' discounted average lifetime earnings are about 990,000 euros, and those of persons with a vocational degree are 600,000 euros (Woessmann *et al.* 2017).
20. BAföG is the well-known acronym of the applicable legislation, *Bundesausbildungsförderungsgesetz*.
 21. Since the exact amount of student aid depends on a large number of household characteristics, we use the example to give respondents an impression of student aid levels in Germany. See <https://www.bafög.de/de/bundesausbildungsförderungsgesetz--bafög-204.php> for the legal provisions and <https://www.bafög.de/de/beispiele-183.php> for selected examples (accessed 17 March 2021).
 22. Students can leave school for vocational training after grade 10 (or 9 in some states) at the earliest. Those pursuing the academic track usually continue in upper secondary school to earn the *Abitur* after grade 12 or 13.
 23. Even though it is possible to obtain both an apprenticeship and a university degree, we ask respondents to choose between the two in order to elicit their main preference. Empirically, the share of individuals who hold both degrees is very small (about 2% of respondents in the adult sample). We did not provide the answer category to aspire to obtain no degree at all, as this would seem an unnatural option to many respondents in the German context, making the question wording awkward. Quantitatively, our data suggest that the share of respondents with such an aspiration is negligible, as only 1% of our adolescent sample *expect* not to obtain any degree (and even they may still *aspire* to a degree). Furthermore, more than 90% of students in Germany attend a public university (Autorengruppe Bildungsberichterstattung 2018), which is why respondents most likely have a public university in mind when stating aspirations.
 24. Interestingly, the aspiration shares correspond closely to the actual current university enrolment decisions of children from different educational backgrounds in Germany (Middendorff *et al.* 2013). Among children whose parents do not have a university degree, 43% enrol in the upper-secondary school track (*gymnasiale Oberstufe*) that leads to a university entrance certificate, and 23% eventually enrol in university. By contrast, among children who have at least one parent with a university degree, 79% enrol in the upper-secondary school track and 77% enrol in university. Given these selection patterns, we consider it very important to consider representative samples of adolescents (as opposed to focusing only on those who are enrolled in the upper-secondary school track) when investigating the educational equality implications of information provision.
 25. The sample characteristics of the 2018 survey are very similar to the previous surveys conducted in 2016 and 2017. Furthermore, random assignment again successfully balanced covariates between treatment and control groups in this experiment (results available on request).
 26. As the correct value of tuition fees is zero, we divide tuition fees by 100 euros. For unemployment rates, we multiply by -1 so that higher values correspond to lower unemployment estimates. To avoid being driven by severe outliers on the expressed beliefs, we trim the top and bottom 2% of the belief distributions throughout.
 27. The differences in beliefs between respondents with and without a university degree are clearly visible in the underlying distributions, shown in Figure O.1 of the Online Appendix. Taking into account the entire distributions, two-sample Kolmogorov–Smirnov tests reject the null hypothesis that beliefs do not differ by respondents' education.
 28. In general, there are no incentives for respondents to report their beliefs truthfully. Therefore one concern might be that the observed differences in beliefs between respondents with and without a university degree reflect differences in the effort invested in reporting beliefs correctly, rather than genuine informational asymmetries. In an unrelated experiment, we therefore tested whether providing pecuniary incentives for belief accuracy affects respondents' stated beliefs on the earnings differential (Grewenig *et al.* 2021). Results show that the difference in beliefs on the earnings differential between respondents with and without university education remains in the same order of magnitude and statistically significant when providing incentives for correct answers, speaking against bias from differential effort in answering the survey truthfully.
 29. The covariates include the following sociodemographic characteristics: age, gender, income, employment status, born in Germany, living in West Germany, municipality size, living with a partner, parent status, risk tolerance and patience.
 30. Among respondents without university education, 85% hold an apprenticeship degree and 15% do not hold any professional degree. Treatment effects of providing earnings and unemployment information are marginally significantly stronger for the latter group (results available on request).
 31. Additional descriptive analyses in the Online Appendix show that differences in prior beliefs significantly correlate with educational aspirations, but that these associations are not large enough to be able to account for relevant shares of the educational aspiration gap.
 32. The gap in educational aspirations turns out slightly larger in 2017 than in 2016 (41 versus 38 percentage points; see the coefficients on not having university education in column (3) of Tables 3 and 4).
 33. Among respondents without university education, we find that information about tuition fees (marginally significantly) increases the university aspirations of those without any degree while not affecting those with an apprenticeship degree. Information on student aid does not affect the aspirations of either of the two groups (results available on request).
 34. In further analyses, we study heterogeneity by respondents' age. While older respondents tend to have lower university aspirations, treatment effects do not differ significantly by age (results available on request).

35. The fact that we elicited respondents' beliefs prior to the information experiments allows us to estimate effect heterogeneities by initial beliefs, which can inform about the relative relevance of belief updating and salience. If the information treatments affect university aspirations through genuine belief updating, then treatment effects should be larger, the more a respondent underestimates returns and overestimates costs. If, on the other hand, the information treatments operate through increasing the salience of returns and costs when making educational choices, then we would not expect such treatment effect heterogeneities. In line with Bleemer and Zafar (2018), we do not find strong evidence of effect heterogeneities by prior beliefs, suggesting that treatment effects mostly reflect increased salience of the provided information. This interpretation is consistent with the finding that providing earnings information increases the university aspirations of university graduates even though these respondents hold correct initial beliefs about the earnings differential on average. However, we also find that the treatment effect of the earnings information is significant only in the subsample of those who initially underestimated the earnings differential, and not among those who overestimated it, indicating that belief updating also plays a role (results available on request).
36. The experiment presented in this section is pre-registered in the AEA RCT Registry as trial 3022, www.socialscienceregistry.org/trials/3022 (accessed 22 March 2021).
37. These items were elicited in the ifo Education Survey 2018. For parents (children) the question was worded as follows: 'Parents can have an influence on their children's educational decisions. What do you think, who mostly decides in your case whether your child (you) takes (take) up an apprenticeship, university studies, or does (do) something else?' Answers were recorded on a five-point scale: 'Mostly parents', 'Rather parents', 'Parents and child equally', 'Rather the child', 'Mostly the child'.
38. We implemented plausibility checks of age and birth date to assure that children and not their parents answered the survey. In case of failure to provide consistent answers, respondents were exited from the survey. Reassuringly, our results do not differ qualitatively by recruitment mode, which suggests that our polling was successful (results available on request).
39. See Table A1 of the Appendix for question wording and ordering.
40. Figure O.2 in the Online Appendix shows the distribution of earnings beliefs for adolescents with and without university-educated parents. Taking into account the entire distributions, a two-sample Kolmogorov–Smirnov test rejects the null hypothesis that beliefs do not differ between both groups of adolescents.
41. In additional analyses of gender heterogeneity, we find no evidence for significant differences in control-group aspirations or heterogeneous treatment effects by adolescents' gender (results available on request).
42. In the adult sample, the link from respondents' economic preferences to aspirations for children might be more indirect than in the adolescent sample, where we elicit aspirations for the respondents themselves. However, parents' economic preferences have been shown to predict children's educational choices (Wölfel and Heineck 2012). Relatedly, self-reported parental investment decisions in children correlate with beliefs about the productivity of these investments (Boneva and Rauh 2018).
43. In the adult sample, the belief questions refer to relative earnings by educational degrees, relative unemployment by educational degrees, student achievement gap by socioeconomic background, school spending per student, tuition fees, student aid, student achievement gap by socioeconomic background, and levels of public spending on education, social security, public safety, defence and culture. In the adolescent sample, they refer to relative earnings by educational degree.
44. The overconfidence analyses have a slightly lower number of observations because we calculate the measure only for respondents who have non-missing answers to all belief questions in the respective survey.
45. For this analysis, we pool the 2016 and 2017 waves of the ifo Education Survey. About 12% of respondents participated in both waves. Standard errors are clustered at the individual level. Excluding these respondents does not alter our results (results available on request).
46. While our analysis is purely positive, the possibility that aspiration gaps may reflect individual preferences raises the normative question of whether governments should take measures to mitigate the educational aspiration gap in the first place, as they may not improve welfare. However, education preferences are likely endogenous to family background (e.g. Carneiro and Heckman 2002), complicating any welfare analysis.
47. As the follow-up survey could be conducted only in the online part and not the offline part of the original sample, participants in the follow-up survey differ from participants in the representative main survey in several background characteristics. Of the significant differences shown in Table O.4 in the Online Appendix, only risk tolerance and patience remain significant (and age becomes significant) when restricting the analysis to the participants in the online sample of the main survey, indicating that differences are mostly driven by our restriction of the follow-up survey to the online sample and not by individual decisions to participate in the follow-up survey.

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APPENDIX

PERSISTENCE OF INFORMATION TREATMENT EFFECTS IN THE FOLLOW-UP SURVEY

To assess whether the information treatments truly change the information status of participants, we conducted a re-survey among the online adult sample in the 2017 wave of the ifo Education Survey about two weeks after the main survey. The follow-up survey again asks respondents about their educational aspirations for their child, as well as their beliefs about tuition fees and student aid, but does not contain any new information treatment. This allows us to test whether improved knowledge persists over a two-week period, which also addresses the potential concern that the limited treatment effects reported above are due to respondents not understanding or internalizing the information provided by the treatments.

Follow-up participation is high, with 62% of respondents (2300 of the 3696 online respondents in the main survey) participating again. Follow-up participation is not related to main-survey treatment status, reducing potential concerns of bias from non-random selection into the follow-up. First, treatment status in the main survey does not predict participation in the follow-up survey (Table O.4 in the Online Appendix).⁴⁷ Second, follow-up respondents' background characteristics are well balanced between respondents who had been assigned to the control group and the three information treatment groups in the main survey (Table O.5 in the Online Appendix).

Table A6 reports the effects of providing information during the main survey on beliefs about tuition fees and student aid expressed about two weeks later in the follow-up survey. Respondents' answers to the same belief questions in the main survey are powerful predictors for their answers in the follow-up survey. This considerable test–retest correlation strengthens confidence in our survey measures of beliefs.

More importantly, the randomized provision of information about fees and aid during the main survey significantly improves the accuracy of respondents' beliefs about the levels of tuition fees and student aid in the follow-up survey. In particular, informing respondents that there are no tuition fees significantly reduces respondents' estimates of tuition fees in the follow-up survey both in the fee-information-only treatment and in the joint treatment with aid information (with the former reaching significance only among university graduates—columns (1) and (2) of Table A6). As respondents on average overestimated the level of tuition fees in the main survey, the information treatments thus lead to an improved knowledge of tuition fee levels among participants about two weeks later. Furthermore, these persistent treatment effects do not differ significantly between respondents with and without university education.

Similarly, informing about the level of student aid in the main survey significantly increases respondents' estimates of student aid in the follow-up survey, both in the aid-information-only treatment and in the joint treatment with fee information (columns (3) and (4) of Table A6). Given the initial underestimation of student aid in the main survey, the positive treatment effects again indicate that information provision persistently improves beliefs about the level of available student aid. Again, the information treatment effects do not differ significantly between those with and without a university degree.

Information provision also significantly increases how certain respondents are about the accuracy of their beliefs. Results in columns (5)–(8) of Table A6 show that respondents who received the respective information in the main survey are more certain that their beliefs are close to correct in the follow-up survey. The same is not true for respondents who received the other piece of information that is not the subject of the respective belief question. There is no significant difference between those with and without university education in the extent to which information provision raises certainty about their beliefs.

Despite their persistent effects on improved beliefs about the costs of university education, the information treatments still do not reduce the educational aspiration gap in the follow-up survey. As shown in Table A7, the effects of providing information about tuition fees and student aid in the main survey on educational aspirations in the follow-up survey are very similar to the immediate effects in the main survey (Table 4) in being mostly small and statistically insignificant. The effect of providing information on student aid to individuals with a university degree is positive but shy of statistical significance, while the difference in treatment to individuals without a

university degree remains marginally significant. In additional analyses, we also interact the treatment indicator with the time lag between the main survey and the follow-up survey. Consistent with previous studies (e.g. Lergetporer et al. 2020), the treatment has no differential effect on answering behaviour in the follow-up survey depending on the time lag (results available on request).

Overall, the information treatments lead to persistent improvements of belief accuracy and certainty among respondents with and without a university degree about two weeks after the provision of the information in the main survey. This indicates that participants did process the information they received in the main survey and remember it in the follow-up survey, documenting that the information treatments do in fact lead to a persistently improved information status. Importantly for the interpretation of our analysis, the consistency of these findings across educational backgrounds also suggests that inattention, differences in information processing, or differences in the extent to which respondents with different educational backgrounds believe the provided information are unlikely to explain the lack of information treatment effects on the educational aspiration gap.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table O1. Prior beliefs on returns to university education and the educational aspiration gap of adults.

Table O2. Prior beliefs on returns to university education and the educational aspiration gap of adolescents.

Table O3. Prior beliefs on costs of university education and the educational aspiration gap of adults.

Table O4. Prediction of participation in the follow-up survey.

Table O5. Summary statistics and balancing tests: Follow-up survey.

Figure O1. Distributions of beliefs about returns and costs of university education by adult respondents' educational background.

Figure O2. Distributions of beliefs about returns of university education by adolescents' educational background.

TABLE A1
WORDING OF SURVEY QUESTIONS

Wave	#	Group	Wording (English translation)	Wording (German original)	Answer categories
<i>Adult sample</i>					
2016	6	All	Persons with a professional degree (apprenticeship) currently earn on average about 1850 euros net per month (full-time position). What is your best guess, how much do the following groups with lower/higher education attainment earn on average? — Persons without a professional degree — Persons with a university degree	Personen mit abgeschlossener beruflicher Ausbildung (Lehre) verdienen derzeit im Durchschnitt rund 1.850 Euro netto im Monat (Vollzeitstelle). Was denken Sie, wie viel verdienen die folgenden Gruppen mit niedrigerem bzw. höherem Bildungsabschluss im Durchschnitt? — Personen ohne abgeschlossene Berufsausbildung — Personen mit abgeschlossenem Hochschulstudium	Two answers in euros net per month, open-ended
2016	7	All	The unemployment rate of persons with a professional degree (apprenticeship) is currently about 5%. What is your best guess, what is the unemployment rate of the following groups with lower/higher educational degrees? — Persons without a professional degree — Persons with a university degree	Die Arbeitslosenquote von Personen mit abgeschlossener beruflicher Ausbildung (Lehre) liegt derzeit bei rund 5%. Was denken Sie, wie hoch ist die Arbeitslosenquote von folgenden Gruppen mit niedrigerem bzw. höherem Bildungsabschluss? — Personen ohne abgeschlossene Berufsausbildung — Personen mit abgeschlossenem Hochschulstudium	Two answers in %, open-ended
2017	7	All	What is your best guess, how high are the tuition fees that students in your state as a general currently have to pay? (Enter '0' if you guess that students in your state as a	Was schätzen Sie, wie hoch sind die Studiengebühren, die Studierende in Ihrem Bundesland in der Regel derzeit zahlen müssen? (Geben Sie „0“ ein, wenn Sie schätzen, dass	In euros per semester (half year), open-ended

TABLE A1
CONTINUED

Wave	#	Group	Wording (English translation)	Wording (German original)	Answer categories
2017	8	All	<p>general currently do not have to pay tuition fees.)</p> <p>What is your best guess, how much public student aid (BAföG) are students generally eligible for whose parents earn 50,000 euros gross per year? Think of students who have two non-working siblings, no longer live with their parents, and are covered by their family's health insurance. (Enter '0' if you guess that these students do not receive BAföG.)</p>	<p>Studierende in Ihrem Bundesland in der Regel derzeit keine Studiengebühren zahlen müssen)</p> <p>Was schätzen Sie, wie viel staatliche Studienförderung (BAföG) erhalten in der Regel Studierende, deren Eltern jährlich 50.000 Euro brutto verdienen? Denken Sie dabei an Studierende, die zwei nicht erwerbstätige Geschwister haben, nicht mehr bei ihren Eltern wohnen und über ihre Familie krankensichert sind. (Geben Sie „0“ ein, wenn Sie schätzen, dass diese Studierenden kein BAföG erhalten.)</p>	<p>In euros per month, open-ended</p>
2016/17	23/21	Control	<p>Irrespective of whether you have any children and of which educational degree your child holds or is likely to attain in the future: Which educational degree would match your personal ideal conception for your child?</p>	<p>Sehen Sie einmal ganz davon ab, ob Sie Kinder haben bzw. welchen Bildungsabschluss Ihr Kind hat oder wahrscheinlich später einmal machen wird. Welcher Bildungsabschluss würde Ihrer persönlichen Idealvorstellung für Ihr Kind entsprechen?</p>	<p>Single choice: professional degree (apprenticeship), university degree^a</p>
2016	23	Treatment 'Earnings differential'	<p>Persons without a professional degree earn on average about 1400 euros net per month, persons with a professional degree (apprenticeship) about 1850 euros, and persons with a university degree about</p>	<p>Personen ohne abgeschlossene berufliche Ausbildung verdienen im Durchschnitt etwa 1.400 Euro netto im Monat, Personen mit abgeschlossener beruflicher</p>	<p>[see Control]</p>

TABLE A1
CONTINUED

Wave	#	Group	Wording (English translation)	Wording (German original)	Answer categories
2016	23	Treatment 'Unemployment differential'	2750 euros. Irrespective of whether ... [see Control]	Ausbildung (Lehre) etwa 1.850 Euro und Personen mit abgeschlossenem Hochschulstudium etwa 2.750 Euro. Sehen Sie einmal ganz davon ab, ...	[see Control]
2017	21	Treatment 'Tuition fees'	The unemployment rate of persons without a professional degree is currently 20%, for persons with a professional degree (apprenticeship) it is about 5%, and for persons with a university degree it is about 2.5%. Irrespective of whether ... [see Control]	Die Arbeitslosenquote von Personen ohne abgeschlossene berufliche Ausbildung liegt derzeit bei 20%, bei Personen mit abgeschlossener beruflicher Ausbildung (Lehre) sind es etwa 5% und bei Personen mit abgeschlossenem Hochschulstudium sind es etwa 2,5%. Sehen Sie einmal ganz davon ab, ...	[see Control]
2017	21	Treatment 'Student aid'	Currently, students in all of Germany do not have to pay tuition fees. Irrespective of whether ... [see Control]	Derzeit müssen Studierende in ganz Deutschland keine Studiengebühren zahlen. Sehen Sie einmal ganz davon ab, ...	[see Control]
2017	21	Treatment 'Student aid'	In Germany, comprehensive public student aid (BAföG) is available, only half of which has to be paid back later at most. For example, students with two non-working siblings whose parents earn 50,000 euros gross per year at most are generally eligible for 649 euros per month. Irrespective of whether ... [see Control]	In Deutschland gibt es umfangreiche staatliche Studienförderung (BAföG), die später höchstens zur Hälfte zurückgezahlt werden muss. Zum Beispiel erhalten Studierende mit zwei nicht erwerbstätigen Geschwistern, deren Eltern jährlich höchstens 50.000 Euro brutto verdienen, in der Regel monatlich	[see Control]

TABLE A1
CONTINUED

Wave	#	Group	Wording (English translation)	Wording (German original)	Answer categories
2017	21	Treatment 'Both'	Currently, students in all of Germany do not have to pay tuition fees. In addition, comprehensive public student aid (BAföG) is available, only half of which has to be paid back later at most. For example, students with two non-working siblings whose parents earn 50,000 euros gross per year at most are generally eligible for 649 euros per month. Irrespective of whether . . . [see Control]	649 Euro. Sehen Sie einmal ganz davon ab, . . . Derzeit müssen Studierende in ganz Deutschland keine Studiengebühren zahlen. Darüber hinaus gibt es umfangreiche staatliche Studienförderung (BAföG), die später höchstens zur Hälfte zurückgezahlt werden muss. Zum Beispiel erhalten Studierende mit zwei nicht erwerbstätigen Geschwistern, deren Eltern jährlich höchstens 50.000 Euro brutto verdienen, in der Regel monatlich 649 Euro. Sehen Sie einmal ganz davon ab, . . .	[see Control]
2018	26	Treatment 'Professional degree'	Imagine an acquaintance who holds a professional degree (apprenticeship). This person asks for your advice which educational degree you would consider ideal for his 15-year-old child. Which educational degree would you recommend to your acquaintance for his child?	Stellen Sie sich einen Bekannten mit abgeschlossener beruflicher Ausbildung (Lehre) vor. Diese Person fragt Sie um Ihren Rat, welchen Bildungsabschluss Sie für sein 15-jähriges Kind als ideal empfinden würden. Welchen Bildungsabschluss würden Sie Ihrem Bekannten für sein Kind empfehlen?	Single choice: professional degree (apprenticeship), university degree
2018	26	Treatment 'University degree'	Imagine an acquaintance who holds a university degree. This person asks . . . [see Treatment 'Professional degree']	Stellen Sie sich einen Bekannten mit Hochschulabschluss vor. Diese Person fragt . . .	[see Treatment 'Professional degree']

TABLE A1
CONTINUED

Wave	#	Group	Wording (English translation)	Wording (German original)	Answer categories
<i>Adolescent sample</i>					
2018	9	Control	Irrespective of which school you are currently attending and how good your grades are: Which educational degree would you prefer to complete? The next question concerns how much one earns on average with different educational degrees. Persons without an educational degree (e.g. apprenticeship or university) currently earn on average about 1400 euros net per month (full-time position). What is your best guess, how much do the following groups with higher education attainment earn on average? — Persons with a professional degree (apprenticeship) — Persons with a university degree	Egal, welche Schule du gerade besuchst und wie gut deine Noten sind: Welchen Bildungsabschluss würdest du am liebsten machen? Jetzt geht es darum, wieviel man mit verschiedenen Bildungsabschlüssen im Durchschnitt verdient. Personen ohne Berufsausbildung (z.B. ohne Lehre oder Studium) verdienen derzeit im Durchschnitt rund 1.400 Euro netto im Monat (Vollzeitstelle). Was denkst du, wieviel verdienen die folgenden Gruppen mit höherem Bildungsabschluss im Durchschnitt? — Personen mit abgeschlossener beruflicher Ausbildung (Lehre) — Personen mit abgeschlossenem Studium (z.B. an einer Universität oder Fachhochschule)	Single choice: professional degree (apprenticeship), university degree
2018	18	All			Two answers in euros net per month, open-ended
2018	24	Control	Imagine you just received your <i>Abitur</i> . In this case, would you like to study (e.g. at a university or university of applied sciences)? Persons without a professional degree earn on average about 1400 euros net per month, persons with a professional degree (apprenticeship) about 1850 euros, and	Stell dir vor, du hättest gerade Abitur gemacht. Würdest du in diesem Fall gerne studieren (z.B. an einer Universität oder Fachhochschule)? Personen ohne abgeschlossene berufliche Ausbildung verdienen im Durchschnitt etwa 1.400 Euro netto im Monat, Personen mit	11-point Likert scale from 'Under no circumstances' to 'For certain' ^b [see Control]
2018	24	Treatment			

TABLE A1
CONTINUED

Wave	#	Group	Wording (English translation)	Wording (German original)	Answer categories
			persons with a university degree about 2750 euros. Imagine you just . . . [see Control]	abgeschlossener beruflicher Ausbildung (Lehre) etwa 1.850 Euro und Personen mit abgeschlossenem Hochschulstudium etwa 2.750 Euro. Stell dir vor, . . .	

Notes

^aGerman original: 'Beruflicher Ausbildungsabschluss (Lehre), Hochschulabschluss'.

^bGerman original: from 'auf keinen Fall' to 'auf jeden Fall'.

#refers to position of the question in the respective survey.

TABLE A2
EFFECTS OF ACQUAINTANCES' EDUCATIONAL BACKGROUND ON EDUCATIONAL RECOMMENDATION FOR THEIR CHILD

	Recommendation for acquaintances' child: university	
	(1)	(2)
Acquaintance (parent) has university degree	0.027 (0.023)	0.034 (0.050)
No university education (refers to respondent)		-0.181*** (0.038)
Acquaintance (parent) has university degree × No university education		-0.006 (0.056)
Constant	0.443	0.587
Observations	4044	4042
R^2	0.0007	0.0226
Effect for 'No university education'		0.028

Notes

Data source: ifo Education Survey 2018.

OLS regressions. Whether or not the acquaintance (parent) holds a university degree is randomly varied. Dependent variable: dummy variable coded 1 if respondent would recommend a university degree as ideal educational outcome for the acquaintance's child. No university education: dummy equal to 1 if respondent does not hold a university degree. Bottom row shows estimate of a Wald test for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

TABLE A3
EFFECTS OF COST INFORMATION ON EDUCATIONAL ASPIRATIONS OF PARENTS

	Aspiration for child: university degree			
	All respondents (1)	Parents (2)	All respondents (3)	Parents (4)
Information on tuition fees	0.006 (0.026)	0.002 (0.047)	-0.003 (0.042)	-0.016 (0.074)
Information on student aid	0.008 (0.026)	0.057 (0.048)	0.076** (0.037)	0.122** (0.049)
Information on both	-0.013 (0.026)	-0.024 (0.048)	0.027 (0.040)	-0.078 (0.091)
No university education			-0.406*** (0.034)	-0.448*** (0.058)
Information on tuition fees × No university education			0.030 (0.051)	0.054 (0.090)
Information on student aid × No university education			-0.082* (0.047)	-0.046 (0.072)
Information on both × No university education			-0.033 (0.050)	0.098 (0.105)
Control mean	0.493	0.507	0.806	0.858
Observations	3939	1058	3934	1057
R^2	0.0003	0.0035	0.1216	0.1086
Information effects for 'No university education':				
Tuition fees			0.027	0.038
Student aid			-0.006	0.076
Both			-0.006	0.020

Notes

Data source: ifo Education Survey 2017.

OLS regressions. Sample restriction for parents includes only respondents who state that at least one of either their oldest or youngest child is still in formal education. Information was provided to a random subgroup of respondents. Dependent variable: dummy variable coded 1 if respondent prefers a university degree as ideal educational outcome for her child. No university education: dummy equal to 1 if respondent does not hold a university degree. Bottom rows show estimates of Wald tests for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

TABLE A4
ASPIRATION VS. EXPECTED LIKELIHOOD OF OBTAINING A UNIVERSITY DEGREE

	Aspiration for child: university degree		
	(1)	(2)	(3)
No university education	-0.194*** (0.034)	-0.082** (0.034)	-0.071** (0.033)
Subjective likelihood that child earns a university degree			
Continuous measure		0.166*** (0.010)	
Dummy: Unlikely			-0.171*** (0.036)
Dummy: Likely			0.313*** (0.033)
Constant	0.738*** (0.030)	0.119** (0.051)	0.550*** (0.040)
Observations	2258	2258	2258
R^2	0.0247	0.1834	0.1913

Notes

Data source: ifo Education Survey 2015.

OLS regressions. Sample: parents of children who did not yet complete their educational career, 2015 survey. Dependent variable: dummy variable coded 1 if respondent states that she would consider a university degree the ideal educational outcome for her child (by selecting 4 or 5 on a 5-point Likert scale). No university education: dummy equal to 1 if respondent does not hold a university degree. Subjective likelihood that child earns a university degree is recorded on a 5-point Likert scale from 1 = 'Impossible' to 5 = 'Absolutely certain'. Dummy 'Unlikely' is coded 1 if respondents answer 1 or 2 on the 5-point scale. Dummy 'Likely' is coded 1 if respondents answer 4 or 5 on the 5-point scale. Regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

TABLE A5
DIFFERENCE IN ECONOMIC PREFERENCES BY RESPONDENTS' EDUCATIONAL BACKGROUND

	Patience (1)	Risk tolerance (2)	Overconfidence (3)
<i>Panel A: Adults</i>			
No university education	-0.712*** (0.081)	-0.776*** (0.085)	-0.516*** (0.055)
Observations	7214	7236	6775
R^2	0.0129	0.0153	0.0177
<i>Panel B: Adolescents</i>			
No parent with university education	-0.627*** (0.156)	-0.263 (0.162)	-0.082 (0.089)
Observations	1061	1062	1062
R^2	0.0167	0.0028	0.0009

Notes

Data source: ifo Education Survey 2016, 2017 and 2018.

OLS regressions. Panel A: no university education—dummy equal to 1 if respondent does not hold a university degree. Includes wave fixed effects. Panel B: no parent with university education—dummy equal to 1 if respondent does not have a parent with a university degree. All regressions weighted by survey weights. Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

TABLE A6
EFFECTS OF INFORMATION PROVISION IN THE MAIN SURVEY ON BELIEFS ABOUT COSTS OF UNIVERSITY EDUCATION IN THE FOLLOW-UP SURVEY

	Beliefs on			Certainty of beliefs on				
	Tuition fees in follow-up survey	Student aid in follow-up survey	Tuition fees in follow-up survey	Student aid in follow-up survey	Tuition fees in follow-up survey	Student aid in follow-up survey	Tuition fees in follow-up survey	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Information on tuition fees	-0.964 (0.723)	-2.214*** (0.838)	0.028 (0.072)	-0.034 (0.097)	0.333*** (0.092)	0.372** (0.176)	0.125 (0.079)	-0.044 (0.146)
Information on student aid	-0.282 (0.671)	-0.966 (0.809)	0.167** (0.072)	0.136 (0.104)	0.074 (0.085)	0.026 (0.163)	0.322*** (0.081)	0.426*** (0.161)
Information on both	-1.939*** (0.639)	-1.513 (1.020)	0.140** (0.069)	0.103 (0.093)	0.293*** (0.092)	0.066 (0.178)	0.241*** (0.081)	0.309** (0.153)
No university education		2.545*** (0.884)		0.064 (0.104)		-0.623*** (0.126)		-0.471*** (0.115)
Information on tuition fees × No university education		1.469 (1.238)		0.077 (0.132)		-0.010 (0.205)		0.253 (0.173)
Information on student aid × No university education		0.741 (1.172)		0.038 (0.136)		0.106 (0.190)		-0.106 (0.186)
Information on both × No university education		-0.704 (1.286)		0.044 (0.126)		0.334 (0.207)		-0.057 (0.179)
Dependent variable in main survey	0.550*** (0.072)	0.531*** (0.073)	0.263*** (0.080)	0.262*** (0.080)	0.537*** (0.017)	0.502*** (0.019)	0.435*** (0.019)	0.415*** (0.020)
Constant	5.022*** (0.492)	3.248*** (0.675)	-0.204*** (0.068)	-0.250*** (0.095)	1.637*** (0.084)	2.215*** (0.135)	1.555*** (0.075)	1.956*** (0.116)
Observations	2293	2293	2295	2295	2289	2289	2290	2290
R ²	0.1078	0.1185	0.0434	0.0447	0.3130	0.3267	0.2186	0.2344
Information effects for 'No university education':								
Tuition fees		-0.745		0.043		0.362***		0.209**

TABLE A6
CONTINUED

	Beliefs on		Certainty of beliefs on					
	Tuition fees in follow-up survey	Student aid in follow-up survey	Tuition fees in follow-up survey	Student aid in follow-up survey	Tuition fees in follow-up survey	Student aid in follow-up survey		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Student aid		-0.225		0.173*		0.131		0.320***
Both		-2.217***		0.147*		0.400***		0.252***

Notes

Data source: ifo Education Survey 2017.

OLS regressions. Dependent variables recorded in follow-up survey conducted about two weeks after the main survey (median interval: 12 days). Information was provided to a random subgroup of respondents in the main survey. No university education: dummy equal to 1 if respondent does not hold a university degree. Dependent variable columns (1)–(4): beliefs as indicated in the column header, expressed as difference from the correct value, divided by the correct value (tuition fees: divided by 100 euros). Dependent variable columns (5)–(8): certainty that belief is close to correct on 7-point Likert scale. Bottom rows show estimates of Wald tests for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

TABLE A7
EFFECTS OF COST INFORMATION ON EDUCATIONAL ASPIRATION: FOLLOW-UP SURVEY

	Aspiration for child: university degree	
	(1)	(2)
Information on tuition fees	-0.000 (0.029)	-0.011 (0.048)
Information on student aid	-0.036 (0.029)	0.055 (0.044)
Information on both	-0.004 (0.029)	0.059 (0.045)
No university education		-0.339*** (0.039)
Information on tuition fees × No university education		0.036 (0.059)
Information on student aid × No university education		-0.100* (0.056)
Information on both × No university education		-0.061 (0.056)
Control mean	0.543	0.788
Observations	2300	2300
R^2	0.0009	0.1029
Information effects for 'No university education':		
Tuition fees		0.024
Student aid		-0.045
Both		-0.002

Notes

Data source: ifo Education Survey 2017.

OLS regressions. Information was provided to a random subgroup of respondents in the main survey. Dependent variable: dummy variable coded 1 if respondent prefers a university degree as ideal educational outcome for her child. No university education: dummy equal to 1 if respondent does not hold a university degree. Bottom rows show estimates of Wald tests for $H_0: \beta_1 + \beta_3 = 0$ based on equation (2). Robust standard errors in parentheses.

***, **, * indicate significance $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.