Opening the Black Box of College Major Choice: Evidence from an Information Intervention*

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Abstract

This paper studies the importance of job-related and non-job-related factors in students' college major choices. Using a staggered intervention that allows us to provide students information about many different aspects of majors and to compare the magnitudes of the effects of each piece of information, we show that major choices depend on a wide set of factors. Learning of higher post-college employment probabilities attracts students to a major, while earnings information has no effect. The non-job aspects of majors are also important to students but are not well-known to them at the decision point. Students are initially misinformed about majors' gender composition, course difficulty, and family outcomes, and partially update their beliefs when provided with information. We find that male students gravitate strongly toward majors they learn have a higher share of female students than they originally thought, but they are equally repelled by majors that have a higher share of female faculty than they thought. Female students move away from majors that are more difficult than they believed. Overall, our results show that a variety of factors are important for students' major choices and that male and female students are motivated by different factors.

Keywords: college major choice, beliefs, job-related factors, non-job-related factors

JEL Classification: I21, I23, D83

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1 Introduction

The choice of college major is one of the most important economic decisions a person can make. Majors are associated with vastly different earnings after college (Altonji et al., 2012, 2016), and at least some of these differences are causal and can be larger than the payoff from attending a selective institution (Kirkeboen et al., 2016; Andrews et al., 2017). But majors also differ along many other dimensions, including employment prospects, work-life balance, graduation probabilities, coursework, student composition, and much more.

Given the importance of this decision, there is a large literature that explores the determinants of major choice, identifying both job-related and non-job-related factors as important factors (see Altonji et al. (2012) and Patnaik et al. (2021) for reviews of this literature). Many papers argue that unobserved tastes and preferences of students are important and can explain much of the observed gender gap in major choices (Zafar, 2013; Akyol et al., 2017; Astorne-Figari and Speer, 2019; Ngo and Dustan, 2021; Dasgupta and Sharma, 2022). Yet these "tastes" are something of a black box. Identifying what factors influence major choice – and their relative importance – is difficult or impossible in observational data, given the complexity of majors and the lack of random variation in how students learn about these factors.

In this paper, we use an innovative design to open this black box of college major choice. Using a staggered information intervention, we estimate and compare the importance of a wide set of factors for the major choices of college freshmen. We study both job-related (e.g., earnings and employment, industry outcomes, work flexibility, work-life balance) and non-job-related (e.g., difficulty of coursework, gender composition of students and faculty, graduate school probabilities, and family outcomes) aspects of majors. While it is well-known that information about earnings and other job-related factors can induce students to change majors (e.g., Baker et al. (2018); Wiswall and Zafar (2015a); Conlon (2021))[1], we are the first to include most of these non-job-related factors in an experimental setting.

[1] Carrell et al. (2020) also provide information to students about both earnings and other job-related factors, like whether graduates from a major are working in a job related to their degree. They find no effect on students' choices, but their intervention is very light, consisting of only an email to students.

For our intervention, we recruit freshmen of a selective private university (Loyola Marymount University) to participate in a survey early in their first semester of college. Students first indicate their probabilities of majoring in different categories of majors. Then, they are asked about their beliefs regarding various aspects of each major (coursework difficulty, gender composition, graduate school probabilities, employment and earnings, industry outcomes, workplace characteristics, and family status), and they then receive these information sets in a randomized order. These information sets were constructed from LMU-specific administrative data and two alumni surveys (one conducted for new graduates and one for alumni ten years after graduation), so they are relevant to the student population in our intervention. After seeing each information set, students are re-asked their major choice probabilities. After all the information is provided, we once again ask students their beliefs regarding various aspects of each major and their major choice probabilities.

Students are initially misinformed about most aspects of majors. While students are correct "on average" about major earnings, they overestimate earnings for science and engineering majors and underestimate them for economics and political science majors. For other major characteristics, students' prior beliefs are far off on average. For example, students vastly underestimate the probability of being employed both right after college and 10 years later, and they vastly overestimate the share of graduates who have children 10 years after college. When provided information about these major-related factors, taken from a combination of sources, students typically partially update their beliefs toward the information they were given.

Our overall finding is that both job-related and non-job-related factors influence major choice and that different factors matter for men and women. First, comparing the major choice probabilities reported at the beginning and at the end of the survey, we show that 55% of the students change their major choice probabilities, with the aggregate effect being students moving away from Film and Television majors and toward Business majors. While all seven information sets had significant effects on students' major choices, the Employment

& Earnings set stands out as the most impactful, with Gender Composition (of both students and faculty) the least.

We then dig into the individual elements of the information sets. Our design allows us to directly compare the magnitudes of the effects on major choice of each piece of information. While the Employment & Earnings information set was the most powerful, it was the employment information, not the earnings information, that moved students' choices. Learning of high post-college employment rates induces students to switch toward a given major. Surprisingly, however, learning of high employment rates 10 years after college pushes students *away* from a major, an effect driven by female students.

Factors other than employment also matter and shed light on the well-documented gender differences in major choice. Male students gravitate toward majors that they learn have a higher share of female students than they originally believed. However, they move *away* from majors that they learn have a higher share of female faculty than they initially thought. Neither of these measures has a significant effect on major choice for female students. Meanwhile, female students move strongly away from majors that they learn have more difficult coursework than they believed. They also move toward majors that they believe are more flexible for part-time work after college than they originally believed, but we interpret this with caution because about one-third of students updated their beliefs in the wrong direction after receiving information about flexibility.

Overall, our results show that both job-related and non-job-related factors influence major choice and that students are often not well-informed about these aspects of majors at the beginning of college. The notion that students are simply making a calculation about monetary costs and benefits when choosing a major can be rejected. The post-college outcomes associated with a major clearly matter, but so does the experience while in college – particularly course difficulty and the composition of peers and faculty.

The key contribution of this paper is the inclusion of a wide variety of non-job-related aspects of majors in the information intervention, several of which are important for students'

choices and in understanding the gender gap in major choice. Our work most closely relates to the literature that uses subjective expectations and/or information experiments to understand the determinants of college major choices. A number of papers have tested the impact of giving students information about major-specific earnings or employment prospects (e.g., Wiswall and Zafar (2015a); Baker et al. (2018); Conlon (2021); Ding et al. (2021)), and others have provided students with other job-related information (or have asked about hypothetical job scenarios) touching on work flexibility, job stability, and job satisfaction (Wiswall and Zafar, 2018; Carrell et al., 2020; Ajzenman et al., 2021). Other papers explore these ideas with the help of structural modeling (Arcidiacono et al., 2020; Wiswall and Zafar, 2021).

However, these experiments have rarely if ever included information about non-job-related factors, despite substantial evidence from the non-experimental major choice literature (reviewed below) that these factors are important. Like Wiswall and Zafar (2015a), who study the effect of providing earnings information, our design allows us to compare the exogenously manipulated changes in students' reported probabilities of majoring in different fields with the changes in their beliefs about various aspects of these fields. In addition to earnings and employment, though, we provide information about factors such as the difficulty of coursework, the gender composition of students and faculty, graduate school attendance rates, and family outcomes. We are then able to disentangle the relative importance of different pieces of information.

Our work also contributes to the non-experimental literature on college major choice. There are many papers that investigate the role of earnings in college major choice (Montmarquette et al., 2002; Beffy et al., 2012), but there is also a large literature that recognizes the importance of non-job factors. Some papers show that course grades can be a determining factor for major choice (Minaya, 2017; Kugler et al., 2021; McEwan et al., 2021). Several others provide evidence that a student's peers can influence their choice of major (Fischer, 2017; Zölitz and Feld, 2018) and that the gender composition of students and faculty matters (Hoffmann and Oreopoulos, 2009; Carrell et al., 2010; Astorne-Figari and Speer, 2019; Breda et al., 2020; Canaan and Mouganie, 2021; Delaney and Devereux, 2021; Bostwick and

Weinberg, 2022).[2] Our information treatments were inspired by this literature, and we contribute by experimentally testing the relevance of these various different sets of information on students' major choice.

A final contribution of our paper is our innovative design that makes the provision of so much information possible. Rather than giving a different set of information to different groups of students – which would require a huge sample given the information we want to provide – we design an intervention in which all students receive all information sets in random order. Because we elicit students' major choice probabilities before and after each information set, we can estimate the impact of each information set and measure those impacts against each other. This methodology allows us to create a sample much larger than the number of students actually surveyed, because we have several observations per student. Given the costs and logistics of performing information interventions, we believe this is a significant contribution to this area of research.

Section 2 lays the design of our information intervention, Section 3 shows a variety of summary statistics for our sample, Section 4 presents our main findings, and Section 5 concludes.

2 Intervention Design

In this section, we describe the setup of our information intervention. We use an innovative staggered design that allows us to measure and compare the effects of providing many different pieces of information on students' major choices. We focus exclusively on college freshmen in their first (fall) semester so that the students are unlikely to have complete knowledge of majors' characteristics. This also ensures that we have many respondents who are still unsure about their major choices at the time of the survey. The survey was conducted in October 2021 and took about one hour on average to complete.

[2]There is also a strand of this literature evaluating role siblings and parents in college major choice (Altmejd et al., 2021; Carlana et al., 2021). The state of the overall labor market (Ersoy, 2020; Blom et al., 2021) and local labor market shocks (Weinstein, 2020) also influence what students study. Our study does not address these factors.

2.1 Design Overview

Freshmen at Loyola Marymount University (LMU), a selective private university in Los Angeles, California, were invited to participate in an online research study about major choice. The invitation email included a survey link. Students were told to do the study in one sitting and given fifteen days to complete the survey. The survey has seven parts, summarized in Figure 1.[3] The first part of the survey asks students questions about demographics and their educational and family background. In the second part of the survey, we ask students about their major choice for eight different categories of majors offered at LMU. In the third part of the survey, we ask students their opinions and beliefs about various aspects of the different major categories. Then, students rank information sets that they will receive in the next part of the survey in terms of importance to them. In Part 5, students receive information regarding different aspects of majors in a random order. After each information set, we repeat the major choice questions of Part 2. In the sixth part of the survey, we re-ask students their opinions and beliefs about various aspects of different majors for each major category. At the end of the survey, students answer some follow-up questions. Upon completion of the survey, we pay students $30 in the form of Amazon gift cards.

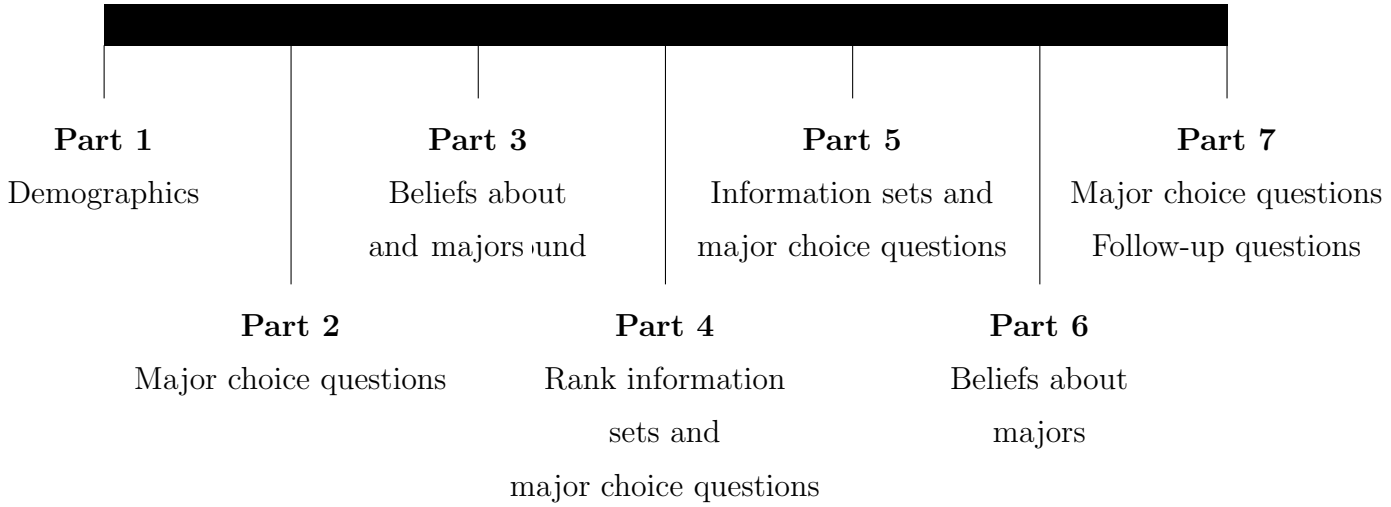
The result of this design is that we have measures of students' beliefs about majors both before and after the whole set of information is provided. We also have students' stated probabilities of majoring in each field both before and after receiving *each* of the information sets, as well as at the beginning and at the end of the experiment.

2.2 Survey Details

Part 1 The first part of the survey asks students questions about their demographics, educational background, and family characteristics. We ask students their gender, age, ethnicity, highest level of education for father and mother, high school GPA, high school rank, SAT/ACT scores, intended field of study, whether they have declared a major, financial aid status, and annual family income.

[3]The survey is accessible here: https://mylmu.co1.qualtrics.com/jfe/form/SV_8G1E792jjyWIiY6.

Figure 1: Survey Parts



Part 2 In the second part of the survey, we ask students questions about their major choice. In particular, we ask the probability that they will graduate from LMU with a degree in each of the eight major categories (the *major choice* question). To keep it simple for the students, we ask them to assume that they will certainly graduate with a degree and to consider only their primary major when answering this question. Hence, their answers to this question must add up to 100%.[4] The *major choice* question form the basis for our main dependent variable. In this part of the survey, we also ask about their perceived ability in each of these major categories as well as an open-ended question about the most important factor in their major choice.

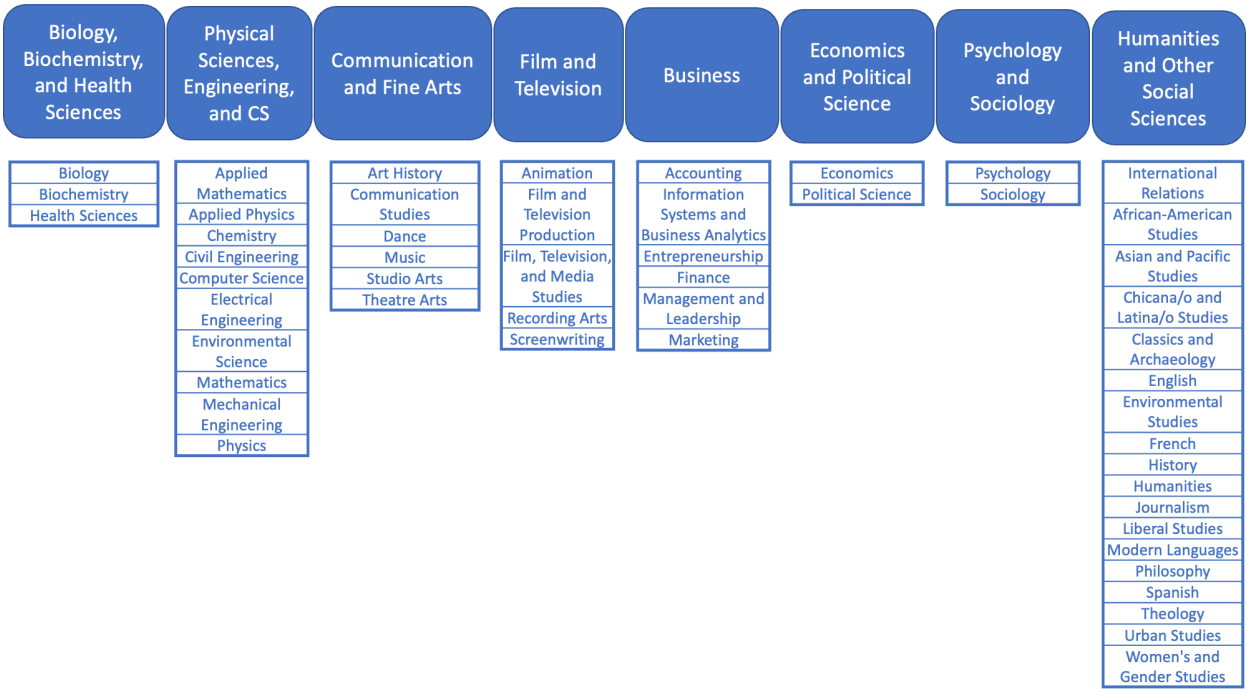
Throughout the survey, we ask students about eight different major categories: *Biology, Biochemistry, and Health Sciences*; *Physical Sciences, Engineering, and Computer Science*; *Communication and Fine Arts*; *Film and Television*; *Business*; *Economics and Political Science*; *Psychology and Sociology*; and *Humanities and Other Social Sciences*. We chose these categories of majors, rather than asking about every major offered at LMU separately,

[4] According to the university's statistics, the actual share of freshmen at LMU who graduate with a degree from LMU is about 80%. We additionally ask students the probability that they will graduate from LMU with a double major, assuming that they will certainly graduate with a degree (the *double major* question). Since we do not ask what field the double major would be in, we end up not using this question in our main analysis.

to keep the survey manageable. There is a trade-off between simplicity (using a small number of majors) and comprehensiveness. Using a small number of major categories would put very different majors together and make the information we provide more difficult to interpret for students.[5]

There are 52 total majors offered at LMU, which we put into the eight categories listed above. When classifying majors, our goal was to keep "similar" majors together in the same category and to make the categories of comparable size. To do this, we considered major characteristics, which school these majors belong to at LMU, and the number of students in each category.[6]

Figure 2: Major Categories



[5]In comparison, Wiswall and Zafar (2015a) have only four major categories and an additional category for not graduating, and Arcidiacono et al. (2012) has six categories.

[6]According to the data obtained from the registrar's office in Fall 2020, the eight major categories range from 511 students (*Biology, Biochemistry, and Health Sciences*) to 1,791 students (*Business*). Figure 2 displays which specific majors are in each category according to our classification. Students are shown this figure before they answer the *major choice* questions.

Part 3 In the third part of the survey, we ask students their beliefs about various aspects of each major category. We ask students 15 questions seeking their opinions about each major's coursework difficulty, gender composition (both students and faculty), graduate school probabilities, employment prospects, earnings, most common industry, workplace characteristics, and family status. Table 1 lists these questions. The answers to these questions are not incentivized. We have administrative data for questions 2, 3, 4, and 5, so for these we can measure the students' accuracy. For the other questions, we elicit students' beliefs about themselves. That is, rather than asking what they think about students majoring in *Business*, we ask them to imagine that they are graduating with a degree in *Business*.

Part 4 In this part of the survey, we would like to know what information students say is the most important to them. Students are told that they will receive information about various aspects of majors in the next part of the survey and are asked to rank which information sets they would most like to see. Figure 3 displays the information sets and what type of information they contain. Students are shown this figure before they rank the information sets. To incentivize truthful ranking, we inform students that their rankings might affect what information set they will see in the next part of the survey without providing them details about the process. Then, we randomly select 5% of students to only receive their highest-ranked information set, while the remaining 95% of students receive all information sets in a randomized order. Before moving to Part 5, we re-ask students the *major choice* question (described in Part 2), in case thinking about different aspects of majors in Part 3 has affected their major choices.

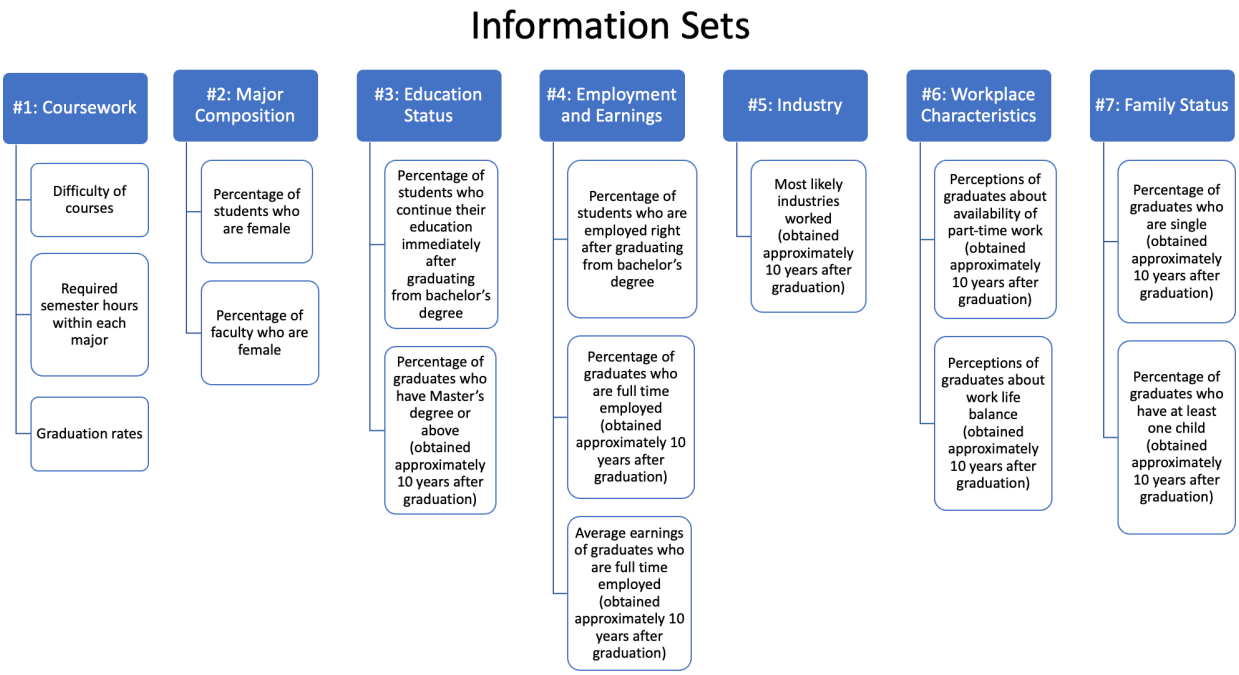
Part 5 Students are provided with the information sets in a randomized order. Students are told to examine the information sets carefully since this information might affect their opinions about various aspects of different majors and their major choices. To alleviate the experimental demand effects, students are also told that it is normal if some of the information provided does not change their opinions and major choices. After each information set, we ask students the *major choice* question.

Table 1: Belief Questions

Question	Answer Choices
1. What do you think about the average difficulty of the courses in each of the following major categories?	(1-10, 1: very easy, 10: very difficult)
2. What is the average required semester hours that need to be completed within the program for each of the following major categories	range of hours
3. What percentage of the LMU freshmen in each of the following major categories do you think graduate from LMU (with any major) within 4 years?	0-100
4. What percentage of the LMU students in each of the following major categories do you think is female?	0-100
5. What percentage of the LMU faculty in each of the following major categories do you think is female?	0-100
6. What is the probability that you will continue your education immediately after graduation if you major in the following major categories?	0-100
7. What is the probability that you will have a graduate degree (masters, professional, phd, etc.) 10 years after graduation if you major in the following major categories?	0-100
8. What is the probability that you will be employed right after graduating from LMU with a bachelor's degree if you major in the following major categories?	0-100
9. What is the probability that you will be employed full-time 10 years after graduation if you major in the following major categories?	0-100
10. What will be your annual earnings 10 years after graduation if you major in the following major categories?	range of earnings
11. What is the most likely industry that you will work in 10 years after graduation if you major in the following major categories?	industry categories
12. What is the probability that you will work in a job 10 years after graduation where you agree or strongly agree with the statement "my current job is flexible in terms of availability of part-time work" if you major in the following major categories?	0-100
13. What is the probability that you will work in a job 10 years after graduation where you agree or strongly agree with the statement "my current job has work-life balance" if you major in the following major categories?	0-100
14. What is the probability that you will be single 10 years after graduation if you major in the following major categories?	0-100
15. What is the probability that you will have at least one child 10 years after graduation if you major in the following major categories?	0-100

Notes: For questions 6-15, students were told to assume that they will certainly graduate with a degree from LMU. Students were told to answer question 10 by assuming that they will be full-time employed 10 years after graduation and by disregarding inflation.

Figure 3: Information Sets



To construct the information sets, we use three sources (administrative sources, the First Destination Survey, and an alumni survey), as described in Table 2. First, we obtained publicly and readily available data from the Registrar's Office and the Office of Institutional Research, and we collected publicly available data from department websites. Second, we compiled data from the First Destination Survey (FDS) 2019 and 2020. The FDS is conducted by LMU's Career and Professional Development Center and asks graduating LMU students questions about their career plans. The response rate for the FDS is 51.3% for the years we have used.

Finally, since most of the information we want to provide students was not readily available, we conducted an alumni survey with LMU graduates of 2010, 2011, and 2012 to measure outcomes approximately ten years after graduation. To do this, we obtained names, majors, and personal email addresses of graduates of undergraduate programs of those three years from the registrar's office. We sent an invitation email to take a short survey to 3,918 graduates in total. Since these email addresses were collected by the registrar's office at the time

of enrollment, many of them were outdated. Consequently, delivery was unsuccessful for 1,489 of these graduates. Overall, 203 graduates took our alumni survey.[7]

Table 2: Sources of Information

Information	Source
1. Difficulty of the courses	Alumni Survey
2. Required semester hours that need to be completed within the program	Department Websites
3. Freshmen graduation rates (4-year within university)	Institutional Research Office
4. Percentage of female students	Registrar's Office
5. Percentage of female faculty	Department Websites
6. Percentage of graduates continuing education immediately after graduation	First Destination Survey
7. Percentage with graduate degree 10 years after graduation	Alumni Survey
8. Percentage of employed immediately after graduation	First Destination Survey
9. Percentage of employed full-time 10 years after graduation	Alumni Survey
10. Annual earnings 10 years after graduation (for full-time employed)	Alumni Survey
11. The most common industry 10 years after graduation	Alumni Survey
12. Percentage of graduates who agree or strongly agree with the statement "my current job is flexible in terms of availability of part-time work" 10 years after graduation	Alumni Survey
13. Percentage of graduates who agree or strongly agree with the statement "my current job has work-life balance" 10 years after graduation	Alumni Survey
14. Percentage of graduates who are single 10 years after graduation	Alumni Survey
15. Percentage of graduates who have at least one child 10 years after graduation	Alumni Survey

Notes: The Alumni Survey was conducted in Summer 2021. The data on the required semester hours and the percentage of female faculty was collected in Winter 2021. Freshmen graduation rates is a weighted average of freshmen graduation rates for classes of 2016 to 2020. The data on the percentage of female students is based on all undergraduates students enrolled at LMU in Fall 2020. The data on percentage of graduates continuing their education and employed immediately after graduation was based on First Destination Survey 2019 and 2020.

Part 6 In this part, we repeat the questions of Part 3, asking students their opinions and beliefs about various aspects of each major category.

[7]We have tried to reach out the graduates with invalid email addresses through LinkedIn. But this task is challenging since LinkedIn only allows 30 messages per month to be sent to non-contacts. We have tried to reach out some of these graduates by adding them to our contact list. Out of 475 individuals who graduated from LMU in 2011 and for whom the e-mail delivery was unsuccessful, 194 were not found on LinkedIn. For the remaining graduates, we were able to send 39 direct messages and 82 connection requests. We have received 14 responses from this LinkedIn sample and include those responses in the information sets. The alumni survey is accessible here: https://mylmu.co1.qualtrics.com/jfe/form/SV_6ujkPn6U1KYhj0i.

Part 7 In the last part of the study, we ask students the *major choice* question for the last time. We also ask them whether they have paid attention to the questions and information throughout the research study and which information (if any) they think is the most important at changing their opinion about which field to major in.

2.3 Implementation

An invitation email to participate in an online research study about major choice was sent to all freshmen enrolled at LMU in Fall 2021. Students were given fifteen days to participate in the research study, and we sent them two reminder emails. Students were told to complete the survey in one sitting and in a quiet place using a computer. Surveys were implemented through Qualtrics (see Appendix A.2 for screenshots of all survey questions). At the beginning of the survey, students needed to electronically sign an informed consent form and declare that they are age 18 or above to be able to continue with the research study. Between Parts 3 and 4 and between Parts 5 and 6, students were told to take three-minute breaks. These breaks were enforced through Qualtrics, but students could also take longer than three minutes. At the end of the survey, we collect consent for obtaining the administrative records. Within three days of survey completion, all students who completed the survey were sent $30 in the form of Amazon e-gift cards.

3 Summary Statistics

Table 3 presents summary statistics. Column 1 shows the average values of answers to the Part 1 survey questions for the 310 students who started the survey.[8] Out of these students, 270 students completed all parts of the research study. Columns 2 and 3 show the average values for those who did not complete the research study and for those who completed the research study, respectively. Column 6 of the table shows that those who finished and did not

[8]Overall, 387 students attempted to take our survey. 51 students only opened the survey link but did not proceed to the next page, an additional 3 students did not give consent, and 19 students could not continue because they were under age 18. Our experiment was designed to recruit freshmen only, but we ended up with 4 individuals in our sample who are not freshmen; we drop these individuals from the analysis. Comparing our sample to the freshmen population at LMU, we have more females, less Hispanic students, and more Asian students.

finish the survey are statistically similar on most characteristics, although those who finished the survey are (perhaps unsurprisingly) more likely to report that they are uncertain of their intended major.

Table 3: Summary Statistics

	(1) Initial Sample	(2) Unfinished	(3) Finished	(4) Unsure about major	(5) Sure about major	(6) p-values (2)=(3)	(7) p-values (4)=(5)
Female	.635	.55	.648	.667	.607	.23	.345
Race							
Asian	.155	.1	.163	.172	.143	.306	.549
Black	.097	.125	.093	.102	.071	.519	.422
White	.4	.35	.407	.409	.405	.491	.953
Hispanic	.152	.175	.148	.145	.155	.66	.838
Multi-race	.152	.15	.152	.129	.202	.976	.121
Other	.045	.1	.037	.043	.024	.074	.441
Age	18.15	18.13	18.15	18.15	18.16	.692	.933
Household Income	232K	233K	232K	227K	244K	.992	.504
Father college graduate	.632	.55	.644	.672	.583	.249	.16
Mother college graduate	.848	.825	.852	.844	.869	.66	.595
Father has Master's or above	.235	.1	.256	.28	.202	.031	.18
Mother has Master's or above	.374	.425	.367	.376	.345	.478	.625
High School GPA	3.77	3.76	3.78	3.78	3.77	.632	.875
High School Rank							
Top 1%	.039	.105	.03	.032	.024	.024	.706
Between Top 1% and Top 10%	.334	.316	.337	.344	.321	.796	.717
Between Top 10% and Top 25%	.455	.342	.47	.462	.488	.138	.696
Between Top 25% and Top 50%	.143	.184	.137	.134	.143	.438	.852
Between Top 50% and Top 75%	.029	.053	.026	.027	.024	.362	.884
Took SAT or ACT	.425	.368	.433	.425	.452	.45	.673
Officially declared a major	.792	.865	.781	.747	.857	.243	.043
Intended Field of Study							
Biology, Biochemistry & Health Sciences	.13	.135	.13	.108	.179	.926	.108
Physical Sciences, Engineering & CS	.078	.135	.07	.086	.036	.17	.136
Communication and Fine Arts	.124	.216	.111	.129	.071	.069	.164
Film and Television	.124	.081	.13	.108	.179	.402	.108
Business	.199	.216	.196	.183	.226	.777	.408
Economics and Political Science	.078	.081	.078	.086	.06	.944	.454
Psychology and Sociology	.156	.081	.167	.167	.167	.18	1
Other Social Sciences	.046	.054	.044	.043	.048	.794	.866
Uncertain	.065	0	.074	.091	.036	.087	.107
Observations	310	40	270	186	84	310	270

Notes: Column 1 is all students who started our survey, column 2 students who didn't complete the survey, and column 3 are students who completed our survey. Columns 4 and 5 are students who are unsure and sure about their major choices, respectively. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Column 6 tests the equality of means across students who finished and didn't finished the research study. Column 7 tests the equality of means across sure and unsure students.

Columns 4 and 5 split the sample into students who are unsure about their major and those who are sure. We define "sure" as putting a 100% probability on majoring in a certain field in Part 2 of the survey (prior to the information being provided). 84 students (31% of those who finished the survey) were sure of their major before the experiment, while 186 were unsure. Column 7 shows that the sure students are more likely to report that they have officially declared a major (statistically significant at the 10% level), but the fields of study for sure and unsure students are not statistically different.

4 Results

We will begin by analyzing the types of information students said they were most interested in receiving. We then investigate how the research study altered the stated major choices of students overall and which information sets were the most powerful in changing students' stated choices. After that, we look at the individual pieces of information inside each information set and ask how well-informed students were prior to the experiment, how students updated their beliefs with the new information, and how those updated beliefs translated into changes in stated major choices.

4.1 What types of information are students interested in?

We begin by looking at which information sets students say are the most important to them, using their answers from Part 4 of the survey. Table 4 presents these results. The most important information set to students is Employment & Earnings, which is ranked either first or second by 61.1% of students. Coursework Difficulty ranks second on this measure at 40%. On the other hand, the Family Status information set (with marriage and parenthood rates) is the least important, with only 10.4% rating it highly and 59.3% rating it at or near the bottom.[9]

[9]This rank-order is in line with how much time students spent looking at the information sets in Part 5. Median time spent on the Employment & Earnings information set is 27 seconds and median time spent on Coursework Difficulty is 23.5 seconds, whereas median time spent on Family Status is 15 seconds.

Table 4: How Students Rank the Information Sets

Rank	Coursework Difficulty	Gender Composition	Graduate School	Employment & Earnings	Industry Outcomes	Workplace Characteristics	Family Status
1	26.7	6.3	4.81	33.0	16.7	6.3	6.3
2	13.3	14.4	11.5	28.2	14.1	14.4	4.1
3	13.0	11.9	18.2	16.3	12.6	19.3	8.9
4	17.8	13.3	14.8	13.0	16.3	15.6	9.3
5	12.6	16.7	20 .0	6.3	18.2	14.1	12.2
6	10.7	18.5	19.3	2.2	13.0	21.9	14.4
7	5.9	18.9	11.5	1.1	9.3	8.5	44.8
Overall							
1st or 2nd	40.0	20.7	16.3	61.1	30.7	20.7	10.4
6th or 7th	16.7	37.4	30.7	3.3	22.2	30.4	59.3
Females							
1st or 2nd	44.0	24.0	17.7	56.0	22.9	25.7	9.7
6th or 7th	17.1	34.3	28.6	5.1	25.7	28.6	60.6
Males							
1st or 2nd	32.66	14.7	13.7	70.4	45.3	11.6	11.6
6th or 7th	15.8	43.2	34.7	0.0	15.8	33.7	56.8

The bottom rows of the table look at how these rankings differed by gender. Male students were more interested than females in receiving information about Employment & Earnings and Industry Outcomes, while females said they were more interested than males in Coursework Difficulty, Gender Composition, and Workplace Characteristics information sets. We have also compared the rankings of "sure" and "unsure" students and found that they were largely similar.

4.2 How does the intervention change students' major choices?

We continue by asking how the intervention as a whole – receiving all seven information sets – affected students' stated major choices from the beginning of the experiment to the end. This is one way to check if students were paying attention to the information they were provided and if the information was new and relevant to the students. We run regressions for each major category of the form

$$\pi_{ijFinal} - \pi_{ijInitial} = \sum_{j=1}^{8} \alpha_j Major_j + \epsilon_{ij} \tag{1}$$

where $\pi_{ijFinal}$ is the probability of student i graduating with a degree in major category j elicited at the end of the experiment (Part 7) and $\pi_{ijInitial}$ is the probability of student i graduating with a degree in major category j elicited at the beginning of the experiment (Part 2). At this point, we are not asking why these probabilities change, but merely asking if and how the students' choices are changed by their participation in the study.

Table 5 presents these results.[10] For the whole sample of students (column 1), there is a movement away from *Film and Television* and toward *Business*. On average, students increase their probability of majoring in *Business* by 1.2 percentage points (ppt), with almost a corresponding decline in *Film and Television*. None of the other major probabilities changes significantly; keep in mind, however, that these are averages, so different students may be moving probabilities up and down to cancel each other out. Columns 2 and 3 distinguish between sure and unsure students, based on their initial major choice probabilities. The sure students do not change any of their major probabilities significantly by the end of the experiment. The unsure students move significantly toward *Business* (+1.5 ppt) and away from *Film and Television* (-1.7 ppt).

Columns 4 and 5 reveal some interesting differences by gender. Over the course of the experiment, males move strongly toward *Business* (+2.3 ppt) and away from both *Film and Television* and *Economics and Political Science* (each -1.8 ppt). Females, on the other hand, move toward *Economics and Political Science* (+1.2 ppt). While they do shift toward *Business* (+0.6 ppt, insignificant), this is much smaller than the corresponding effect for males. This is suggestive evidence that the information we give is having different effects for males and females, which we will continue to investigate in the rest of our results.

[10] Appendix Table 1 replicates this table with an alternative dependent variable, $\pi_{ijFinal} - \pi_{ijPart4}$, where $\pi_{ijPart4}$ is the probability elicited after the initial belief elicitation but before any information provision. Results for that specification are similar to our main specification.

Table 5: Students' Major Changes from Beginning to End

	(1)	(2)	(3)	(4)	(5)
	Change in Major Choices (Final-Initial)				
Biology, Biochemistry & Health Sciences	-0.070	0.085	-0.402	0.600	-0.426
	(0.371)	(0.479)	(0.558)	(0.577)	(0.479)
Physical Sciences, Engineering & CS	0.598	0.791	0.183	0.089	0.870
	(0.448)	(0.653)	(0.136)	(0.515)	(0.631)
Communication and Fine Arts	-0.052	0.065	-0.305	-0.167	0.009
	(0.315)	(0.409)	(0.464)	(0.367)	(0.443)
Film and Television	-1.095**	-1.743***	0.305	-1.800*	-0.719
	(0.465)	(0.631)	(0.526)	(0.959)	(0.499)
Business	1.189**	1.554**	0.402	2.300**	0.598
	(0.496)	(0.697)	(0.435)	(0.999)	(0.542)
Economics and Political Science	0.151	0.446	-0.488	-1.778*	1.178*
	(0.545)	(0.782)	(0.345)	(0.926)	(0.665)
Psychology and Sociology	-0.191	-0.393	0.244	0.883	-0.763
	(0.645)	(0.917)	(0.500)	(1.166)	(0.770)
Other Social Sciences	-0.531	-0.805	0.0610	-0.128	-0.746
	(0.396)	(0.564)	(0.283)	(0.351)	(0.578)
Sample	All	Unsure	Sure	Male	Female
Observations	2072	1416	656	720	1352
Subjects	259	177	82	90	169

Notes: The dependent variable is the difference between a student's stated probability of graduating with a degree in a major category elicited at the end of the experiment (Part 7) and the student's stated probability of graduating with a degree in that major category elicited at the beginning of the experiment (Part 2). Independent variables are the major category dummies. We have 8 observations per student in each column. Column 1 is all students who finished our survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Which information sets are the most important at moving students' major choices?

We now take a closer look at which information sets have the largest impacts on students' major choice probabilities. Here we take advantage of the staggered survey design in which students are asked their major choice probabilities before and after seeing each information set, which are given in an individually randomized order (Part 5 of the survey). We run regressions of the form

$$|\pi_{ijt} - \pi_{ijt-1}| = \sum_{k=1}^{7} \alpha_k IS_{it}^k + \epsilon_{ijt} \tag{2}$$

where π_{ijt} is probability of student i graduating with a degree in major category j elicited at time t where $t \in \{1, 2, 3, 4, 5, 6, 7\}$, IS_{it}^{k} is a dummy variable which is equal to 1 if the information set student i sees at time t is equal to information set k and 0 otherwise. In other words, we compare the major probabilities given by the student just before and just after seeing each information set. For each student, we have 56 observations (8 major categories*7 times of elicitation). The question here is which information sets had the largest impact on students' major choices, not the direction in which they moved students' choices, so we look at the absolute change in reported probabilities rather than the raw change.

Table 6 presents the results. Column 1 reports the results for the overall sample. The top panel shows the estimated absolute percentage point change in all major probabilities after seeing each information set, and the p-values comparing the coefficients are found below. The Employment & Earnings information set stands out from the others; its coefficient is the highest (1.9 ppts) and it is statistically significantly different from all other coefficients. The Gender Composition information set seems to be the least effective, with the smallest coefficient (0.8 ppts), which is significantly different from all others, except Family Status. The Coursework Difficulty, Graduate School, Industry Outcomes, Workplace Characteristics, and Family Status information sets have similar magnitudes of impact at around 1 to 1.3 ppts.

As we would expect, the effect of each information set is larger for the unsure students than for the sure students, but the ranking of which information sets matter most is largely the same (Employment & Earnings first, Gender Composition last or near-last). Interestingly, in columns 4 and 5, we see that women respond more to seeing the Employment & Earnings set than men do (2.1 ppts, compared with 1.5 ppts for men). This is surprising given prior evidence that women put less weight on earnings when making major choices (Wiswall and Zafar, 2018). Note, however, that Employment & Earnings set includes more information than just earnings.

Table 6: Information Sets and Major Probability Changes

	(1)	(2)	(3)	(4)	(5)
	Absolute Change in Stated Major Choice ($\lvert\pi_{ijt} - \pi_{ijt-1}\rvert$)				
Coursework Difficulty	1.119***	1.565***	0.155	0.981***	1.192***
	(0.217)	(0.304)	(0.153)	(0.336)	(0.280)
Gender Composition	0.787***	1.044***	0.232	0.517**	0.930***
	(0.147)	(0.200)	(0.158)	(0.207)	(0.196)
Graduate School	1.320***	1.448***	1.046**	0.967***	1.509***
	(0.237)	(0.266)	(0.481)	(0.337)	(0.316)
Employment & Earnings	1.885***	2.099***	1.424**	1.456***	2.114***
	(0.287)	(0.314)	(0.603)	(0.424)	(0.377)
Industry Outcomes	1.299***	1.629***	0.585*	1.175**	1.365***
	(0.249)	(0.324)	(0.347)	(0.465)	(0.291)
Workplace Characteristics	1.151***	1.540***	0.311*	1.069***	1.195***
	(0.189)	(0.259)	(0.180)	(0.331)	(0.231)
Family Status	1.047***	1.373***	0.345	0.422***	1.380***
	(0.223)	(0.292)	(0.306)	(0.141)	(0.332)
p-values:					
coursework=composition	0.068	0.050	0.098	0.158	0.231
coursework=graduate	0.412	0.683	0.056	0.935	0.387
coursework=employment	0.003	0.021	0.046	0.182	0.007
coursework=industry	0.399	0.803	0.264	0.649	0.468
coursework=workplace	0.851	0.913	0.516	0.724	0.992
coursework=family	0.765	0.537	0.584	0.103	0.554
composition =graduate	0.026	0.149	0.079	0.143	0.081
composition=employment	0.000	0.000	0.060	0.037	0.001
composition=industry	0.036	0.058	0.362	0.193	0.096
composition=workplace	0.070	0.068	0.744	0.145	0.258
composition=family	0.233	0.236	0.744	0.573	0.164
graduate=employment	0.028	0.030	0.440	0.158	0.082
graduate=industry	0.940	0.581	0.417	0.621	0.704
graduate=workplace	0.479	0.750	0.083	0.689	0.357
graduate=family	0.307	0.794	0.224	0.102	0.728
employment=industry	0.008	0.017	0.136	0.329	0.014
employment=workplace	0.003	0.012	0.067	0.294	0.004
employment=family	0.003	0.026	0.043	0.014	0.044
industry=workplace	0.441	0.705	0.410	0.802	0.374
industry=family	0.361	0.451	0.608	0.116	0.963
workplace=family	0.686	0.620	0.926	0.057	0.595
Sample	All	Unsure	Sure	Male	Female
Observations	14504	9912	4592	5040	9464
Subjects	259	177	82	90	169

Notes: The dependent variable is the absolute difference between a student's stated probability of graduating with a degree in a major category elicited at time t versus at time t-1 in Part 5 of the survey. Independent variables are the information set dummies. We have 56 observations (8 majors*7 information sets) per student in each column. Column 1 is all students who finished our survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Keep in mind that each information set is a collection of several pieces of information, so we cannot say yet what specific pieces of information are impacting student choices. Also, we would expect an information set to have a larger effect the more it changes student beliefs; if students are already knowledgeable about a certain piece of information, then that set will not have much impact even if it is very important to students. We investigate these issues in Sections 4.4 and 4.5.

In Table 7, we look at how each information set changed students' stated probabilities of each major separately. In this case, we are interested in the direction of the change, not just the magnitude, so we use the raw changes rather than the absolute change. Each of the eight columns is a different major category. We see that the Employment & Earnings information set tended to push people toward *Business* majors and *Physical Sciences, Engineering, and Computer Science* majors and away from *Humanities and Other Social Sciences*. Learning about the difficulty of coursework pushed students toward *Communication and Fine Arts* majors and away from the *Physical Sciences, Engineering, and Computer Science*. While Gender Composition was the least powerful information set in general, it pushed students toward *Biology, Biochemistry, and Health Sciences* majors, *Communication and Fine Arts* majors, and *Economics and Political Science* majors.

As a final way of assessing the overall impact of the information sets on major choices, in Table 8, we estimate the probabilities that seeing each information set led to *any* change in the elicited major probabilities. For all seven information sets, the provision of information led to changes in students' major probabilities. After seeing Employment & Earnings information, 38% of students made at least some change to their probabilities (50% of unsure students and 12% of sure students). Even for Gender Composition, 21% of students responded to the information with some change.[11]

[11]In Appendix Table 2, we look at how receiving the information sets changed the probability of double-majoring. We thought the information might induce students to add or subtract a major rather than just changing their stated first-major probabilities. However, we do not find any overall significant effects of the information sets on these probabilities.

Table 7: Effect of Each Information Set on Each Major

Major	(1) Biology, Biochemistry & Human Sci.	(2) Physical Sci., Engineering & Computer Sci.	(3) Communication and Fine Arts	(4) Film and Television	(5) Business	(6) Economics and Political Sci	(7) Psychology and Sociology	(8) Humanities and Other Social Sci.
	Change in Stated Major Choice ($\pi_{it} - \pi_{it-1}$)							
Coursework Difficulty	-0.506	-0.382**	1.031*	0.085	0.151	-0.378	0.467	-0.467
	(0.349)	(0.184)	(0.617)	(0.231)	(0.367)	(0.508)	(0.451)	(0.414)
Gender Composition	0.444*	-0.185	0.421*	-0.305	-0.297	0.591*	-0.293	-0.375
	(0.258)	(0.288)	(0.229)	(0.194)	(0.313)	(0.353)	(0.293)	(0.307)
Graduate School	0.189	-0.676	-0.263	0.355	-0.0502	0.216	0.0695	0.174
	(0.346)	(0.418)	(0.185)	(0.627)	(0.646)	(0.598)	(0.475)	(0.209)
Employment & Earnings	-0.452	0.514*	-0.120	0.139	1.514*	-0.753	-0.297	-0.544**
	(0.467)	(0.301)	(0.560)	(0.833)	(0.819)	(0.609)	(0.484)	(0.274)
Industry Outcomes	-0.243	-0.054	-0.469	-0.117	0.707	0.186	-0.752	0.722
	(0.166)	(0.284)	(0.302)	(0.463)	(0.609)	(0.674)	(0.585)	(0.458)
Workplace Characteristics	-0.193	0.193	-0.008	0.290	-0.359	-0.232	-0.0695	0.382
	(0.471)	(0.309)	(0.449)	(0.267)	(0.310)	(0.298)	(0.323)	(0.456)
Family Status	-0.228	0.282	-0.830	-0.351	0.124	0.278	0.641	0.0849
	(0.285)	(0.361)	(0.566)	(0.671)	(0.226)	(0.430)	(0.473)	(0.182)
p-values:								
coursework=composition	0.080	0.476	0.319	0.206	0.267	0.138	0.172	0.774
coursework=graduate	0.195	0.537	0.061	0.691	0.789	0.532	0.541	0.180
coursework=employment	0.927	0.011	0.198	0.950	0.167	0.628	0.313	0.879
coursework=industry	0.544	0.401	0.047	0.715	0.468	0.588	0.187	0.149
coursework=workplace	0.573	0.133	0.253	0.560	0.233	0.796	0.370	0.307
coursework=family	0.392	0.114	0.063	0.547	0.953	0.415	0.803	0.226
composition =graduate	0.625	0.375	0.038	0.341	0.746	0.581	0.563	0.238
composition=employment	0.107	0.063	0.443	0.610	0.061	0.092	0.995	0.692
composition=industry	0.023	0.786	0.044	0.703	0.149	0.585	0.486	0.106
composition=workplace	0.248	0.369	0.364	0.079	0.882	0.088	0.587	0.239
composition=family	0.093	0.362	0.036	0.946	0.293	0.598	0.135	0.222
graduate=employment	0.253	0.045	0.803	0.859	0.230	0.344	0.679	0.067
graduate=industry	0.228	0.222	0.414	0.555	0.399	0.969	0.244	0.243
graduate=workplace	0.521	0.134	0.624	0.930	0.671	0.509	0.817	0.688
graduate=family	0.451	0.164	0.326	0.510	0.807	0.934	0.403	0.754
employment=industry	0.660	0.152	0.587	0.821	0.475	0.377	0.524	0.037
employment=workplace	0.774	0.538	0.878	0.856	0.038	0.427	0.698	0.095
employment=family	0.686	0.642	0.476	0.710	0.102	0.185	0.169	0.081
industry=workplace	0.923	0.576	0.426	0.458	0.151	0.574	0.364	0.339
industry=family	0.969	0.468	0.574	0.766	0.390	0.904	0.125	0.201
workplace=family	0.951	0.851	0.277	0.376	0.262	0.397	0.122	0.553
Observations	1813	1813	1813	1813	1813	1813	1813	1813
Subjects	259	259	259	259	259	259	259	259

Notes: The dependent variable is the difference between a student's stated probability of graduating with a degree in a major category elicited at time t versus at time t-1 in Part 5 of the survey. Independent variables are the information set dummies. Each column belongs to a different major category. We have 7 observations per student in each column. All students who finished the survey are included in the table. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.4 How did information affect students' beliefs?

Before we can look at how the specific pieces of information affected students' major choices, we must assess how the information affected students' beliefs. We would only expect a change in major choices if students' beliefs were actually changed by the information, which requires that it was both relevant to students and new to them.

Table 9 assesses the difference between students' prior beliefs and the information they were shown, which we call their "surprise".[12] Panel A shows these differences (information provided in Part 5 of the survey minus prior belief elicited in Part 3 of the survey) across all majors for each of the opinion questions. On average, students were not surprised by the information on required hours, graduation probabilities, or earnings. However, their prior beliefs were significantly different from the information given on the other pieces of information. For example, students overestimated the chance of having children 10 years after college by about 20 percentage points and underestimated the chance of being single. Students also overestimated the probability of going to graduate school immediately after college but underestimated the chances of having a graduate degree 10 years later. On employment, students vastly underestimated the chances of being employed both right after college and 10 years later.

[12]We use the term "surprise" for the difference between the information and prior beliefs rather than "accuracy" because most of the beliefs are elicited about self whereas the information belongs to LMU alumni. Furthermore, some of our information was taken from an alumni survey that may not be representative of all LMU alumni. Still, our use of actual alumni from LMU should be an improvement over using local or national averages. Our use of "overestimate" or "underestimate" when referring to the beliefs means that students' guesses were higher or lower than the information provided.

Table 8: Information Sets and Any Change in Major Probabilities

	(1)	(2)	(3)	(4)	(5)
	Any Change in Stated Major Choice Probabilities				
Coursework Difficulty	0.255***	0.362***	0.024	0.244***	0.260***
	(0.0272)	(0.0363)	(0.0172)	(0.0458)	(0.0339)
Gender Composition	0.212***	0.282***	0.061**	0.167***	0.237***
	(0.0255)	(0.0340)	(0.0267)	(0.0397)	(0.0329)
Graduate School	0.270***	0.356***	0.085***	0.256***	0.278***
	(0.0277)	(0.0362)	(0.0312)	(0.0465)	(0.0347)
Employment & Earnings	0.382***	0.503***	0.122***	0.356***	0.396***
	(0.0303)	(0.0378)	(0.0366)	(0.0510)	(0.0378)
Industry Outcomes	0.228***	0.299***	0.073**	0.178***	0.254***
	(0.0262)	(0.0346)	(0.0291)	(0.0407)	(0.0337)
Workplace Characteristics	0.301***	0.412***	0.061**	0.322***	0.290***
	(0.0286)	(0.0372)	(0.0267)	(0.0498)	(0.0351)
Family Status	0.236***	0.316***	0.061**	0.200***	0.254***
	(0.0265)	(0.0351)	(0.0267)	(0.0426)	(0.0337)
p-values:					
coursework=composition	0.109	0.031	0.184	0.091	0.468
coursework=graduate	0.595	0.887	0.060	0.811	0.633
coursework=employment	0.000	0.000	0.021	0.025	0.000
coursework=industry	0.347	0.117	0.105	0.183	0.867
coursework=workplace	0.097	0.182	0.262	0.147	0.356
coursework=family	0.448	0.196	0.184	0.290	0.854
composition =graduate	0.025	0.037	0.420	0.075	0.163
composition=employment	0.000	0.000	0.098	0.000	0.000
composition=industry	0.588	0.657	0.742	0.829	0.604
composition=workplace	0.002	0.001	1.000	0.002	0.130
composition=family	0.407	0.379	1.000	0.496	0.604
graduate=employment	0.000	0.000	0.323	0.029	0.001
graduate=industry	0.139	0.142	0.742	0.091	0.519
graduate=workplace	0.269	0.150	0.323	0.160	0.733
graduate=family	0.209	0.288	0.485	0.229	0.495
employment=industry	0.000	0.000	0.210	0.000	0.000
employment=workplace	0.004	0.013	0.135	0.472	0.003
employment=family	0.000	0.000	0.060	0.001	0.000
industry=workplace	0.009	0.003	0.709	0.004	0.291
industry=family	0.786	0.664	0.709	0.598	1.000
workplace=family	0.024	0.015	1.000	0.028	0.291
Sample	All	Unsure	Sure	Male	Female
Observations	1813	1239	574	630	1183
Subjects	259	177	82	90	169

Notes: The dependent variable is a dummy variable that is equal to 1 if a student had change in any of their major probabilities elicited at time t versus at time t-1 in Part 5 of the survey. Independent variables are the information set dummies. We have 7 observations per student in each column. Column 1 is all students who finished the survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Differences between Students' Prior Beliefs and Information Provided

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Surprise (Information-Prior Belief) about													
	difficulty of courses	required hours	graduation probabilities	female student ratio	female faculty ratio	continuing education at graduation	holding graduate degree in 10 years	employed at graduation	employed in 10 years	earnings in 10 years	workplace flexibility	work-life balance	being single in 10 years	having children in 10 years
Panel A														
Constant	0.284***	1.522	1.943	2.548***	0.513	-23.85***	11.01***	16.59***	23.52***	-0.515	-20.38***	8.249***	3.637***	-20.24***
	(0.0707)	(1.485)	(1.284)	(0.541)	(0.620)	(1.495)	(1.552)	(1.393)	(1.656)	(0.644)	(1.142)	(1.041)	(1.167)	(1.453)
Panel B														
Majors														
1	-0.490***	9.865***	11.41***	19.33***	17.04***	-18.05***	23.21***	-12.42***	23.90***	-2.769***	-20.98***	6.571***	-5.201***	-3.359**
	(0.0894)	(1.868)	(1.428)	(0.925)	(0.995)	(2.233)	(2.206)	(1.918)	(2.110)	(0.915)	(1.590)	(1.437)	(1.610)	(1.629)
2	-1.046***	19.51***	6.039***	-8.081***	0.965	-25.81***	31.14***	14.63***	26.01***	-1.855*	-1.849	28.48***	-4.579***	-8.996***
	(0.0931)	(1.875)	(1.438)	(0.849)	(0.985)	(2.171)	(2.147)	(2.014)	(2.144)	(0.947)	(1.659)	(1.466)	(1.601)	(1.640)
3	0.321***	1.625	5.228***	12.98***	-4.232***	-17.76***	21.76***	25.03***	32.10***	0.271	-33.87***	12.52***	6.467***	-29.15***
	(0.111)	(1.567)	(1.442)	(0.802)	(0.878)	(1.761)	(1.865)	(1.737)	(1.986)	(0.616)	(1.501)	(1.474)	(1.403)	(1.674)
4	-0.0251	0.552	-4.317***	-4.409***	-15.51***	-31.63***	-2.158	39.30***	14.46***	-1.840	-10.73***	-9.649***	17.37***	-32.03***
	(0.121)	(1.642)	(1.376)	(0.836)	(0.888)	(1.773)	(1.799)	(1.756)	(1.920)	(1.230)	(1.564)	(1.487)	(1.429)	(1.629)
5	1.083***	5.143***	-3.830***	-2.853***	0.363	-32.97***	-24.44***	24.86***	24.26***	0.0176	-18.90***	7.656***	-6.297***	-17.46***
	(0.123)	(1.611)	(1.308)	(0.762)	(0.868)	(1.930)	(2.029)	(1.720)	(1.844)	(0.983)	(1.531)	(1.389)	(1.379)	(1.666)
6	0.662***	-10.94***	-1.479	-6.633***	0.591	-23.58***	7.073***	14.98***	23.62***	1.510**	-23.04***	20.46***	8.564***	-20.92***
	(0.105)	(1.640)	(1.444)	(0.817)	(0.913)	(2.017)	(2.035)	(1.772)	(1.931)	(0.645)	(1.421)	(1.336)	(1.454)	(1.625)
7	0.639***	-10.03***	-2.923**	9.015***	8.938***	-26.93***	13.06***	17.40***	20.48***	0.289	-28.46***	-10.92***	18.36***	-16.12***
	(0.116)	(1.667)	(1.403)	(0.818)	(0.955)	(2.052)	(2.193)	(1.702)	(1.942)	(0.638)	(1.501)	(1.437)	(1.402)	(1.697)
8	1.129***	-3.556**	5.409***	1.031	-4.058***	-14.08***	18.40***	8.946***	23.31***	0.260	-25.23***	10.87***	-5.591***	-33.92***
	(0.112)	(1.634)	(1.514)	(0.888)	(0.877)	(1.914)	(2.060)	(1.767)	(1.987)	(0.514)	(1.488)	(1.432)	(1.367)	(1.709)
Observations	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072
Subjects	259	259	259	259	259	259	259	259	259	259	259	259	259	259

Notes: The dependent variables are the "surprises" (information provided in Part 5 of the survey minus prior belief elicited in Part 3 of the survey) across all majors for each of the opinion questions. Different columns correspond to different opinion questions. There are 8 observations per student. Panel A shows the overall "surprises" whereas Panel B displays the "surprises" regarding each major category. Major 1 is *Biology, Biochemistry, and Health Sciences*, Major 2 is *Physical Sciences, Engineering, and Computer Science*, Major 3 is *Communication and Fine Arts*, Major 4 is *Film and Television*, Major 5 is *Business*, Major 6 is *Economics and Political Science*, Major 7 is *Psychology and Sociology*, and Major 8 is *Humanities and Other Social Sciences*. Standard errors are clustered at the subject level and are reported in parentheses.*$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9 Panel B breaks these differences down for the eight different major categories. Students' beliefs were generally "off" about all majors, but there are some interesting patterns. While students were correct on average about earnings, they underestimated earnings in science fields and overestimated earnings in *Economics and Political Science*. Students also initially overestimated the difficulty of the sciences but underestimated the difficulty of communication, business and all social science majors. Their beliefs about student and faculty gender were all over the map, vastly underestimating the share of females in *Biology, Biochemistry, and Health Sciences* majors and *Psychology and Sociology* majors but overestimating the share in *Physical Sciences, Engineering, and Computer Science* majors and *Film and Television* majors.[13]

Given the differences between students' prior beliefs and the information provided, there is ample opportunity for students to update their beliefs. If we assume that our students are Bayesian updaters, that would imply that their posterior beliefs (elicited in Part 6 of the survey) are a weighted average of their prior beliefs and the information provided. In that case, regressing the change in beliefs (posterior-prior) on their surprise (information-prior) would tell us how students' revisions of beliefs relate to how surprised they are by the information. However, in a similar setup to ours, Wiswall and Zafar (2015b) find that the majority of students are not Bayesian updaters, so we do not want to impose this assumption.

Instead, we start with a non-parametric analysis, using a local linear regression to explore the relationship between belief updating (posterior-prior) and surprise (information-prior). Figure 4 shows the results for each of the opinion questions. These figures reveal that there is a positive and roughly linear relationship between the surprise and belief updating for most of the questions. For the majority of the belief questions, people are updating in the direction of the information they receive. There are a few partial exceptions: initial graduate school probabilities, workplace flexibility in terms of having part-time work, and probability of having children 10 years after graduation. For these, there are some people who are negatively surprised by the information but are updating positively (the portion of data in

[13]Appendix Table 3 compares the "surprises" for sure vs. unsure students and for males vs. females. Sure and unsure students' surprises are mostly similar, as are those for males and females.

the upper left quadrant of the figures). This may echo some findings in Wiswall and Zafar (2015b), showing that students are more conservative in their updating when the news is "negative" rather than positive.

Because the relationships between surprise and updating seem mostly linear, we proceed by regressing students' posterior beliefs on their prior beliefs, the information provided and a constant:

$$posterior_{ijm} = \alpha_m + \beta^*_m prior_{ijm} + \gamma^*_m information_{jm} + \epsilon_{ijm}$$

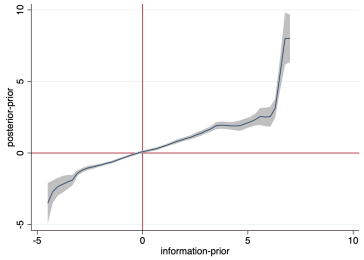
where $prior_{ijm}$ is student i's beliefs about major j regarding topic m elicited before the information provision (Part 3), $posterior_{ijm}$ is student i's beliefs about major j regarding topic m elicited after the information provision (Part 6), and $information_{jm}$ is the information provided to students about major j regarding topic m. This model is equivalent to one in which we regress the update (posterior-prior) on the surprise (information-preBeliefs). However, that model would constrain the weights on *information* and *prior* to add to 1. Our preferred specification is more flexible but nests the constrained model.

Table 10 presents these results, with Panel A showing the results for the full sample. All coefficients on the information are significantly positive (ranging between 0.08 and 0.58), except graduation probabilities. Students are updating their beliefs partially; full updating would give coefficients of 1 on the information.[14] For example, the 0.572 coefficient for difficulty of coursework means that a one unit surprise in course difficulty corresponds to 0.572 unit increase in posterior beliefs regarding course difficulty. We can reject the constrained model since we can reject that the coefficients on the prior beliefs and information add up to 1 for all the opinion questions, except the one about earnings in 10 years.

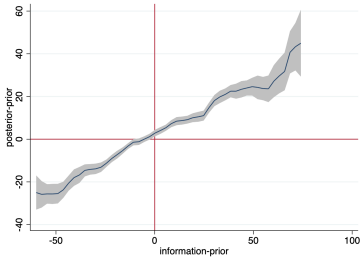
[14]Because many of the beliefs we elicited are for the student themselves, while the information is about LMU alumni, partial updating is to be expected.

Figure 4: Local Linear Regression of Change in Beliefs on Surprise

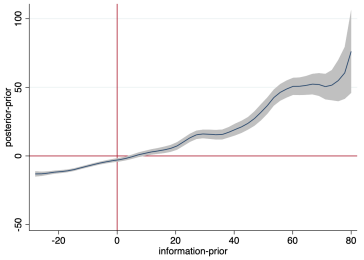
Difficulty of courses



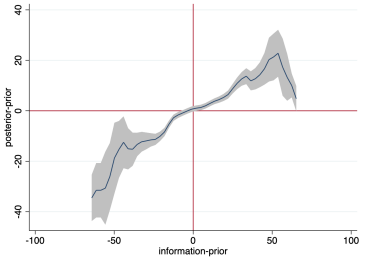
Required hours



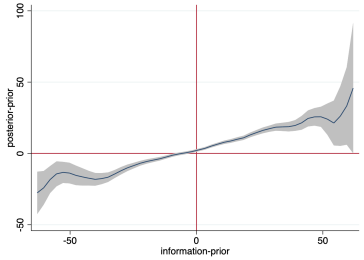
Graduation probabilities



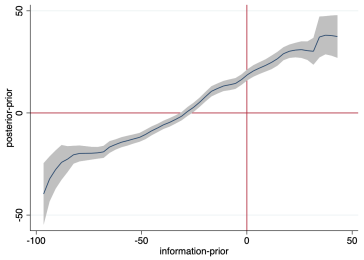
Female student ratio



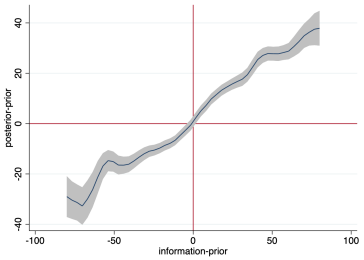
Female faculty ratio



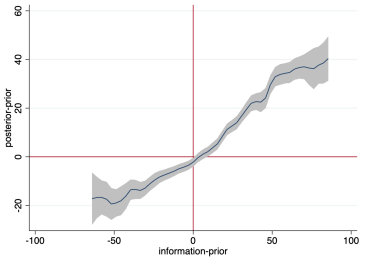
Cont. education at graduation



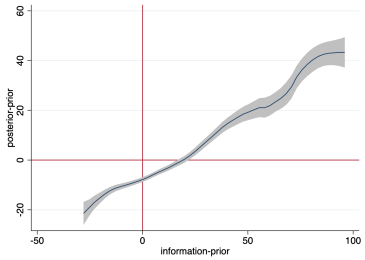
Having a grad degree in 10 years



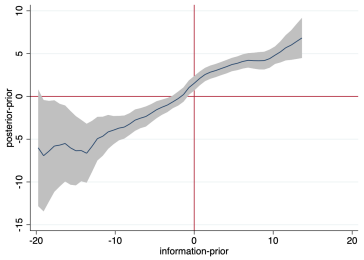
Being employed at graduation



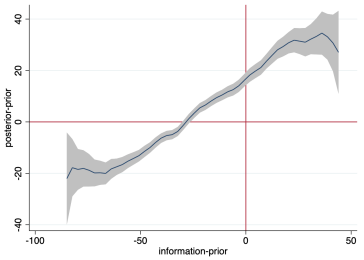
Being employed in 10 years



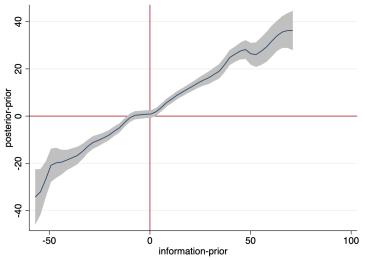
Earnings in 10 years



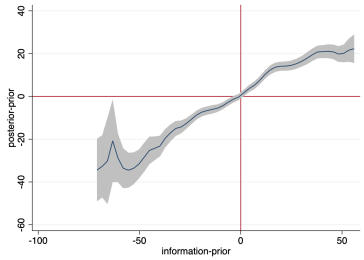
Workplace flexibility



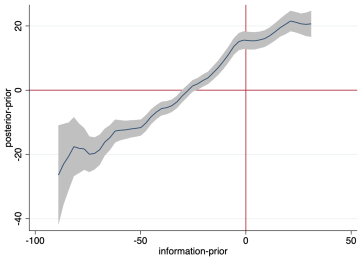
Work-life balance



Being single in 10 years



Having children in 10 years



Notes: 95% confidence intervals are depicted in the figures. The earnings surprise variable has a long left tail; so the bottom 5% of the observations were dropped for the local linear regression figure. All the statistics reported in the text and tables regarding earnings use all of the observations.

Table 10: How Posterior Beliefs Move with New Information

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Posterior beliefs regarding													
y=	difficulty of courses	required hours	graduation probabilities	female student ratio	female faculty ratio	continuing education at graduation	holding graduate degree in 10 years	employed at graduation	employed in 10 years	earnings in 10 years	workplace flexibility	work-life balance	being single in 10 years	having children in 10 years
Panel A: All Students														
Information	0.572***	0.310***	-0.00954	0.191***	0.256***	0.366***	0.256***	0.0852***	0.264***	0.314**	0.109***	0.0817***	0.115***	0.174***
regarding y	(0.0520)	(0.0305)	(0.0472)	(0.0227)	(0.0269)	(0.0532)	(0.0291)	(0.0265)	(0.0548)	(0.128)	(0.0320)	(0.0224)	(0.0301)	(0.0395)
Prior regarding y	0.501***	0.468***	0.327***	0.463***	0.438***	0.447***	0.463***	0.385***	0.438***	0.671***	0.388***	0.396***	0.421***	0.544***
	(0.0272)	(0.0400)	(0.0543)	(0.0316)	(0.0329)	(0.0352)	(0.0317)	(0.0405)	(0.0480)	(0.0883)	(0.0402)	(0.0434)	(0.0428)	(0.0439)
Observations	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072
Subjects	259	259	259	259	259	259	259	259	259	259	259	259	259	259
Panel B: Unsure Students														
Information	0.519***	0.280***	-0.00107	0.195***	0.266***	0.388***	0.239***	0.0718**	0.313***	0.270*	0.0959***	0.0972***	0.0949***	0.185***
regarding y	(0.0583)	(0.0332)	(0.0607)	(0.0275)	(0.0326)	(0.0606)	(0.0335)	(0.0300)	(0.0651)	(0.160)	(0.0366)	(0.0278)	(0.0316)	(0.0476)
Prior regarding y	0.517***	0.489***	0.388***	0.460***	0.466***	0.414***	0.464***	0.366***	0.398***	0.699***	0.377***	0.381***	0.382***	0.565***
	(0.0316)	(0.0474)	(0.0638)	(0.0397)	(0.0410)	(0.0418)	(0.0368)	(0.0480)	(0.0538)	(0.101)	(0.0488)	(0.0556)	(0.0523)	(0.0520)
Observations	1416	1416	1416	1416	1416	1416	1416	1416	1416	1416	1416	1416	1416	1416
Subjects	177	177	177	177	177	177	177	177	177	177	177	177	177	177
Panel C: Sure Students														
Information	0.688***	0.368***	-0.00947	0.187***	0.246***	0.327***	0.292***	0.113**	0.181*	0.471***	0.141**	0.0487	0.170**	0.154**
regarding y	(0.103)	(0.0619)	(0.0741)	(0.0391)	(0.0470)	(0.105)	(0.0548)	(0.0538)	(0.0969)	(0.139)	(0.0631)	(0.0375)	(0.0649)	(0.0725)
Prior regarding y	0.470***	0.432***	0.195**	0.463***	0.367***	0.501***	0.461***	0.417***	0.509***	0.545***	0.403***	0.421***	0.491***	0.508***
	(0.0498)	(0.0711)	(0.0862)	(0.0501)	(0.0530)	(0.0625)	(0.0578)	(0.0733)	(0.0906)	(0.0812)	(0.0694)	(0.0690)	(0.0694)	(0.0765)
Observations	656	656	656	656	656	656	656	656	656	656	656	656	656	656
Subjects	82	82	82	82	82	82	82	82	82	82	82	82	82	82
Panel D: Male Students														
Information	0.566***	0.328***	-0.0171	0.158***	0.194***	0.265***	0.185***	0.0539	0.327***	0.0898	0.102*	0.103***	0.142***	0.286***
regarding y	(0.0808)	(0.0519)	(0.0749)	(0.0366)	(0.0426)	(0.0954)	(0.0481)	(0.0419)	(0.0779)	(0.170)	(0.0530)	(0.0387)	(0.0505)	(0.0705)
Prior regarding y	0.513***	0.458***	0.432***	0.473***	0.439***	0.476***	0.479***	0.354***	0.370***	0.814***	0.325***	0.363***	0.521***	0.596***
	(0.0415)	(0.0754)	(0.108)	(0.0644)	(0.0813)	(0.0537)	(0.0496)	(0.0707)	(0.0856)	(0.112)	(0.0773)	(0.0926)	(0.0756)	(0.0751)
Observations	720	720	720	720	720	720	720	720	720	720	720	720	720	720
Subjects	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Panel E: Female Students														
Information	0.575***	0.300***	-0.00810	0.214***	0.289***	0.421***	0.294***	0.102***	0.227***	0.501***	0.115***	0.0691**	0.102***	0.110**
regarding y	(0.0675)	(0.0377)	(0.0601)	(0.0283)	(0.0345)	(0.0638)	(0.0364)	(0.0341)	(0.0728)	(0.126)	(0.0404)	(0.0274)	(0.0370)	(0.0478)
Prior regarding y	0.495***	0.472***	0.289***	0.451***	0.439***	0.429***	0.453***	0.402***	0.472***	0.559***	0.424***	0.414***	0.353***	0.509***
	(0.0360)	(0.0461)	(0.0596)	(0.0351)	(0.0344)	(0.0462)	(0.0410)	(0.0493)	(0.0572)	(0.0778)	(0.0437)	(0.0441)	(0.0508)	(0.0529)
Observations	1352	1352	1352	1352	1352	1352	1352	1352	1352	1352	1352	1352	1352	1352
Subjects	169	169	169	169	169	169	169	169	169	169	169	169	169	169

Notes: The dependent variables are the posterior beliefs elicited in Part 6 of the survey across all majors for each of the opinion questions. Information represents the information provided in Part 5 of the survey and prior represents beliefs elicited in Part 3 of the survey. All regressions include a constant term. Different columns correspond to different opinion questions.There are 8 observations per student. Panel A includes all students who finished the survey. Panels B and C have unsure and sure students, respectively. Panels D and E have male and female students, respectively. Standard errors are clustered at the subject level and are reported in parentheses.*$p < 0.10$, ** $p < 0.05$, ***

Table 10 Panels B and C present the results for unsure and sure students, respectively. Testing for equality of coefficients across sure and unsure students for any of the beliefs, we are unable to reject the hypothesis that sure and unsure students react to the information in the same way. Panels D and E show the results for male and female students, respectively. Females react more to the information regarding female faculty ratio, probability of having graduate degree in 10 years, and earnings in 10 years, and they react less to information about having a child in 10 years.

4.5 How do changing beliefs relate to changes in major choices?

We have shown that receiving information about majors changed students' major choices overall, that much of the information was actually new to students, and that students' updated beliefs are a function of the information provided. Now we are ready to ask how those updated beliefs translated into changes in the students' major probabilities. To do this, we regress

$$\pi_{ijFinal} - \pi_{ijInitial} = \alpha_0 + \sum_{m=1}^{14} \alpha_m (posterior_{ijm} - prior_{ijm}) + \epsilon_{ij} \tag{3}$$

where $\pi_{ijFinal}$ is the probability of student i graduating with a degree in major category j elicited at the end of the experiment (Part 7) and $\pi_{ijInitial}$ is the probability of student i graduating with a degree in major category j elicited at the beginning of the experiment (Part 2). $prior_{ijm}$ is student i's beliefs about major j regarding topic m elicited before the information provision (Part 3) and $posterior_{ijm}$ is student i's beliefs about major j regarding topic m elicited after the information provision (Part 6). For each student, we have 8 observations.

We use the "final" and "initial" major choice probabilities here, so we are asking how students' changes in beliefs affected major choices after they have seen all information sets. Table 11 presents the results. Column 1 is all students, columns 2 and 3 are unsure and

sure students, and columns 4 and 5 are males and females.[15] To make the magnitudes of the coefficients comparable, we standardize all of the change in beliefs variables. We exclude the changes in opinions about industry outcomes of different majors from this table, because we cannot meaningfully compare these magnitudes to the others. These changes are given in standard deviations of the distribution of prior beliefs about each aspect of majors.

For the full sample, believing that a major has a higher share of female students translates into a higher probability of choosing that major, with a coefficient of 0.415. This means that for every standard deviation that beliefs change toward "more females in the major", the probability of majoring in that field goes up by 0.415 percentage points (ppt). Believing a major requires more credit hours within the major also has a positive effect on choosing that major, though the effect is a bit smaller than that of gender composition (0.26 ppt). It may be that students interpret more required hours as the major being more rigorous, or it could be that students prefer a more specific and less flexible course schedule (which might require less scheduling work on the student's part). Job flexibility is a positive factor, and having children after 10 years is a slight negative. Comparing the unsure and sure students in columns 2 and 3, we see that most of the same factors matter, but they almost always matter more for the unsure students. Unsure students' major choices are more sensitive to changes in beliefs.

Interestingly, the earnings information does not have any significant effect on major choices, despite the Employment & Earnings information set being the most powerful of all information sets in Table 6. This is because it is the employment pieces that are actually moving students' choices.[16] Confusingly, the change in beliefs about employment right after college and employment 10 years later have opposite effects on major probabilities. Believing a major has a higher employment rate right after college has a positive effect on major choice (+0.29 ppt), but the opposite is true for employment 10 years later (-0.47 ppt).

[15] Appendix Tables 4 and 5 replicate this table with controls and with an alternative dependent variable, $(\pi_{ijFinal} - \pi_{ijPart4})$, where $\pi_{ijPart4}$ is the probability of student i graduating with a degree in major category j elicited after the initial belief elicitation but before any information provision. Results are similar.

[16] Note that while students were not surprised by the earnings information on average, this does not mean they were not surprised by the information for all individual majors.

Table 11: How Change in Beliefs Relate to Change in Stated Major Choices

	(1)	(2)	(3)	(4)	(5)
	Change in Major Choices (Final-Initial)				
Change in beliefs about					
Difficulty of courses (sd)	-0.354	-0.354	-0.238	0.388	-0.763**
	(0.235)	(0.341)	(0.215)	(0.331)	(0.314)
Required hours (sd)	0.263**	0.451**	-0.0346	0.200	0.331*
	(0.131)	(0.217)	(0.0800)	(0.211)	(0.188)
Graduation probabilities (sd)	0.0908	0.127	0.0844	0.102	0.125
	(0.140)	(0.225)	(0.0581)	(0.225)	(0.189)
Female student ratio (sd)	0.415**	0.769***	-0.316*	0.629*	0.334
	(0.183)	(0.237)	(0.173)	(0.365)	(0.221)
Female faculty ratio (sd)	-0.204	-0.378	0.104	-0.647*	-0.0434
	(0.209)	(0.293)	(0.133)	(0.377)	(0.253)
Pr. of continuing education upon graduation (sd)	-0.153	-0.282	0.0783	0.127	-0.234
	(0.212)	(0.311)	(0.0693)	(0.372)	(0.274)
Pr. of holding a graduate degree in 10 years (sd)	0.137	0.166	-0.0258	-0.0324	0.271
	(0.192)	(0.279)	(0.0712)	(0.244)	(0.256)
Pr. of being employed upon graduation (sd)	0.288*	0.408*	0.0326	-0.0597	0.488**
	(0.167)	(0.243)	(0.116)	(0.292)	(0.221)
Pr. of being employed in 10 years (sd)	-0.472***	-0.588**	-0.164	-0.167	-0.689***
	(0.165)	(0.235)	(0.130)	(0.234)	(0.242)
Earnings in 10 years (sd)	0.0563	0.0875	-0.126	0.0980	0.0125
	(0.102)	(0.120)	(0.132)	(0.277)	(0.107)
Pr. of working in a flexible job in 10 years (sd)	0.301**	0.400**	0.230*	0.131	0.407**
	(0.126)	(0.178)	(0.128)	(0.160)	(0.183)
Pr. of having work-life balance in 10 years (sd)	-0.199	-0.284	-0.0690	-0.0637	-0.355
	(0.168)	(0.246)	(0.103)	(0.184)	(0.257)
Pr. of being single in 10 years (sd)	-0.0273	0.0801	-0.203*	-0.0159	0.0262
	(0.117)	(0.174)	(0.114)	(0.270)	(0.134)
Pr. of having children in 10 years (sd)	-0.247*	-0.296	-0.159	-0.382	-0.143
	(0.133)	(0.199)	(0.110)	(0.314)	(0.149)
Constant	0.00986	-0.0342	0.0128	0.0928	-0.0780
	(0.0730)	(0.116)	(0.0498)	(0.144)	(0.0987)
Sample	All	Unsure	Sure	Male	Female
Observations	2072	1416	656	720	1352
Subjects	259	177	82	90	169

Notes: The dependent variable is the difference between a student's stated probability of graduating with a degree in a major category elicited at the end of the experiment (Part 7) and the student's stated probability of graduating with a degree in that major category elicited at the beginning of the experiment (Part 2). Independent variables are the change in beliefs (posterior-prior) regarding the factors presented in each of the opinion questions. These variables are standardized using the standard deviation of the prior belief distribution of each opinion question. We have 8 observations per student in each column. Column 1 is all students who finished our survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The gender differences seen in columns 4 and 5 help us understand the overall effects. Four things stand out. First, female students are driving the odd results for employment probabilities. Female students are moving strongly toward the majors about which they are positively surprised about initial employment opportunities (+0.49 ppt), but the opposite effect for employment 10 years after graduation is even stronger (-0.69 ppt). It may be that female students are seeing employment 10 years later as a substitute for having children or being secure enough to engage in home production, although this is is not showing up in the family variables, so we cannot say for sure that this is the reason.[17]

Second, women have a strong negative reaction to majors that they learn have more difficult coursework (-0.76 ppt), while men move (insignificantly) toward majors that they believe are more difficult. This is the largest coefficient of all for women, meaning that changes in beliefs about course difficulty are having the largest absolute effect on women's major choices of any information. This is in line with results from papers showing that women prefer less competitive enironments (Buser et al., 2014) and could also reflect a gender gap in confidence (Bertrand, 2011).

Third, male students are the main drivers of the results on the gender composition of the major. Male students move strongly toward majors that they learn have a higher share of female students than originally thought (+0.63 ppt) but equally away from majors that they learn have a higher share of female faculty than expected (-0.65 ppt), both significant at the 10% level. Female students also seem to prefer more female classmates, though not significantly.[18]

Finally, the table also shows that women seem to have a strong preference for majors associated with jobs that are flexible to part-time work (+0.41 ppt), while men do not have

[17]This would be consistent with results from Wiswall and Zafar (2021), who find that female students believe that completing a degree in science or business (relative to a humanities or social sciences degree) will reduce their chances of being married by nearly 15% by age 30 and will reduce their expected number of children at age 30 by about 48%.

[18]Males' seeming preference for fields with more male professors echoes the findings from the recent literature on faculty evaluations, where male students consistently give higher ratings to male instructors (e.g., Boring (2017)).

much reaction to this information. This would be consistent with other evidence on gender differences in job preferences, showing that women prefer more flexible jobs (Wiswall and Zafar, 2018; He et al., 2021). We interpret this with some caution due to the fact that a large minority of students (38%) updated their beliefs about flexibility in the opposite direction of the information they were given.

4.6 Summary and Implications

Our information intervention significantly affected students' beliefs and stated major choices. Students' initial beliefs about most pieces of information were quite different from the information they were provided, although they were "right" on average about earnings of different majors. We find important gender differences in how students respond to new information about majors. Male students are drawn to majors that have a surprisingly large share of female students, but they move move away from majors with more female faculty. Female students seem to respond positively to information about higher employment rates right after college, while they respond negatively to information about higher employment rates 10 years later. Females also seem to strongly prefer majors with less difficult coursework. The family status of graduates from each major and the graduate school probabilities seem to have little effect on students' choices.

One interesting feature of our study is the distinction between students who come in sure about their major and those who do not. These groups react differently to information. The sure group rarely changes their major choice probabilities in response to the information given. The unsure group is more sensitive to the information. This is important both for researchers – who are sometimes puzzled when information provision does not change students' choices – and for policymakers and administrators, who sometimes try to influence students' major choices. There seems to be a subset of students who come into college with their minds made up, and these students are unlikely to respond to such attempts. Eliciting major choice probabilities before any intervention can help researchers and administrators better target their efforts toward those whose minds are still open.

5 Concluding Remarks

Using an innovative staggered information intervention, we show that both job-related and non-job-related factors influence students' college major choices. While students rank earnings and employment probabilities as the most important, their choices respond to new information about a wide variety of factors, including job flexibility, course difficulty, and the gender composition of the major. Students are clearly considering both the post-college outcomes of a major and the in-college experience.

These results can help us understand the gender gaps in college major choice, as male and female students respond to different information about majors. Male students gravitate toward majors they learn have more female students, but away from those with more female faculty. Female students move toward majors with high initial employment rates and part-time job flexibility, but away from those with more difficulty coursework and high employment a decade after college.

Our paper contributes to the vast literature on college major choice and provides the first evidence from a randomized intervention on how non-job-related major characteristics influence major choice. Much of the research on major choice has focused on helping students to understand the monetary returns. Our paper suggests that this strategy has limits – and, in fact, that it may not be the information that students will respond most to. Instead, the information that students will naturally learn about as they go through college, such as the composition of their peers and the difficulty of classes, is a strong motivating factor. If colleges want students to make well-informed major decisions early in their college careers, then they must provide a wide set of information, not just information about monetary returns.

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A Appendix

A.1 Tables

Table 1: Replication of Table 5 with alternative dependent variable

	(1)	(2)	(3)	(4)	(5)
	Change in Major Choices (Final-Part 4)				
Biology, Biochemistry & Health Sciences	-0.277	-0.0782	-0.707	-0.354	-0.237
	(0.328)	(0.423)	(0.492)	(0.271)	(0.483)
Physical Sciences, Engineering & CS	-0.119	-0.259	0.183	-0.343	0
	(0.492)	(0.719)	(0.136)	(0.786)	(0.631)
Communication and Fine Arts	-0.0245	0.444	-1.037	0.546	-0.328
	(0.469)	(0.368)	(1.254)	(0.394)	(0.688)
Film and Television	-0.0322	-0.527	1.037	-0.398	0.163
	(0.550)	(0.559)	(1.254)	(1.006)	(0.654)
Business	1.514**	1.916**	0.646*	3.191**	0.621
	(0.587)	(0.845)	(0.332)	(1.401)	(0.498)
Economics and Political Science	-0.281	-0.186	-0.488	-2.177*	0.728*
	(0.488)	(0.698)	(0.345)	(1.158)	(0.410)
Psychology and Sociology	-0.384	-0.590	0.0610	-0.0261	-0.574
	(0.523)	(0.730)	(0.512)	(0.982)	(0.612)
Other Social Sciences	-0.396	-0.720*	0.305	-0.439	-0.373
	(0.290)	(0.407)	(0.252)	(0.473)	(0.368)
Sample	All	Unsure	Sure	Male	Female
Observations	2072	1416	656	720	1352
Subjects	259	177	82	90	169

Notes: The dependent variable is the difference between a student's stated probability of graduating with a degree in a major category elicited at the end of the experiment (Part 7) and the student's stated probability of graduating with a degree in that major category elicited in Part 4 of the survey. Independent variables are the major category dummies. We have 8 observations per student in each column. Column 1 is all students who finished our survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Effect of Information Sets on the Probability of Double Majoring

	(1)	(2)	(3)	(4)	(5)
	Change in Probability of Double Majoring				
Coursework Difficulty	-0.653	-0.520	-0.939	-1.256	-0.331
	(0.526)	(0.510)	(1.256)	(0.879)	(0.659)
Gender Composition	-0.174	-0.441	0.402	0.322	-0.438
	(0.469)	(0.547)	(0.904)	(0.379)	(0.691)
Graduate School	-0.529	-0.684	-0.195	-0.689	-0.444
	(0.561)	(0.698)	(0.944)	(0.894)	(0.720)
Employment & Earnings	0.931	1.164*	0.427	-0.478	1.680**
	(0.582)	(0.696)	(1.070)	(0.904)	(0.748)
Industry Outcomes	0.942	0.588	1.707	1.189	0.811
	(0.605)	(0.724)	(1.109)	(0.804)	(0.826)
Workplace Characteristics	-0.564	-0.887**	0.134	-0.544	-0.574
	(0.465)	(0.429)	(1.148)	(1.021)	(0.466)
Family Status	-0.494	-0.141	-1.256	-0.144	-0.680
	(0.523)	(0.531)	(1.194)	(1.097)	(0.552)
p-values:					
coursework=composition	0.478	0.922	0.273	0.154	0.901
coursework=graduate	0.879	0.856	0.663	0.652	0.916
coursework=employment	0.048	0.049	0.435	0.516	0.056
coursework=industry	0.077	0.250	0.180	0.055	0.345
coursework=workplace	0.895	0.557	0.517	0.612	0.736
coursework=family	0.853	0.627	0.881	0.520	0.709
composition =graduate	0.611	0.771	0.644	0.308	0.995
composition=employment	0.120	0.064	0.984	0.425	0.026
composition=industry	0.215	0.313	0.474	0.312	0.339
composition=workplace	0.533	0.547	0.820	0.428	0.859
composition=family	0.681	0.722	0.323	0.677	0.815
graduate=employment	0.095	0.095	0.659	0.878	0.059
graduate=industry	0.102	0.230	0.267	0.211	0.267
graduate=workplace	0.966	0.826	0.843	0.921	0.896
graduate=family	0.966	0.559	0.504	0.705	0.808
employment=industry	0.990	0.606	0.419	0.174	0.482
employment=workplace	0.069	0.016	0.874	0.967	0.015
employment=family	0.084	0.212	0.201	0.778	0.031
industry=workplace	0.071	0.115	0.360	0.192	0.196
industry=family	0.064	0.401	0.063	0.338	0.111
workplace=family	0.931	0.298	0.496	0.828	0.889
Sample	All	Unsure	Sure	Male	Female
Observations	1813	1239	574	630	1183
Subjects	259	177	82	90	169

Notes: The dependent variable is the difference between a student's stated probability of graduating with a double major elicited at time t versus at time t-1 in Part 5 of the survey. Independent variables are the information set dummies. We have 7 observations per student in each column. Column 1 is all students who finished our survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Heterogeneity Analysis of Differences between Students' Prior Beliefs and Information Provided

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Surprise (Information-Prior Belief) about													
	difficulty of courses	required hours	graduation probabilities	female student ratio	female faculty ratio	continuing education at graduation	holding graduate degree in 10 years	employed at graduation	employed in 10 years	earnings in 10 years	workplace flexibility	work-life balance	being single in 10 years	having children in 10 years
Panel A: Unsure vs Sure Students														
Sure	0.178	-0.462	-2.780	-2.123*	-2.637**	3.652	2.091	0.180	2.035	1.607	4.961*	0.0929	-4.115	-0.0791
	(0.156)	(3.336)	(2.836)	(1.194)	(1.326)	(3.448)	(3.488)	(3.191)	(3.633)	(1.136)	(2.554)	(2.382)	(2.705)	(3.331)
Constant	0.228***	1.668	2.823*	3.220***	1.347*	-25.01***	10.34***	16.53***	22.87***	-1.023	-21.95***	8.220***	4.939***	-20.22***
	(0.0834)	(1.724)	(1.511)	(0.632)	(0.744)	(1.678)	(1.798)	(1.585)	(1.966)	(0.879)	(1.311)	(1.185)	(1.294)	(1.652)
Panel B: Male vs Female Students														
Female	-0.325**	6.734**	3.456	-1.563	1.292	-4.818	-6.068*	0.418	2.490	1.318	-1.770	-0.936	-1.802	-7.203**
	(0.147)	(3.095)	(2.595)	(1.096)	(1.266)	(3.046)	(3.191)	(2.938)	(3.456)	(1.513)	(2.531)	(2.310)	(2.567)	(3.041)
Constant	0.496***	-2.872	-0.312	3.568***	-0.331	-20.71***	14.97***	16.32***	21.89***	-1.375	-19.23***	8.860***	4.812**	-15.54***
	(0.119)	(2.505)	(2.006)	(0.849)	(0.990)	(2.384)	(2.534)	(2.383)	(2.775)	(1.356)	(2.162)	(1.974)	(2.177)	(2.476)
Observations	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072	2072
Subjects	259	259	259	259	259	259	259	259	259	259	259	259	259	259

Notes: The dependent variables are the "surprises" (information provided in Part 5 of the survey minus prior belief elicited in Part 3 of the survey) across all majors for each of the opinion questions. Different columns correspond to different opinion questions. There are 8 observations per student. In Panel A, constant presents the mean surprises of unsure students and "Sure" coefficient shows the *additional* surprises encountered by the sure students. In Panel B, constant presents the mean surprises of male students and "Female" coefficient shows the *additional* surprises encountered by the female students. Standard errors are clustered at the subject level and are reported in parentheses.*$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Replication of Table 11 with full set of controls

	(1)	(2)	(3)	(4)	(5)
	Change in Major Choices (Final-Initial)				
Change in beliefs about					
Difficulty of courses (sd)	-0.384	-0.354	-0.311	0.436	-0.812**
	(0.245)	(0.362)	(0.289)	(0.418)	(0.337)
Required hours (sd)	0.227*	0.405*	-0.0266	0.0979	0.350*
	(0.136)	(0.233)	(0.106)	(0.239)	(0.199)
Graduation probabilities (sd)	0.0816	0.124	0.0888	-0.0362	0.145
	(0.152)	(0.253)	(0.0697)	(0.315)	(0.205)
Female student ratio (sd)	0.373**	0.693***	-0.363*	0.538	0.317
	(0.181)	(0.236)	(0.189)	(0.365)	(0.229)
Female faculty ratio (sd)	-0.211	-0.401	0.151	-0.672	-0.0454
	(0.219)	(0.320)	(0.161)	(0.414)	(0.266)
Pr. of continuing education upon graduation (sd)	-0.173	-0.319	0.105	0.0697	-0.226
	(0.235)	(0.340)	(0.0993)	(0.425)	(0.307)
Pr. of holding a graduate degree in 10 years (sd)	0.133	0.143	-0.0124	0.00410	0.254
	(0.222)	(0.326)	(0.108)	(0.323)	(0.286)
Pr. of being employed upon graduation (sd)	0.339*	0.472*	0.0548	-0.00109	0.558**
	(0.178)	(0.256)	(0.147)	(0.349)	(0.239)
Pr. of being employed in 10 years (sd)	-0.543***	-0.669**	-0.211	-0.289	-0.807***
	(0.186)	(0.277)	(0.172)	(0.299)	(0.276)
Earnings in 10 years (sd)	0.0272	0.0240	-0.135	-0.0383	0.0165
	(0.114)	(0.144)	(0.169)	(0.366)	(0.116)
Pr. of working in a flexible job in 10 years (sd)	0.327**	0.466**	0.263*	0.227	0.420**
	(0.137)	(0.204)	(0.154)	(0.231)	(0.197)
Pr. of having work-life balance in 10 years (sd)	-0.268	-0.391	-0.0312	-0.184	-0.446
	(0.192)	(0.277)	(0.115)	(0.250)	(0.296)
Pr. of being single in 10 years (sd)	0.0105	0.152	-0.286**	0.131	0.0648
	(0.126)	(0.193)	(0.138)	(0.323)	(0.151)
Pr. of having children in 10 years (sd)	-0.300**	-0.370	-0.186	-0.585	-0.173
	(0.145)	(0.225)	(0.139)	(0.375)	(0.167)
Constant	-1.398	-1.204	2.693	-4.789	0.813
	(1.847)	(3.330)	(3.783)	(5.142)	(2.956)
Sample	All	Unsure	Sure	Male	Female
Observations	2044	1402	642	708	1336
Subjects	259	177	82	90	169

Notes: The dependent variable is the difference between a student's stated probability of graduating with a degree in a major category elicited at the end of the experiment (Part 7) and the student's stated probability of graduating with a degree in that major category elicited at the beginning of the experiment (Part 2). Independent variables are the change in beliefs (posterior-prior) regarding the factors presented in each of the opinion questions. These variables are standardized using the standard deviation of the prior belief distribution of each opinion question. We have 8 observations per student in each column. Column 1 is all students who finished our survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Controls include all controls listed in Table 3 and major specific abilities elicited in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Replication of Table 11 with alternative dependent variable

	(1)	(2)	(3)	(4)	(5)
	Change in Major Choices (Final-Part 4)				
Change in beliefs about					
Difficulty of courses (sd)	-0.469*	-0.337	-0.646	0.282	-0.853**
	(0.284)	(0.317)	(0.551)	(0.349)	(0.399)
Required hours (sd)	0.0869	0.0911	0.128	-0.172	0.282**
	(0.131)	(0.219)	(0.138)	(0.261)	(0.137)
Graduation probabilities (sd)	-0.0911	-0.191	0.0888	-0.168	-0.0606
	(0.0974)	(0.156)	(0.0919)	(0.241)	(0.129)
Female student ratio (sd)	0.258	0.550	-0.312	0.341	0.203
	(0.249)	(0.344)	(0.237)	(0.630)	(0.239)
Female faculty ratio (sd)	-0.149	-0.242	-0.0129	-0.744*	0.0695
	(0.211)	(0.305)	(0.0758)	(0.389)	(0.247)
Pr. of continuing education upon graduation (sd)	-0.0618	-0.103	0.0762	0.108	-0.0973
	(0.147)	(0.214)	(0.0746)	(0.314)	(0.162)
Pr. of holding a graduate degree in 10 years (sd)	0.148	0.182	0.0522	0.0207	0.191
	(0.153)	(0.225)	(0.102)	(0.216)	(0.197)
Pr. of being employed upon graduation (sd)	0.379**	0.444*	0.190	0.231	0.459**
	(0.180)	(0.244)	(0.222)	(0.380)	(0.225)
Pr. of being employed in 10 years (sd)	-0.627**	-0.706**	-0.409	-0.839	-0.513**
	(0.253)	(0.337)	(0.325)	(0.509)	(0.248)
Earnings in 10 years (sd)	-0.0428	-0.0136	-0.288	-0.441	0.0453
	(0.130)	(0.144)	(0.311)	(0.371)	(0.138)
Pr. of working in a flexible job in 10 years (sd)	0.222**	0.289*	0.116	0.0712	0.316*
	(0.110)	(0.156)	(0.113)	(0.165)	(0.167)
Pr. of having work-life balance in 10 years (sd)	-0.149	-0.315*	0.136	0.0902	-0.392**
	(0.128)	(0.167)	(0.123)	(0.153)	(0.198)
Pr. of being single in 10 years (sd)	-0.00821	-0.00208	0.00333	-0.126	0.0813
	(0.109)	(0.162)	(0.114)	(0.232)	(0.130)
Pr. of having children in 10 years (sd)	-0.0876	0.0549	-0.296	0.390	-0.201
	(0.157)	(0.184)	(0.284)	(0.284)	(0.200)
Constant	0.00913	-0.0226	0.0496	-0.0103	-0.0577
	(0.0656)	(0.0992)	(0.0696)	(0.153)	(0.0763)
Sample	All	Unsure	Sure	Male	Female
Observations	2072	1416	656	720	1352
Subjects	259	177	82	90	169

Notes: The dependent variable is the difference between a student's stated probability of graduating with a degree in a major category elicited at the end of the experiment (Part 7) and the student's stated probability of graduating with a degree in that major category elicited at Part 4 of the survey (after prior belief elicitation but before information provision). Independent variables are the change in beliefs (posterior-prior) regarding the factors presented in each of the opinion questions. These variables are standardized using the standard deviation of the prior belief distribution of each opinion question. We have 8 observations per student in each column. Column 1 is all students who finished our survey, columns 2 and 3 are unsure and sure students, and columns 4 and 5 are males and females. Sure students are those who put a 100% probability on majoring in a certain field in Part 2 of the survey. Standard errors are clustered at the subject level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.2 Experimental materials

We add comments for the reader in italics.

WELCOME

This research study aims to understand the determinants of college major choice.

First, we will collect your consent to participate in the study. Your participation is voluntary.

Then, we will ask you some questions about your demographics and academic background.

Then we will ask your beliefs about various aspects of different college majors.

Then, we will provide you information about these aspects.

Finally, we will re-ask your beliefs about various aspects of different college majors.

Please answer the questions as honestly as you can. There are no particular answers we are looking for. We just want your honest answers.

There is no deception involved in this study.

This study has 6 parts. We expect it to take approximately 90 minutes, but no more than 120 minutes.

Please take the survey in one sitting in a quiet place.

You will be paid $30 for completing the survey in the form of an Amazon e-Gift Card.

Loyola Marymount University Informed Consent Form

TITLE: Ersoy and Speer 2021 Study

INVESTIGATOR: Fulya Ersoy, Economics, BCLA, 310-338-7372, fulya.ersoy@lmu.edu
Jamin Speer, Economics, University of Memphis, 901-678-1192, jspeer@memphis.edu.

PURPOSE: You are being asked to participate in a research project that seeks to investigate determinants of college major choice. In this survey, we will ask you questions about your major choice and your opinions about various aspects of different majors. We will also provide you information regarding various aspects of different majors. You will NOT be audiotaped, videotaped or photographed. You will participate in one online session which is expected to take 90 minutes.

RISKS: There are no foreseeable risks associated with this study.

BENEFITS: By participating in this study, you will obtain information about different majors. This study can help you with your major choice. This study will benefit scientific community by shedding light on the determinants of college major choice.

INCENTIVES: Participation in the project will require no monetary cost to you. You will receive $30 for completing the study. Payments will be in the form of Amazon Gift Cards.

CONFIDENTIALITY: Your name, email address, and demographic information will be collected. Your name and email address will never be used in any public dissemination of these data (publications, presentations, etc.). All research materials will be stored in password protected computers and data will only be accessed by investigators. When the research study ends, any identifying information will be removed from the data, or it will be destroyed. All of the information you provide will be kept confidential.

RIGHT TO WITHDRAW: Your participation in this study is *voluntary*. You may withdraw your consent to participate at any time without penalty. Your withdrawal will not influence any other services to which you may be otherwise entitled, your class standing or relationship with Loyola Marymount University.

SUMMARY OF RESULTS: A summary of the results of this research will be supplied to you, at no cost, upon request from Dr. Fulya Ersoy (fulya.ersoy@lmu.edu, 310-338-7372).

VOLUNTARY CONSENT: I have read the above statements and understand what is being asked of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, for any reason, without penalty. If the study design or use of the information is changed, I will be informed and my consent reobtained. On these terms, I certify that I am willing to participate in this research project.

I understand that if I have any further questions, comments or concerns about the study or the informed consent process, I may contact Dr. David Moffet, Chair, Institutional Review Board, Loyola Marymount University, 1 LMU Drive, Los Angeles, CA 90045-2659 or by email at David.Moffet@lmu.edu.

Please enter your full name:

Please enter your LMU student ID number:

Please enter your LMU email address:

Please re-enter the email address to make sure it is correct.

Please enter today's date (mm/dd/yyyy)

Please click here to download a copy of the consent form for your records.

Please check the appropriate box

- ◯ I am under age 18.
- ◯ I am age 18 or above.

Please choose one of the following:

- ◯ I agree to participate in the study.
- ◯ I do not wish to participate in the study.

Students who answered "I am under age 18." or "I do not wish to participate in study." were not able to continue any further.

Loyola Marymount University

PART 1

We will begin the survey by asking you some demographic questions.

What is your gender?

- ◯ Male
- ◯ Female
- ◯ Non-binary / third gender
- ◯ Prefer not to say

Which of these best describes how you identify yourself?

- ◯ American Indian or Alaska Native
- ◯ Asian
- ◯ Black or African-American
- ◯ Hispanic or Latino
- ◯ Native Hawaiian or Other Pacific Islander
- ◯ White or Caucasian
- ◯ Multi Race (Please Specify):

[ ]

- ◯ Non-Resident Alien/International
- ◯ Prefer not to say

What is your age?

BACK NEXT

Are you a first generation college student?

- ◯ No
- ◯ Yes

What is the highest level of education your father completed?

- ◯ No Education
- ◯ Primary Education
- ◯ Some High School, Did Not Complete
- ◯ High School Graduate
- ◯ Some College, No Degree
- ◯ Associates (2-Year College) Degree
- ◯ Bachelors (4-Year College) Degree
- ◯ Master's Degree
- ◯ Professional/Doctoral Degree (PhD, JD, or MD)
- ◯ Do not know

What is the highest level of education your mother completed?

- ◯ No Education
- ◯ Primary Education
- ◯ Some High School, Did Not Complete
- ◯ High School Degree
- ◯ Some College, No Degree
- ◯ Associates (2-Year College) Degree
- ◯ Bachelors (4-Year College) Degree
- ◯ Master's Degree
- ◯ Professional/Doctoral Degree (PhD, JD, or MD)
- ◯ Do not know

What was your high school grade point average (GPA) on a 4-point scale?

Where did you rank in your high school class?

- ◯ Top 1%
- ◯ Top 10%
- ◯ Top 25%
- ◯ Top 50%
- ◯ Top 75%
- ◯ Bottom 25%

Did you take the SAT and/or ACT?

- ◯ Yes, I took SAT.
- ◯ Yes, I took ACT.
- ◯ Yes, I took both SAT and ACT.
- ◯ No, I didn't take SAT or ACT.

To the best of your knowledge, what was your SAT score?
If you took SAT more than once, please enter your highest scores.

SAT Reading Score
SAT Math Score

To the best of your knowledge, what was your ACT score?
If you took ACT more than once, please enter your highest scores.

ACT Composite Score
ACT English Score
ACT Math Score

What is your current status at LMU?

- ◯ Freshman
- ◯ Sophomore
- ◯ Junior
- ◯ Senior
- ◯ Other

What is your current grade point average (GPA) at LMU?
Please choose not applicable if this is your first semester at LMU.

What is your intended field of study?

Have you officially declared a major?

- ◯ Yes
- ◯ No

Do you receive need-based financial aid (grants, student loans, etc.) to attend LMU?

- ◯ No
- ◯ Yes

What is your family's annual income?

- ◯ $0 - $9,999
- ◯ $10,000 - $24,999
- ◯ $25,000 - $49,999
- ◯ $50,000 - $74,999
- ◯ $75,000 - $99,999
- ◯ $100,000 - $149,999
- ◯ $150,000 - $199,999
- ◯ $200,000 - $299,999
- ◯ $300,000 - $499,999
- ◯ $500,000 - $1,000,000
- ◯ More than $1,000,000
- ◯ Do not know

Loyola Marymount University

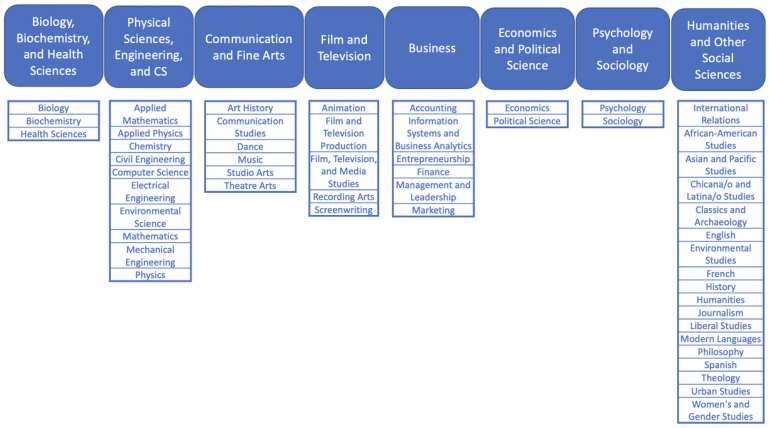
PART 2

In this part of the survey, we will ask you questions about your major choice.

Please answer the questions as honestly as you can. There are no particular answers we are looking for. We just want your honest answers.

Since there are a lot of majors, we group them into 8 categories to make the survey more manageable for you. Below, you can see a chart that depicts which majors belong to which categories.

If the chart is hard to read, please click here to open it in a new window or click here to download it to your computer.



Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

Let's consider a few examples to better understand what the question asks:

- If you think that you will for sure graduate with a Biology major, enter 100 for the "Biology, Biochemistry, and Health Sciences" category and 0 to all other categories.
- If you think that there are 80 in 100 chances that you will graduate with a Finance major and 20 in 100 chances that you will graduate with an Economics major, enter 80 for the "Business" category and 20 for the "Economics and Political Science" category.
- If you think that you are equally likely to graduate from any of the major categories, enter 12.5 for each of them.

NOTE: your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

Please list the most important factor that you consider when you are choosing your major.

Now, suppose you graduate from LMU with a Bachelor's degree in each of the following major categories. Think about the other individuals who will graduate in each of these categories. How do you think you would compare to these individuals?
I would be _____
(Please choose one option on each line!)

	One of the worst	Worse than average	Average	Better than average	One of the best
Biology, Biochemistry, and Health Sciences	○	○	○	○	○
Physical Sciences, Engineering, and CS	○	○	○	○	○
Communication and Fine Arts	○	○	○	○	○
Film and Television	○	○	○	○	○
Business	○	○	○	○	○
Economics and Political Science	○	○	○	○	○
Psychology and Sociology	○	○	○	○	○
Humanities and Other Social Sciences	○	○	○	○	○

Loyola Marymount University

PART 3

Now, we will ask your opinions about various aspects of different major categories.

Please answer the questions as honestly as you can. There are no particular answers we are looking for. We just want your honest answers.

If you need a reminder about which major belongs to which major category, please click here to open the major chart in a new window or click here to download it to your computer before clicking NEXT.

What do you think about the average DIFFICULTY of the courses in each of the following major categories? (1: Very Easy, 10: Very Difficult)

Very Easy 1 2 3 4 5 6 7 8 9 Very Difficult 10

Biology, Biochemistry, and Health Sciences

Physical Sciences, Engineering, and CS

Communication and Fine Arts

Film and Television

Business

Economics and Political Science

Psychology and Sociology

Humanities and Other Social Sciences

All candidates for a baccalaureate degree at LMU must complete a minimum of 120 semester hours to be able to graduate, including core curriculum, program requirements, and 45 semester hours of upper-division course work. However, each academic program requires a different amount of semester hours to be completed within the program.

What is the average required semester HOURS that need to be completed within the program for each of the following major categories?

Biology, Biochemistry, and Health Sciences	
Physical Sciences, Engineering, and CS	
Communication and Fine Arts	
Film and Television	
Business	
Economics and Political Science	
Psychology and Sociology	
Humanities and Other Social Sciences	

What percentage of the LMU FRESHMEN in each of the following major categories do you think GRADUATE from LMU (with any major) within 4 YEARS?

0 10 20 30 40 50 60 70 80 90 100

Biology, Biochemistry, and Health Sciences

Physical Sciences, Engineering, and CS

Communication and Fine Arts

Film and Television

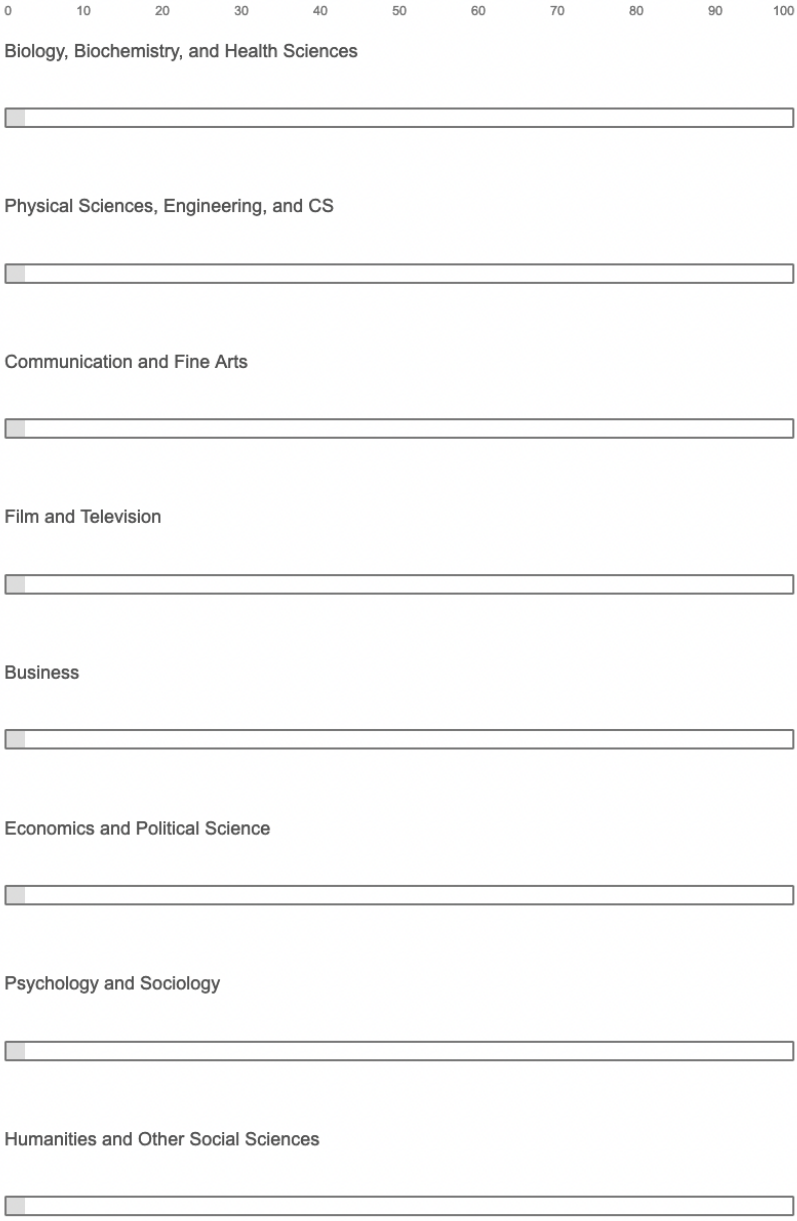
Business

Economics and Political Science

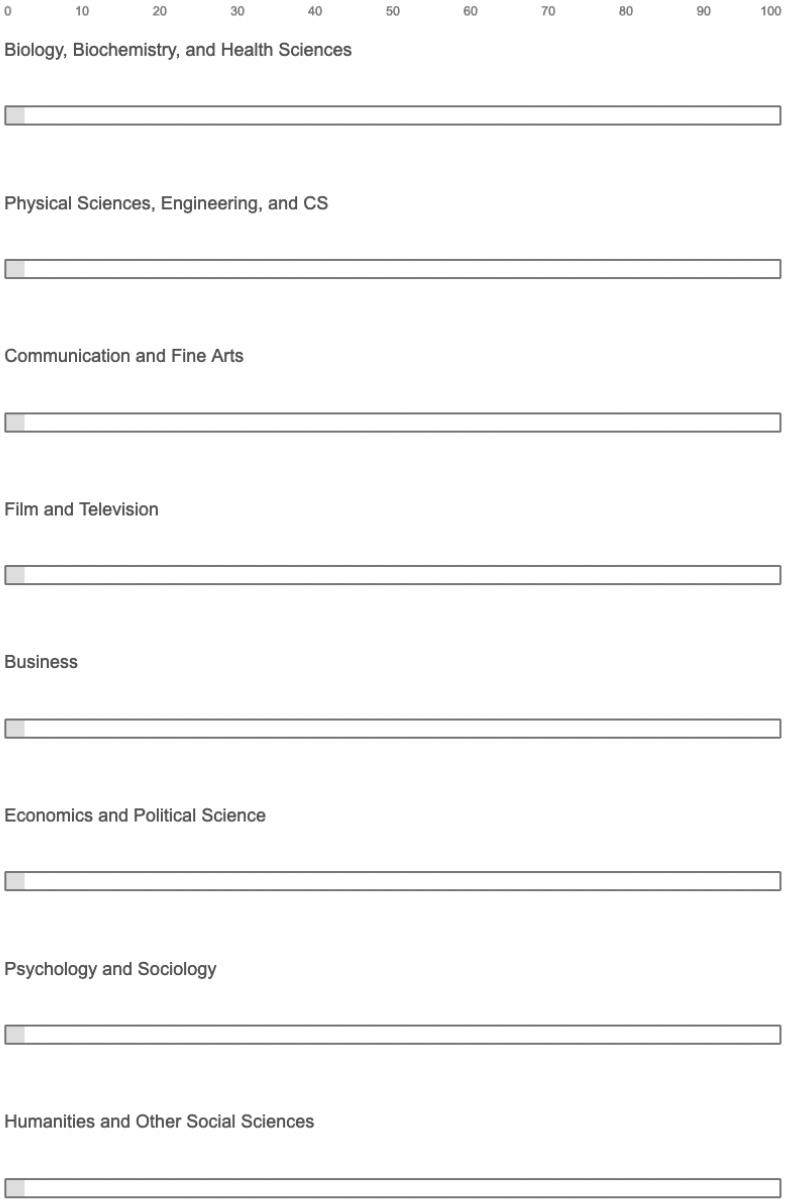
Psychology and Sociology

Humanities and Other Social Sciences

What percentage of the LMU STUDENTS in each of the following major categories do you think is FEMALE?



What percentage of the LMU FACULTY in each of the following major categories do you think is FEMALE?



For the following questions, please assume that you will certainly graduate with a degree from LMU.

BACK NEXT

What is the probability that you will CONTINUE YOUR EDUCATION immediately after graduation if you major in the following major categories?

0 10 20 30 40 50 60 70 80 90 100

Biology, Biochemistry, and Health Sciences

Physical Sciences, Engineering, and CS

Communication and Fine Arts

Film and Television

Business

Economics and Political Science

Psychology and Sociology

Humanities and Other Social Sciences

What is the probability that you will have a GRADUATE DEGREE (Masters, Professional, PhD, etc.) 10 years after graduation if you major in the following major categories?

0 10 20 30 40 50 60 70 80 90 100

Biology, Biochemistry, and Health Sciences

Physical Sciences, Engineering, and CS

Communication and Fine Arts

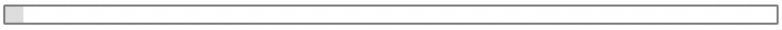
Film and Television

Business

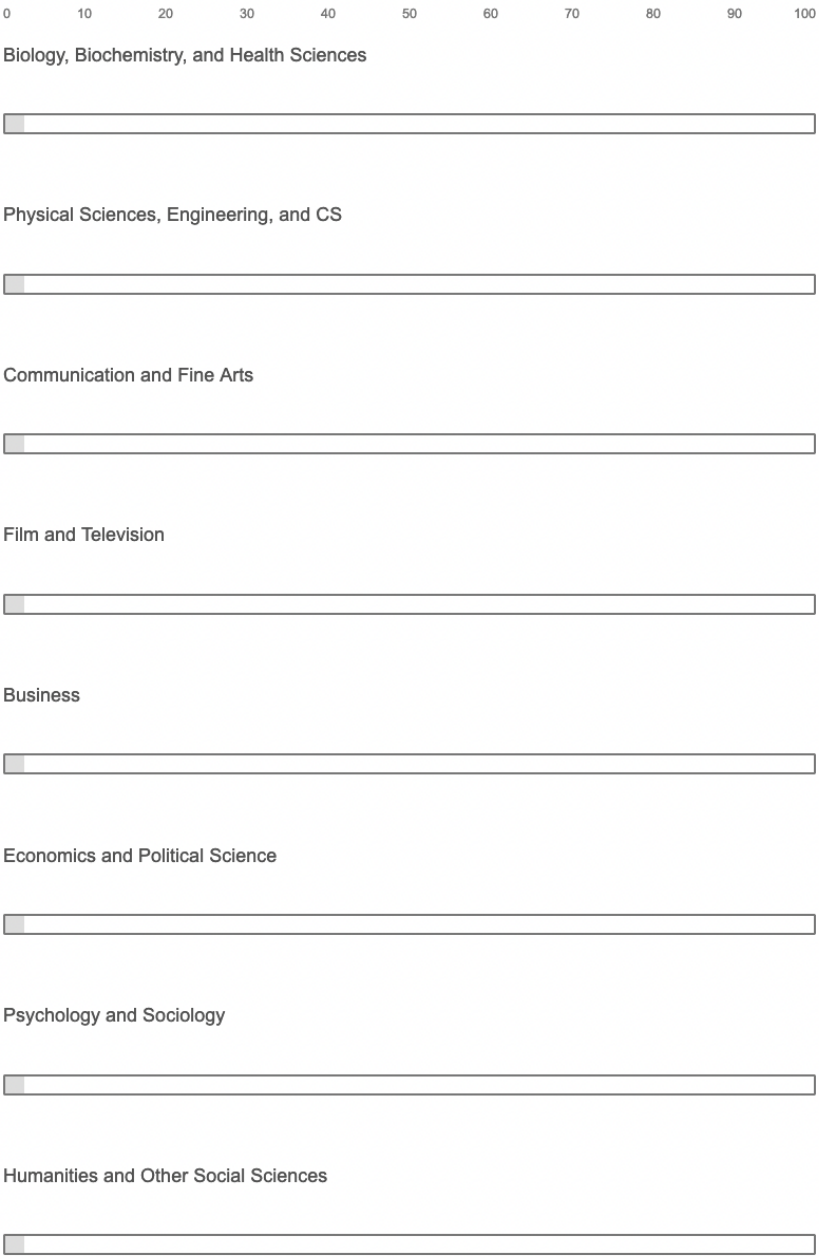
Economics and Political Science

Psychology and Sociology

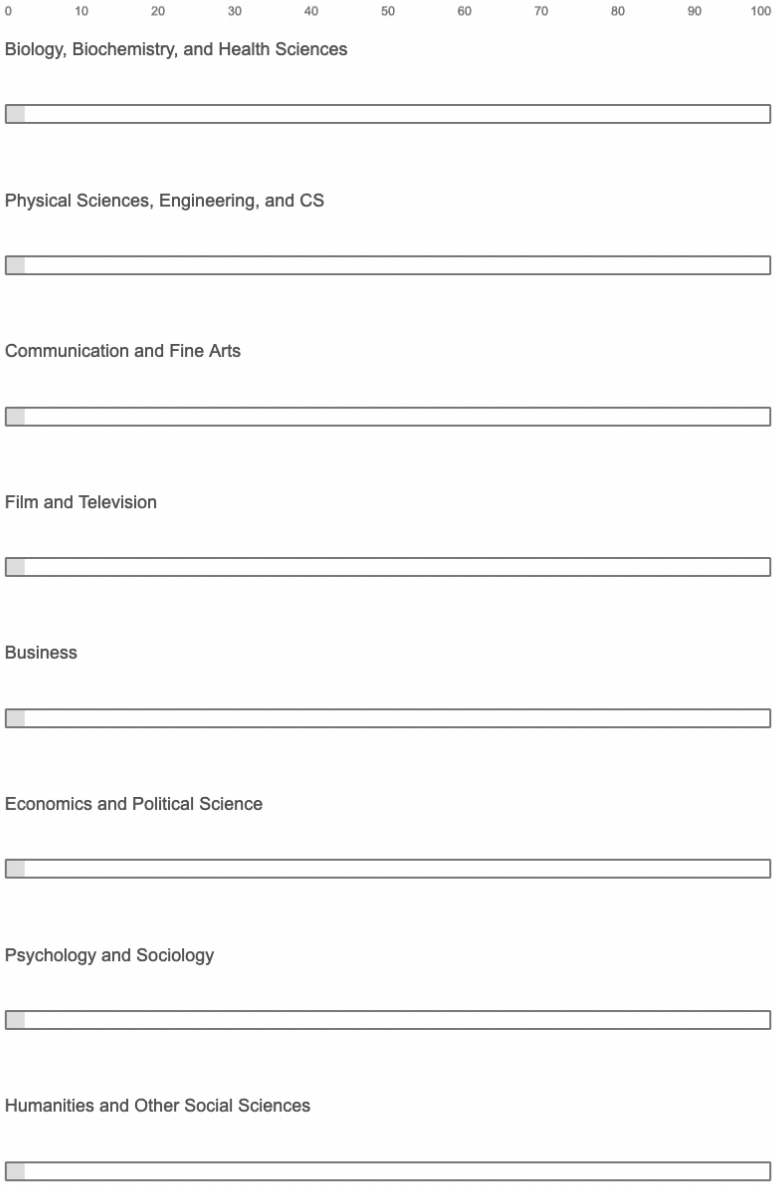
Humanities and Other Social Sciences



What is the probability that you will be EMPLOYED right after graduating from LMU with a Bachelor's degree if you major in the following major categories?



What is the probability that you will be EMPLOYED FULL-TIME 10 years after graduation if you major in the following major categories?



What will be your annual EARNINGS 10 years after graduation if you major in the following major categories?

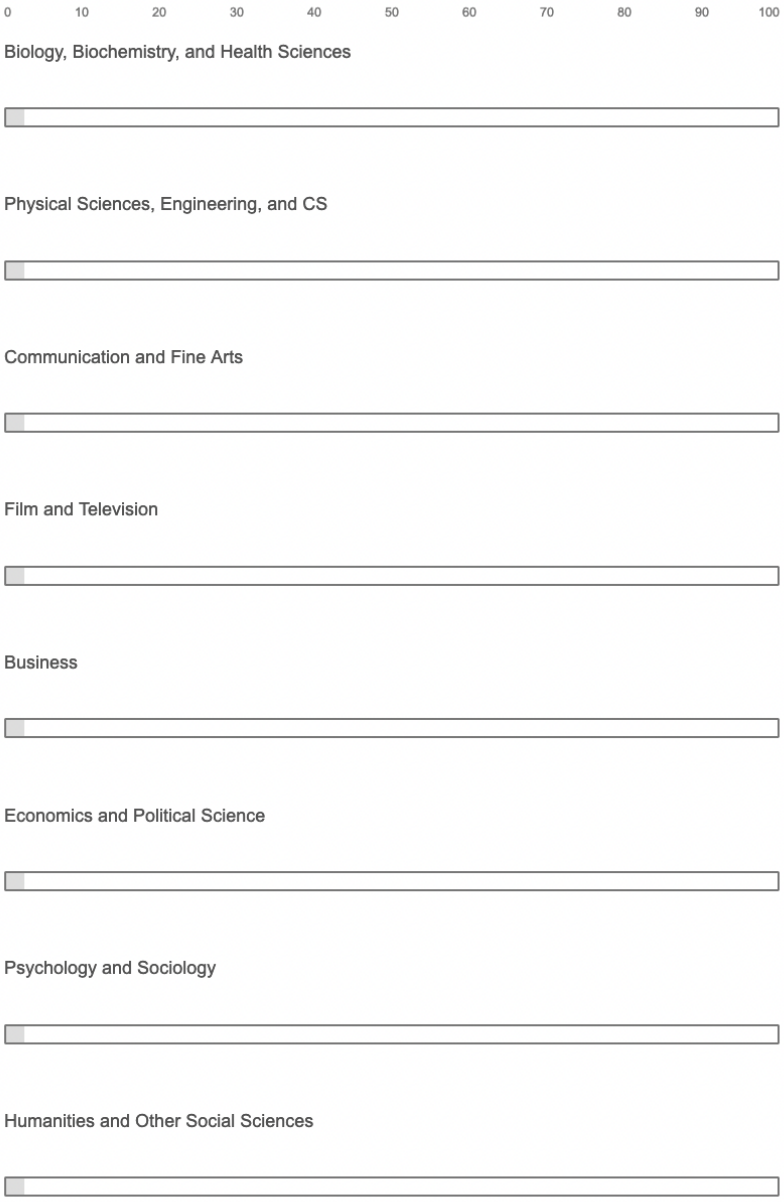
Note: Please answer this question assuming that you will be full-time employed 10 years after graduation. Please disregard inflation.

Biology, Biochemistry, and Health Sciences	
Physical Sciences, Engineering, and CS	
Communication and Fine Arts	
Film and Television	
Business	
Economics and Political Science	
Psychology and Sociology	
Humanities and Other Social Sciences	

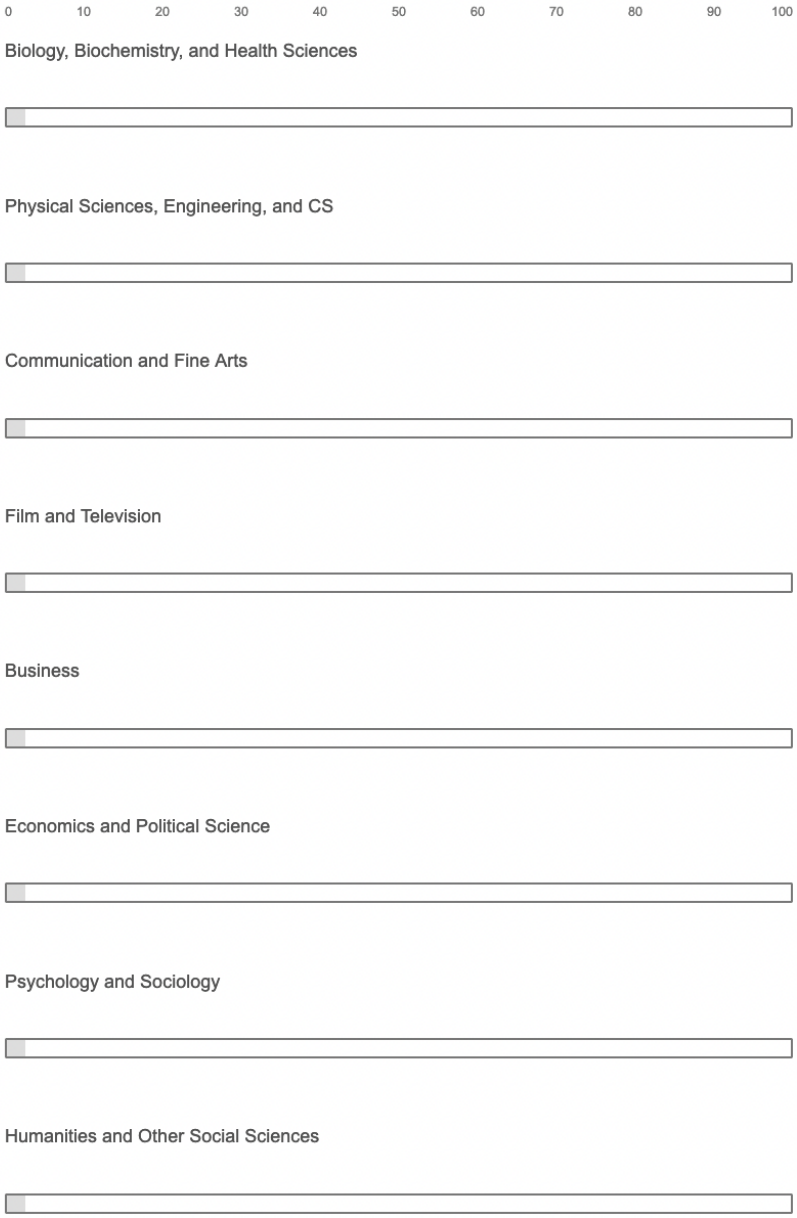
What is the MOST LIKELY INDUSTRY that you will work in 10 years after graduation if you major in the following major categories?

Biology, Biochemistry, and Health Sciences	
Physical Sciences, Engineering, and CS	
Communication and Fine Arts	
Film and Television	
Business	
Economics and Political Science	
Psychology and Sociology	
Humanities and Other Social Sciences	

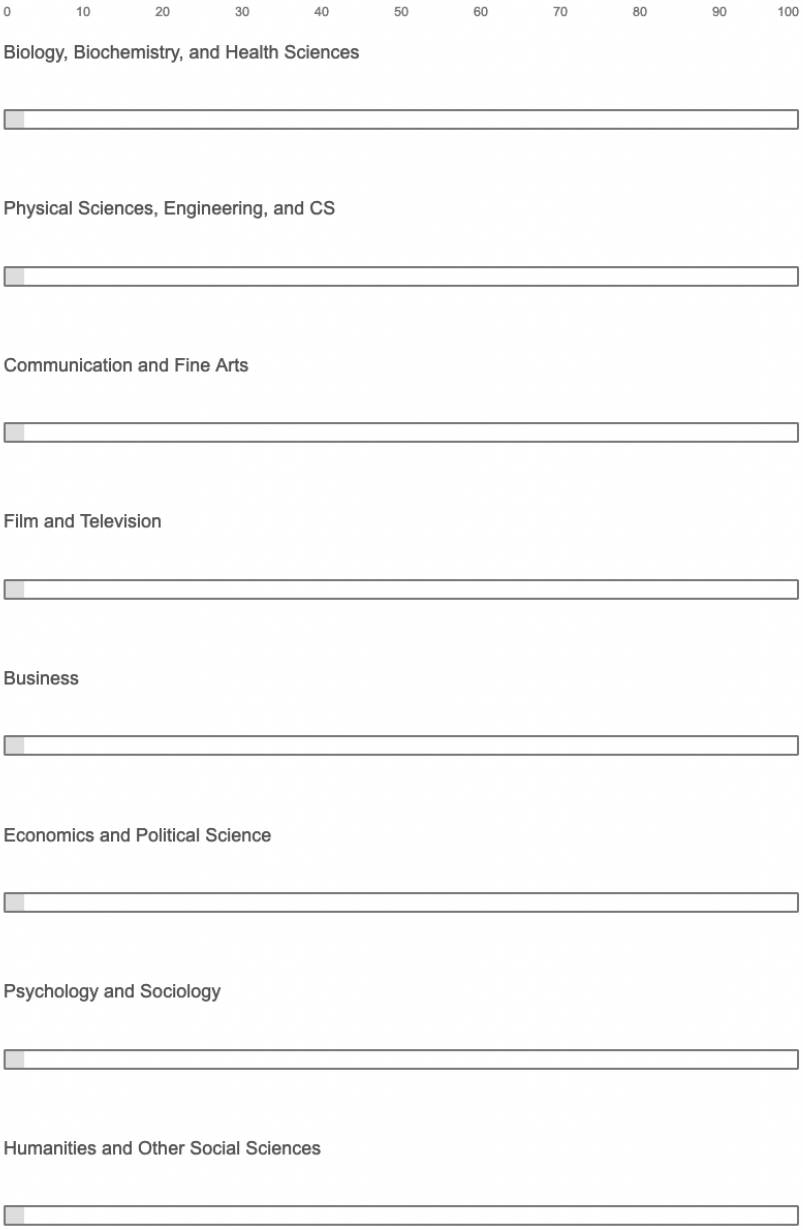
What is the probability that you will work in a job 10 years after graduation where you agree or strongly agree with the statement **"My current job is flexible in terms of availability of part-time work"** if you major in the following major categories?



What is the probability that you will work in a job 10 years after graduation where you agree or strongly agree with the statement **"My current job has work-life balance"** if you major in the following major categories?



What is the probability that you will be SINGLE 10 years after graduation if you major in the following major categories?



What is the probability that you will have at least one CHILD 10 years after graduation if you major in the following major categories?

0 10 20 30 40 50 60 70 80 90 100

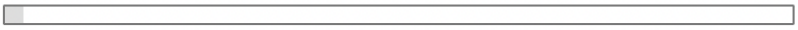
Biology, Biochemistry, and Health Sciences

Physical Sciences, Engineering, and CS

Communication and Fine Arts

Film and Television

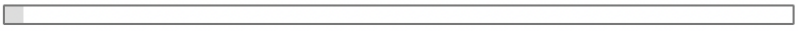
Business



Economics and Political Science

Psychology and Sociology

Humanities and Other Social Sciences



Loyola Marymount University

BREAK

You are done with at least one third of the study. Let's take a break!

Please take 3 minutes off from your screen to have a short break. Grab water or tea, go to restroom, or just simply stretch.

After 3 minutes, the page will proceed automatically.

Loyola Marymount University

PART 4

Welcome Back!

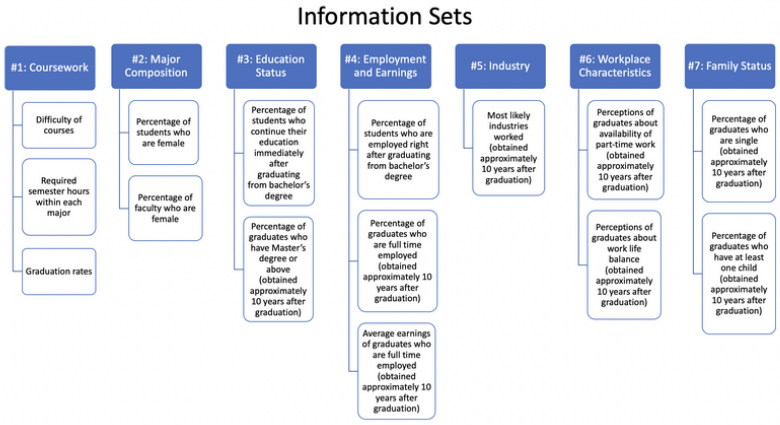
Now, we ask you to rank information sets about various aspects of majors in order of importance to you.

In the next part of the survey (Part 5), we will provide you information about these various aspects of different majors. We have collected this information through both administrative sources and alumni surveys.

Your ranking of the information sets in this part of the survey might affect which information set(s) you will receive in PART 5. So please rank them carefully!

The chart below describes the contents of each information set.

If the chart is hard to read, please click here to open it in a new window or click here to download it to your computer.



Please rank the information sets (by dragging and dropping) in order of importance to you from 1 to 7 (1 = the information set you would most like to receive, 7 = the information set you would least like to receive).

- Information Set 1: Coursework
- Information Set 2: Major Composition
- Information Set 3: Education status
- Information Set 4: Employment and Earnings
- Information Set 5: Industry
- Information Set 6: Workplace Characteristics
- Information Set 7: Family Status

In this part, 95% of the students received all information sets in an individually randomized order. The remaining 5% of the students only received the information set that they ranked the highest in Part 4.

PART 5

We will now provide you information about various aspects of different majors and ask you about your major choice after each information set.

Please examine the information carefully as it might affect your opinions about various aspects of different majors and your major choice. It is also perfectly normal if some information sets do not change your opinions and/or major choices.

Please answer the questions as honestly as you can. There are no particular answers we are looking for. We just want your honest answers.

Loyola Marymount University

Before we start providing you information, let's review your major choice.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

0 10 20 30 40 50 60 70 80 90 100

Loyola Marymount University

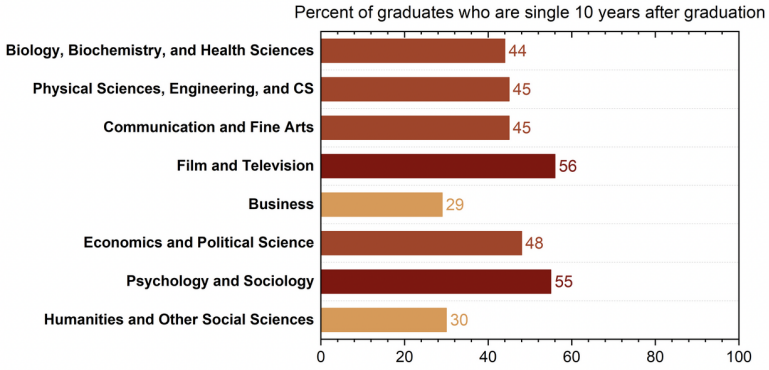
Round 1
Information Set 7

Next, you will see information about **Family Status** for each major category.

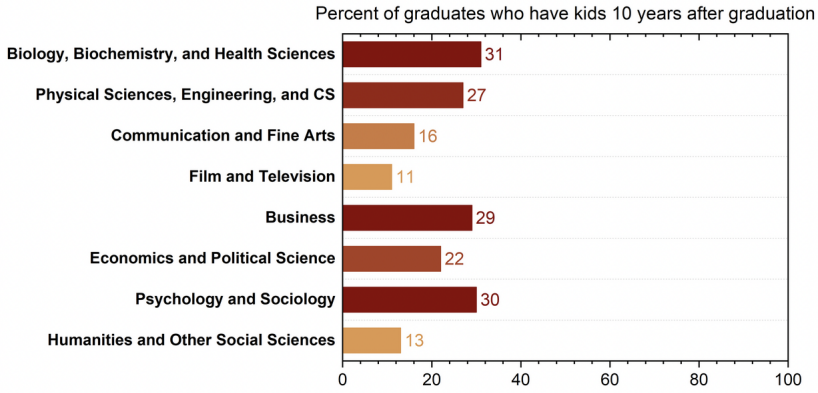
Information Set 7: Family Status

Please wait until all charts are uploaded. There should be 2 charts on this page.

We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them about their relationship status. The chart below shows the **percentage of graduates who are single** within each major category.



We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them whether they have kids.
The chart below shows the **percentage of graduates who have at least one child** within each major category.



You have just reviewed information about Family Status for each major category.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

0 10 20 30 40 50 60 70 80 90 100

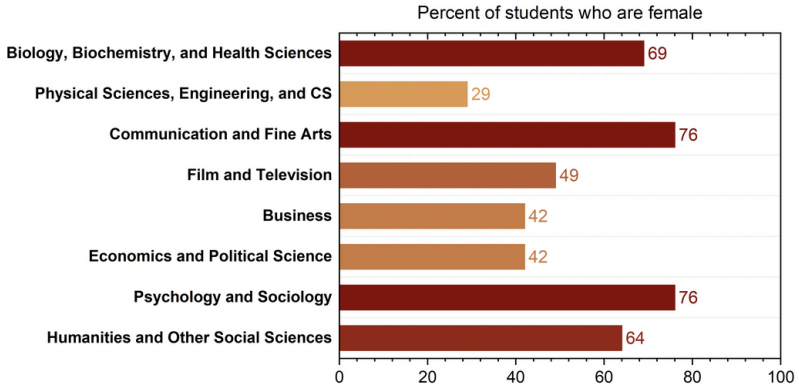
Round 2
Information Set 2

Next, you will see information about **Major Composition** for each major category.

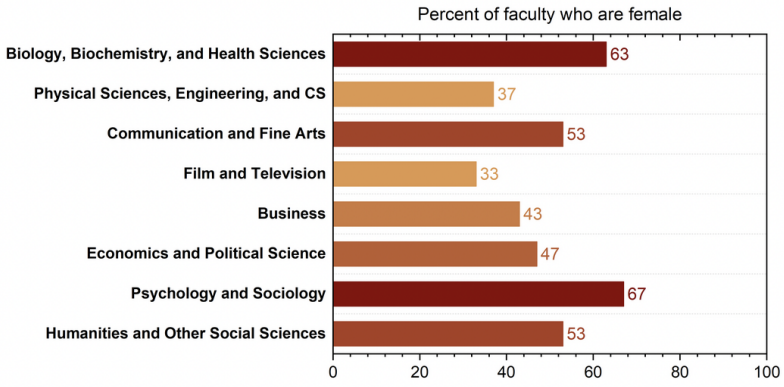
Information Set 2: Major Composition

Please wait until all charts are uploaded. There should be 2 charts on this page.

This chart shows the percentage of **LMU students** who are female within each major category. This data is obtained from the registrar's office in Spring 2021.



This chart shows the percentage of **LMU faculty who are female** within each major category. This data is collected from department websites in the summer of 2021.



You have just reviewed information about Major Composition for each major category.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

0 10 20 30 40 50 60 70 80 90 100

Loyola Marymount University

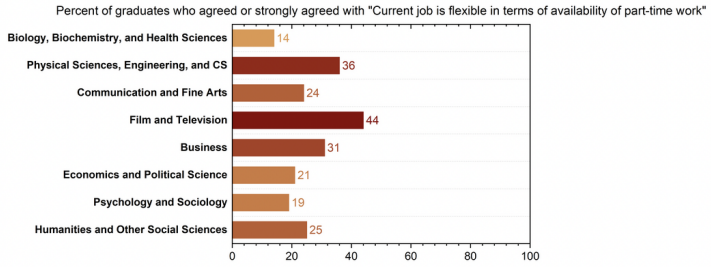
Round 3
Information Set 6

Next, you will see information about **Workplace Characteristics** for each major category.

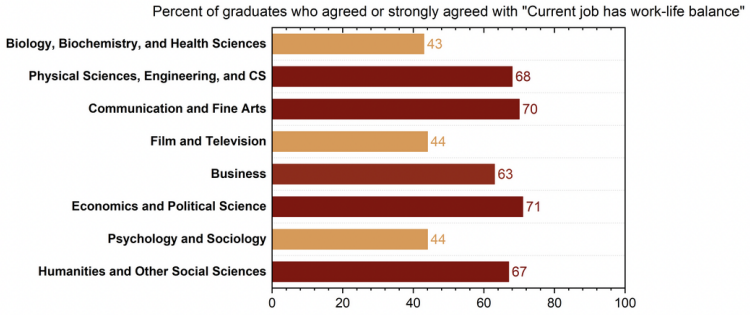
Information Set 6: Workplace Characteristics

Please wait until all charts are uploaded. There should be 2 charts on this page.

We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them about their **workplace characteristics**.
The chart below shows the percentage of graduates who agree or strongly agree that **their job is flexible in terms of availability of part-time work**.



The chart below shows the percentage of graduates who agree or strongly agree that **their job has a good work-life balance**.



You have just reviewed information about Workplace Characteristics for each major category.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

0 10 20 30 40 50 60 70 80 90 100

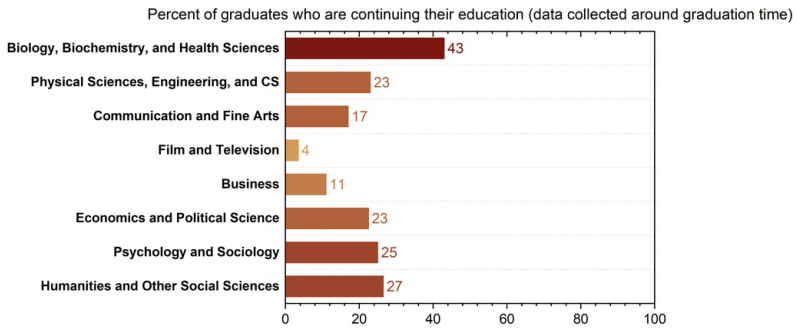
Round 4
Information Set 3

Next, you will see information about **Education Status** for each major category.

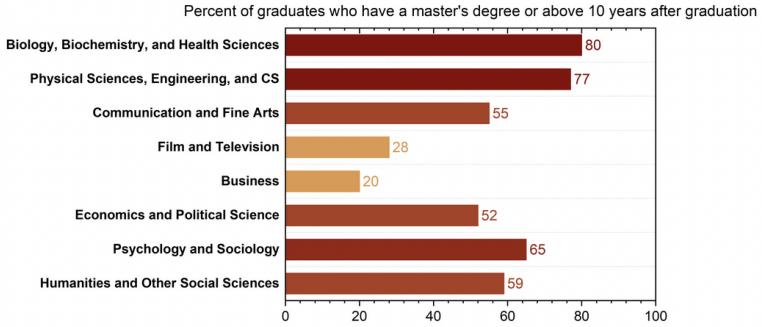
Information Set 3: Education Status

Please wait until all charts are uploaded. There should be 2 charts on this page.

This chart shows the percentage of **LMU students who continue their education** right after completing their bachelor's degree. This data is obtained from the First Destination Survey which is a survey that asks graduating LMU students questions about their career paths.



We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them whether they **hold a master's degree or above**. The chart below shows their responses.



You have just reviewed information about Education Status for each major category.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

0 10 20 30 40 50 60 70 80 90 100

Round 5
Information Set 5

Next, you will see information about **Industry** for each major category.

Information Set 5: Industry

Please wait until all charts are uploaded. There should be 1 charts on this page.

We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them **in which industry they work**. The figure below shows top industries for each major category. The numbers in parentheses are the percentage of graduates working in that industry.

Major Categories:	Most Likely Industries:
Biology, Biochemistry, and Health Sciences	Health (36%), Business (22%)
Physical Sciences, Engineering, and CS	Engineering (36%), Business (22%)
Communication and Fine Arts	Health (33%), Media and Communication (15%), Education or Research (15%)
Film and Television	Media and Communication (50%), Arts and Design (19%)
Business	Business (61%), Science and Technology (12%)
Economics and Political Science	Business (25%), Education or Research (21%), Government or Non-Profit (21%)
Psychology and Sociology	Education or Research (44%), Government or Non-Profit (19%)
Humanities and Other Social Sciences	Business (29%), Education or Research (29%), Government or Non-Profit (21%)

You have just reviewed information about Industry for each major category.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

Loyola Marymount University

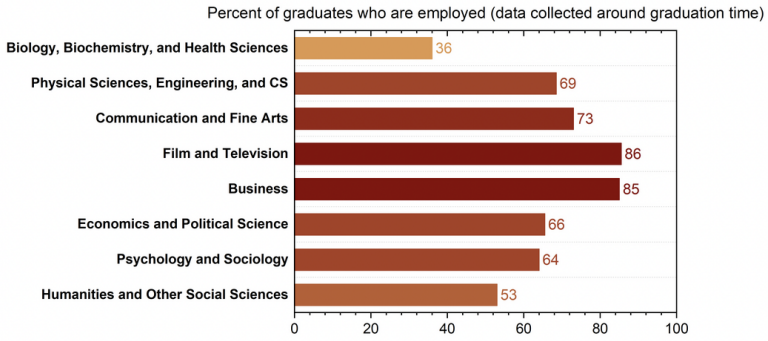
Round 6
Information Set 4

Next, you will see information about **Employment and Earnings** for each major category.

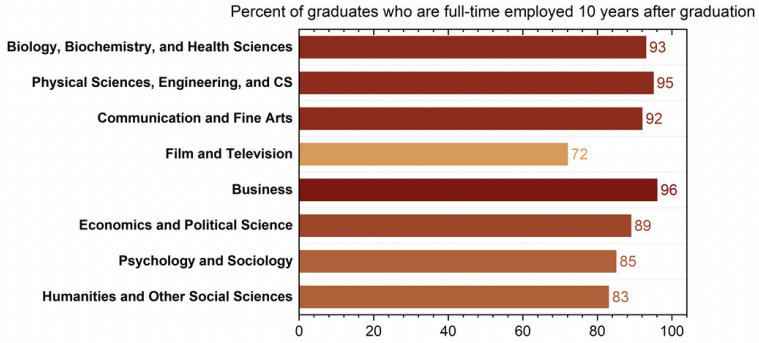
Information Set 4: Employment and Earnings

Please wait until all charts are uploaded. There should be 3 charts on this page.

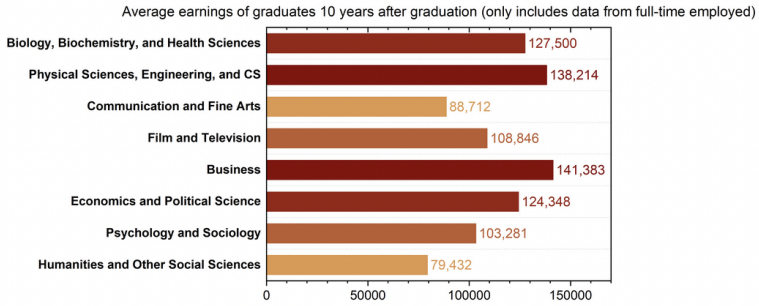
This chart shows the percentage of **LMU students who are employed** right after completing their bachelor's degree. This data is obtained from the First Destination Survey which is a survey that asks graduating LMU students questions about their career paths.



We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them whether they are **employed full-time**. The chart below shows their responses.



We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them about their **average annual earnings** (only if they were employed full-time at the time of data collection). The chart below shows their responses.



You have just reviewed information about Employment and Earnings for each major category.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

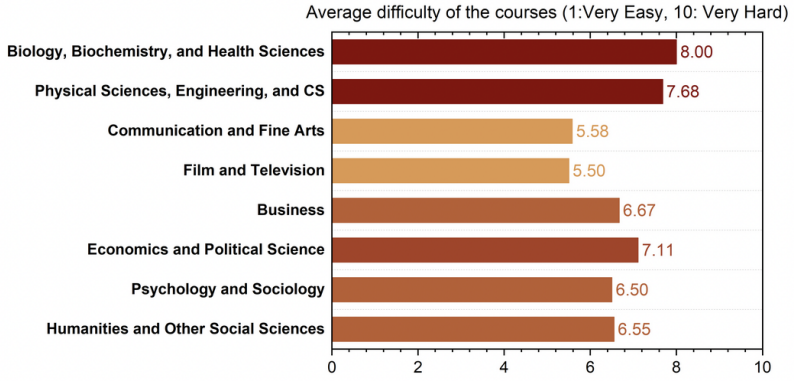
Round 7
Information Set 1

Next, you will see information about **Coursework** for each major category.

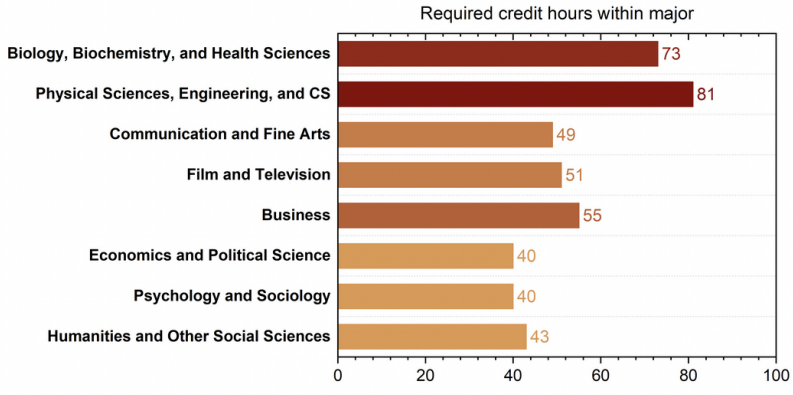
Information Set 1: Coursework

Please wait until all charts are uploaded. There should be 3 charts on this page.

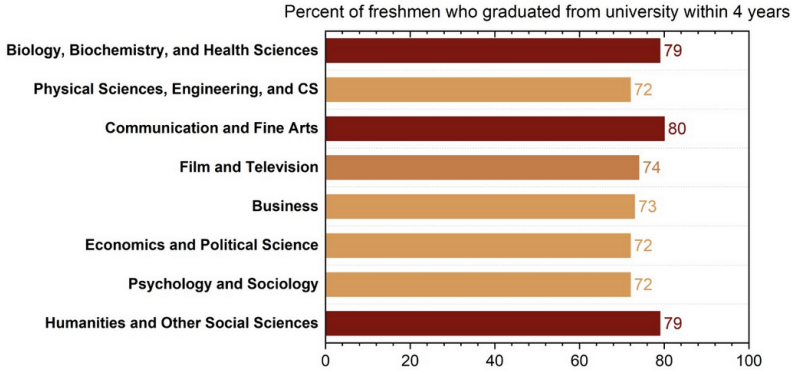
We survey LMU graduates approximately 10 years after graduating from their bachelor's degree and ask them to rate the **difficulty of the coursework** within their major using a scale from 1 to 10, where 1 is "Very Easy" and 10 is "Very Difficult". The chart below shows their responses.



All candidates for a baccalaureate degree at LMU must complete a minimum of 120 semester hours to be able to graduate, including core curriculum, program requirements, and 45 semester hours of upper-division course work. However, each academic program requires a different amount of semester hours to be completed within the program. The chart below shows the average **required semester hours within each major category**.



This chart shows the percentage of LMU freshmen in each major category who graduated from university within 4 years. It includes students who graduated both within their freshmen major category and outside of it. This chart is created using data from the Office of Institutional Research and contains data from freshmen cohorts of 2012 to 2016.



You have just reviewed information about Coursework for each major category.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

0 10 20 30 40 50 60 70 80 90 100

BREAK

You are done with two thirds of the study. Let's take a break!

Please take 3 minutes off from your screen to have a short break.
Grab water or tea, go to restroom, or just simply stretch.

After 3 minutes, the page will proceed automatically.

PART 6

Now, we will re-ask your opinions about various aspects of different major categories.

Please answer the questions as honestly as you can. There are no particular answers we are looking for. We just want your honest answers.

If you need a reminder about which major belongs to which major category, please click here to open the major chart in a new window or click here to download it to your computer before clicking NEXT.

NEXT

Here, we repeat all the opinion questions from Part 3.

Loyola Marymount University

Before we conclude our survey, we have a few final questions for you.

Please answer the questions as honestly as you can. There are no particular answers we are looking for. We just want your honest answers.

Loyola Marymount University

You have recently received a lot of information about various aspects of different major categories. Let's review your major choice one final time.

Assume for now that you will certainly graduate with a degree from LMU. Please think carefully and answer the following question: What is the percent chance that you will graduate from LMU with a degree in...

Biology, Biochemistry, and Health Sciences	0
Physical Sciences, Engineering, and CS	0
Communication and Fine Arts	0
Film and Television	0
Business	0
Economics and Political Science	0
Psychology and Sociology	0
Humanities and Other Social Sciences	0
Total	0

If you need a reminder about which major belongs to which major category, please click here to open the chart in a new window or click here to download the chart to your computer.
NOTE: Your answers must sum to 100%.
NOTE: If you plan to have more than one major, consider only your "primary" major for this question.

Loyola Marymount University

Assume for now that you will certainly graduate from LMU. What is the probability that you will graduate from LMU with two different majors (in other words, you will have a double major)?

0 10 20 30 40 50 60 70 80 90 100

Have you thought carefully when answering the major choice questions in Part 2 and Part 5?

- ◯ A great deal
- ◯ A lot
- ◯ A moderate amount
- ◯ A little
- ◯ None at all

Have you thought carefully when answering the opinion questions in Part 3?

- ◯ A great deal
- ◯ A lot
- ◯ A moderate amount
- ◯ A little
- ◯ None at all

Have you thought carefully when answering the opinion questions in Part 6?

- ◯ A great deal
- ◯ A lot
- ◯ A moderate amount
- ◯ A little
- ◯ None at all

Have you paid attention to the information provided in Part 5?

- ◯ A great deal
- ◯ A lot
- ◯ A moderate amount
- ◯ A little
- ◯ None at all

Have you found the information provided in Part 5 useful for choosing your major?

- ◯ Extremely useful
- ◯ Very useful
- ◯ Moderately useful
- ◯ Slightly useful
- ◯ Not at all useful

Which information set was the most effective at changing your opinion about which field to major in?

- ◯ Information Set 1: Coursework
- ◯ Information Set 2: Major Composition
- ◯ Information Set 3: Education status
- ◯ Information Set 4: Employment and Earnings
- ◯ Information Set 5: Industry
- ◯ Information Set 6: Workplace Characteristics
- ◯ Information Set 7: Family Status
- ◯ None of them

Loyola Marymount University

Did you experience any technical difficulties while taking the survey?

- ◯ No
- ◯ Yes (Please Specify):

Do you have anything that you would like to share with us?

- ◯ No
- ◯ Yes (Please Specify):

CONSENT TO OBTAIN ADMINISTRATIVE RECORDS

Finally, with your permission, we would like to obtain the following information about you at the time of your graduation from the registrar's office:

- Your name
- Your student ID number
- Your major(s) and minor(s) at the time of graduation
- Names of the classes you have taken at LMU and your grades from those courses at the time of the graduation
- Your cumulative GPA at the time of graduation
- Your year of graduation.

Please choose one of the following:

- ◯ I give my permission for the information listed above to be retrieved from the registrar's records, matched with my data, and used only for the purposes of this research study.
- ◯ I do NOT give my permission for the information listed above to be retrieved from the registrar's records.

Please enter your full name:

Please enter your LMU student ID number:

Please enter today's date (mm/dd/yyyy)

This is the end of the survey. Thank you for your participation.

We will send you a $30 Amazon e-Gift Card for your participation in the survey. This gift card will be sent to the email address you have entered at the beginning of the study. You should receive your Amazon Gift Card within 72 hours. Please make sure that you check your spam folder. Please email us at fulya.ersoy@lmu.edu if you do not receive your gift card within 72 hours.

Please click NEXT to finish the survey and save your responses.