Pugatch, Todd; Schroeder, Elizabeth

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A Simple Nudge Increases Socioeconomic Diversity in Undergraduate Economics

Todd Pugatch and Elizabeth Schroeder
Oregon State University
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Abstract: We assess whether a light-touch intervention can increase socioeconomic and racial diversity in undergraduate Economics. We randomly assigned over 2,200 students a message with basic information about the Economics major; the basic message combined with an emphasis on the rewarding careers or financial returns associated with the major; or no message. Messages increased the proportion of first generation and underrepresented minority (URM) students majoring in Economics by five percentage points. This effect size was sufficient to reverse the gap in Economics majors between first generation/URM students and students not in these groups. Effect sizes were larger and more precise for better-performing students and first generation students. Extrapolating to the full sample, the treatment would double the proportion of first generation and underrepresented minority students majoring in Economics.

Keywords: college major choice; diversity in Economics; higher education; nudges; randomized control trial

JEL codes: I21, I23

This project is registered at the AEA RCT Registry as AEARCTR-0002745, "Motivations to Major in Economics" (Pugatch and Schroeder 2019). The experimental protocol was approved by the Oregon State University Institutional Review Board, Study #8402. This project was supported by an Oregon State University FY19 Learning Innovation Grant. We thank the instructors and staff who made this experiment possible: Sal Castillo, Jon Chesbro, Maureen Cochran, Allyson Dean, Camille Nelson, Mike Nelson, Beau Olen, Laura Relyea, and Gail Udell.

1 Introduction

Differences in earnings across graduates of different disciplines rival, and in some cases exceed, the difference in earnings between college and high school graduates (Arcidiacono 2004; Altonji, Blom, and Meghir 2012; Altonji, Kahn, and Speer 2016; Altonji, Arcidiacono, and Maurel 2016). As in many STEM (Science, Technology, Engineering, Mathematics) fields, an Economics degree offers high future salaries, but the share of graduates from racial and ethnic minorities is low, contributing to workplace inequality (Dynan and Rouse 1997; Siegfried 2018; Altonji, Blom, and Meghir 2012). The well-documented underrepresentation of Black, Hispanic and Native American people in the Economics profession (Bayer and Rouse 2016; Bayer, Hoover, and Washington 2020) may also have consequences for the questions studied by economists and corresponding policy recommendations (May, McGarvey, and Whaples 2014). The lack of diversity in the field begins with undergraduate Economics majors.

One channel that impacts major choice is information. In choosing a college major, students form beliefs about the earnings and utility they expect to receive from potential majors (Stinebrickner and Stinebrickner 2013; Zafar 2013), and revise these beliefs in response to new information (Wiswall and Zafar 2014; 2015). Sharing information is a "Best Practice" recommended by the American Economic Association (AEA) to "correct gender and racial/ethnic disparities in knowledge about economics" (Bayer et al. 2019). If students enter college with limited information about what economists study, and if either knowledge or preferences for career paths vary across student groups, then informing students about the true variety of topics in Economics could increase diversity. The AEA suggests using email as a method to address knowledge deficits and misconceptions held by students, noting the effectiveness of such interventions: "When faculty proactively offer information about the breadth of the field of economics, more students from underrepresented groups study economics" (Bayer et al. 2019). This paper tests that claim, focusing on underrepresented minorities (URM) and first generation students (i.e., students whose parents did not complete a four-year degree) as the underrepresented groups. We provide evidence in a different context from previous work, and vary the type of information provided.

We designed a randomized control trial to test whether students respond to messages about majoring in Economics. The experiment included more than 2,200 students enrolled in Economics Principles courses at Oregon State University. We randomly assigned students to receive messages emphasizing the rewarding careers or financial returns associated with the Economics major. The rewarding careers message took two forms, a video produced for wide distribution by the AEA (henceforth, the "AEA video") or a local version featuring current and recent Economics students at the university ("OSU video"). The AEA video is used by many departments attempting to attract underrepresented students by correcting information gaps, and the OSU video allows us to test for role model

effects of receiving similar information from peers. The financial returns message ("earnings information") contrasted salaries for Economics graduates with those from other majors. We compare these groups to students receiving no email ("control") and to a group receiving a message with basic information about the major. All message content aligns with recommendations to promote diversity in Economics (e.g., Bayer, Hoover, and Washington 2020). This paper is a companion to Pugatch and Schroeder (2021), which analyzed the effects of the same experiment on the gender composition of Economics majors.

These email messages increased the probability that first generation and underrepresented minority students went on to major in Economics by five percentage points. This effect size was sufficient to reverse the gap in Economics majors between first generation/URM students and students not in these groups. Effect sizes were larger and more precise for better-performing students and first generation students. The outcome is drawn from administrative data collected in the academic year following treatment, meaning the effects represent a durable change in revealed preference.

We use our results to conduct a thought experiment. How would the proportion of first generation/URM Economics majors change if the intervention became departmental policy? In this scenario, the first generation/URM proportion would double from 0.18 to 0.36. For students earning a B- or better, the implied increase is from 0.14 to 0.35, or 151%.

We contribute to the burgeoning literature on promoting interest in undergraduate Economics among groups underrepresented in the field. The large scale and negligible marginal cost of our experiment—the intervention consisted of a single email—help to understand the frontier of informational nudges to promote undergraduate Economics. We complement Bayer, Bhanot, and Lozano (2019), who test similar messages among incoming students at liberal arts colleges, by studying introductory Economics students at a less-selective public university. Both studies find positive effects of an information intervention on interest in Economics among first generation and URM students. Whereas in Bayer, Bhanot, and Lozano (2019) these effects faded after an academic year, in our case the outcomes were measured in the academic year following the experiment, suggesting durable behavior change.

Related work looks at female participation in Economics. In our experiment, only male students (unconditional on first generation/URM status) majored in Economics at higher rates in response to the messages. As a result, the same counterfactual thought experiment we conduct in this paper would dramatically *decrease* the proportion of female Economics majors in our sample (Pugatch and Schroeder 2021). Experimental evidence from the Undergraduate Women in Economics (UWE) challenge (Avilova and Goldin 2018) suggests that deeper engagement may be required to increase female interest in Economics. Li (2018) finds that a package of information, nudges, and mentoring increased the probability of majoring in Economics for female students whose grades were above the median. Porter and Serra (2019) find that female students were significantly more likely to major in Economics when a female role model visited their Principles class. Whereas these

interventions included personal interaction with students—via class presentations, mentoring, or role model visits—our study and Bayer, Bhanot, and Lozano (2019) included only impersonal, electronic communication. Although the Bayer, Bhanot, and Lozano (2019) experiment increased diversity within their full sample of underrepresented students, they failed to find statistically significant results in the female subsamples. Similarly, another intervention providing information about Economics grade distributions, but without personal interaction, had only modest results among female students (Antman, Flores, and Skoy 2020).

Our work therefore helps to draw a more nuanced picture of the AEA's recommendation to share information. Gaps in information or perceptions may be unevenly distributed among different underrepresented groups in Economics, leading to different responses to informational interventions. Larger information gaps may allow arms-length information interventions to increase interest in Economics among first generation and URM students.

2 Research Design

2.1 Context

The study occurred at Oregon State University (OSU), the largest university in the state, with 31,000 students. In the academic year of the study, 2018-2019, first generation students made up 23% of the student body. Underrepresented minority (URM) students were 12% of students. We follow OSU's definition of URM as American Indian/Alaska Native, Black, Hispanic, and Native Hawaiian/Pacific Islander students of U.S. origin.

The academic year at OSU consists of three 10-week terms. The Economics Principles sequence includes two courses, Introduction to Microeconomics and Introduction to Macroeconomics. The Economics major is relatively small, as is common among land-grant universities such as OSU, with fewer than 100 degree recipients in the year of the study. Nonetheless, the Principles classes are popular, fulfilling course requirements for 40 other majors and 15 minors. Within our sample of Principles students, the most popular majors at baseline are business (49%) and engineering (26%). The sample includes eight sections of Introduction to Microeconomics and five sections of Introduction to Macroeconomics, none of which were taught by an underrepresented minority. Most Principles students take one course or the other. Students who take both courses may take them in either order, and occasionally take them simultaneously.

Admitted students to Oregon State are assigned the major listed as their preference when applying. Undecided students may choose "University Exploratory Studies," which assigns them an academic advisor and other services before they choose a disciplinary major. In our sample, 8% of students are in this or similar exploratory programs at baseline. Students who want to switch to Economics from another major do not need departmental approval, but must meet with an academic advisor. These institutional features may lead

to persistence in major choice compared to institutions where "undecided" is the default major for entering students.

2.2 Experiment

We invited all students registered in Economics Principles courses on OSU's main Corvallis campus to participate in the study. Participants were randomly assigned to the following groups:

1. *Control*: no encouragement message
2. *Basic information*: encouragement message based on description of Economics major on departmental website.
3. *Earnings information*: basic information, plus information on earnings of Economics graduates one and fifteen years after graduation.
4. *AEA video*: basic information, plus link to American Economic Association video "A career in Economics…it's much more than you think."
5. *OSU video*: basic information, plus link to video testimonials by current Economics students and alumni of Oregon State University.

All treatments align with recommendations to promote diversity in Economics. Sharing information about the major is an AEA Best Practice for working with students. Moreover, the content of the earnings information, AEA video, and OSU video treatments matches perceived information gaps among groups underrepresented in Economics. Respondents to a survey of underrepresented minorities in Economics "wished they had more information on "[w]hat you can do with an economics degree…Respondents also wished they had known more about economic research and what academic economists do outside of the classroom. They wanted salary information too" (Bayer, Hoover, and Washington 2020, p. 201-202).

Treated students were sent one message, in Week 8 of the 10-week course, from the email account of the student's instructor.[1] All emails had an identical subject line, "ECON [201/202]: Consider majoring in Economics!" Messages appear in Appendix Figure A1. We repeated the experiment in each of the three terms (fall, winter, and spring) of the 2018-2019 academic year.[2]

We randomly assigned treatments at the level of individual students, stratifying by course section and class year (freshman/sophomore/other). We assigned each treatment

[1] We (the researchers) sent the messages from instructor accounts. Instructors and the Economics Academic Advisor were blinded to the treatment status of individual students.

[2] The experiment also included a second phase, which tested a "resilience" message among a subset of better-performing students after the course ended. This paper focuses on Phase One, both for brevity and because we failed to find statistically significant effects of the Phase Two intervention. For Phase Two description and results, see the appendix and working paper version (Pugatch and Schroeder 2020).

with equal probability within strata, though the total number of students in each group differed due to uneven strata sizes. Because students may take both introductory courses in the same term, or repeat the same course in multiple terms, it is possible to be assigned to a treatment group more than once. Main results use student course enrollment as the unit of analysis, which we refer to as the student for brevity. We also check robustness to repeated observations from the same student.

2.3 Data

We have administrative data and baseline and endline surveys from study participants. The baseline and endline surveys were conducted during the first and last two weeks, respectively, of each ten-week term. The endline survey therefore occurred in Weeks 9-10, after treatment was sent in Week 8. Students earned course credit for completing the surveys. Surveys included questions about the likelihood of majoring or minoring in Economics and perceptions of the Economics major. Administrative data includes measures of experimental take-up, such as whether students opened treatment emails, clicked on links within those emails, or scheduled appointments with the Economics Academic Advisor. Administrative data also include student demographics, grades, and major. Our main outcome of interest is an indicator for majoring in Economics as of Winter 2020.[3] Our main results therefore represent the effects of the treatments two to four terms after the experiment, ensuring that students had sufficient time to reflect on the information and take the necessary administrative steps. Other outcomes come from the endline survey.

3 Methodology

Our primary specification is the ordinary least squares (OLS) regression:

$$EconMajor_{is} = \alpha_0 + \sum_{j=1}^{4} \alpha_j T_{j,is} + \sum_{j=1}^{4} \beta_j (T_{j,is} \times G_{is}) + X_{is}\theta + \varepsilon_{is} \quad (1)$$

In equation (1), j indexes treatment arms; i indexes students; s indexes strata; $EconMajor$ is an indicator for majoring in Economics, the outcome of interest; T_1 through T_4 are indicators for belonging to each of the four treatment arms (basic information, earnings information, AEA video, or OSU video; the control group is the omitted category); G is an indicator for belonging to a demographic group of interest, such as first generation or underrepresented minority; X is a vector of controls, including the main effect of the demographic group G, the baseline outcome, and strata dummies; and ε is an error term.

[3] The data were recorded in January 2020, before COVID-19 cases were widespread in the U.S. We did not observe an administrative major in Winter 2020 for 48 students. For these students, the outcome is an indicator for being an Economics major in the last term observed, provided this was at least one term later than when the student was in the experiment.

The inclusion of strata dummies isolates the random variation in treatment status within strata. The baseline outcome adjusts for any prior outcome differences between treatment groups and increases precision. We estimate heteroscedasticity-robust standard errors.[4]

Our coefficients of interest are β_1 through β_4, which measure differential effects of each treatment among students in demographic group G. For instance, β_1 measures whether basic information changed the proportion of Economics majors from group G differently from the effect of this treatment in the rest of the sample.

We also estimate a simplified version of equation (1) which bundles all treatments into a single indicator. We analyze outcomes using the full sample and for the subsample of students who earned a B- or above, given past evidence of a greater response to informational nudges among better-performing students (Li 2018, Pugatch and Schroeder 2021).

4 Results

4.1 Descriptive statistics

The experiment included 2,277 participants, or 85% of Economics Principles course enrollment.[5] First generation and underrepresented minority students each comprise 10% of the sample, lower than their proportions in the university (23% and 12%, respectively). Table 1 shows summary statistics for the sample, by first generation and underrepresented minority status. Compared to other students, first generation or underrepresented minority students are approximately equally likely to be female, but more likely to be white, have lower GPAs, and are less likely to expect an A in the course (Panel A, columns 1-2). Overlap among first generation and underrepresented minority students is high, with 38% of first generation students also URM, and 40% of URM students also first generation. Nonetheless, the imperfect overlap suggests they are distinct groups.

At baseline, the proportion of first generation or URM students majoring in Economics was higher than students not from these groups (3% vs. 2%), but not statistically distinguishable. However, first generation/URM students were significantly less likely to report an intention to minor in Economics, and had lower intentions to major and minor in Economics on a 0-100 scale. Perceptions of Economics also differed at baseline, with first generation/URM students less likely to cite future income or rewarding careers as the biggest appeal of Economics. URM students were more likely to cite lack of diversity as the biggest drawback to Economics than non-URM students.[6]

[4] Our companion paper followed an analysis plan focused on gender differences in the response to treatment. We build on that analysis plan in this paper, but our focus on different demographic groups and differences in specification make the analysis exploratory.

[5] To participate, students had to be at least 18 years old, complete the baseline survey, and consent.

[6] Table 1 does not condition on treatment status, and therefore is not a test for balance on baseline characteristics with respect to treatment. Baseline values were imbalanced by

Table 1, Panel B shows endline outcomes. Endline survey attrition did not differ by first generation/URM status. By definition, there is no attrition in the administrative data.[7] Differences in majoring and minoring in Economics persisted at endline, though these differences leave open the possibility that first generation/URM students responded differently to treatment. We assess this question in the next subsection.

4.2 Results

About two-thirds of treated students opened the intervention emails, with similar rates on this and other take-up measures between first generation/URM students and students not in these groups (Appendix Table A2). In the sample, 71 students majored in Economics by Winter 2020, or 3.2%. Of these, 33 students—46% of Economics majors—were not Economics majors at baseline. By contrast, only six students switched out of Economics. Of the 33 students who switched into Economics, six were first generation or underrepresented minority students, all of them treated. Of the six students who switched out of Economics, four were first generation/URM, with three from the control group.

The results of estimating equation (1) appear in Table 2. We interact treatment with one of three group indicators: 1) first generation or URM, 2) first generation, and 3) URM. Being in the combined first-generation or URM group is associated with a lower probability of majoring in Economics by four percentage points, significant at 5% (columns 1 □ 2). The point estimates of this coefficient were larger in magnitude, at 10 percentage points, for the subsample of students who earned a B- or above in the course, although only weakly statistically significant (columns 3-4).

In these regressions, none of the individual treatments had a statistically significant effect on students who were neither first-generation nor URM (columns 1 and 3). The interaction terms, however, indicate that there were positive and significant impacts of the treatments for students in the first-generation or URM group. The basic information email increased the probability that a student in this group majored in Economics by eight percentage points, significant at 5% (column 1). This effect was even stronger for the B- and above subsample, where the coefficient was 19 percentage points, likewise significant at 5%. In both cases, assignment to the basic information treatment more than reversed the gap in majoring in Economics for students of this demographic group. The interaction between the AEA video treatment and first-generation or URM status produced somewhat smaller and less precise coefficients, but still sufficient to overcome the gap, at five percentage points in the full sample and 13 percentage points in the B- and above sample (columns 1 and 3). Regressions using an indicator for assignment to any treatment email show similar results. The indicator for any treatment was insignificant, but the interaction

treatment status for two characteristics: female and first generation (Appendix Table A1). Our results are robust to including indicators for these characteristics in the controls.

[7] The administrative data fails to report post-study major for 39 students, however, because the term in which they took Principles is the last term we observe them enrolled at the university.

between this indicator and the first-generation or URM group was statistically significant at 5%, increasing the probability of majoring in Economics by five percentage points in the full sample and by 12 percentage points in the B- and above group (columns 2 and 4).

Allowing for differential effects of the treatments separately for first-generation and URM students produces similar results, although less precise. Being a first-generation student was associated with a four percentage point lower probability of majoring Economics, significant at 10% (columns 5-6); the coefficients were larger in magnitude but insignificant for the B- or above group (columns 7-8). The interaction between any treatment and first-generation was significant at 5%, increasing the probability of majoring in Economics by five percentage points (column 6). For the B- or above group, this coefficient was 13 percentage points, significant at 10% (column 8). Looking at the treatments individually, the coefficients on the interaction with the basic information treatment are similar in magnitude to the above estimates, but weakly significant (columns 5 and 7). Additionally, interactions between first-generation status and the AEA video and OSU video are positive and weakly significant, and the basic information email is weakly significant on its own for the B- or above group (columns 5 and 7).

The coefficients on the URM indicator have negative signs with slightly smaller magnitudes than first generation, but none are statistically significant (columns 9 □ 12). Additionally, most of the interactions between treatments and URM status are positive, with larger magnitudes in the B- or above sample. These results are consistent with the results for first generation students, though none of the URM coefficients are statistically different from zero.

Taken together, these results provide evidence that an email message from a course instructor can successfully encourage underrepresented students to major in Economics. The positive effects represent a lasting change in revealed preference, since the outcome is measured by administrative data collected in the academic year following treatment. Overall, we find that a simple nudge—a single email during a 10-week course—can reverse the lower likelihood of majoring in Economics found for first-generation and URM students.[8]

[8] Our results are robust to several alternative specifications. First, we limit the sample to one observation per student, removing duplicate entries of students who took both Principles courses or repeated a course, and redefining treatment as number of times exposed to each message (Appendix Table A3). Second, we include dummies for female and first generation to control for characteristics imbalanced at baseline (Appendix Table A4). Results from these regressions are consistent with our main findings. We also analyze minoring in Economics as an outcome, using self-reported data from the endline survey, but fail to find significant treatment effects (Appendix Table A5). Finally, we analyze whether the experiment changed student perceptions of Economics, using endline survey data. Student views of the biggest appeal (fun to study, future income, or rewarding career) or drawback (too focused on earning money, boring, or lack of diversity) of Economics did not respond significantly to any message, either for the main effect or when interacted with first-generation/URM (Appendix Table A6).

4.3 Policy simulation

Our main results in Table 2 demonstrate a positive effect of informational nudges on majoring in Economics among first generation or underrepresented minority students. Suppose Oregon State University adopted this intervention as Economics Department policy. How would the policy change the prevalence of first generation/URM students among Economics majors?

Table 3 presents results from this counterfactual exercise. The "control" scenario presents the status quo, by extrapolating the control group proportion majoring in Economics within each student group (columns 2/5) to the entire study population. In this scenario for the full sample, 9 first generation/URM students and 41 non-first generation/URM students would be Economics majors, for a first generation/URM proportion of 0.18 (column 7). The "treatment" scenario adjusts the proportions according to the group-specific point estimates of the treatment effect (Table 2, column 2). In this scenario, the implied first generation/URM proportion doubles to 0.36.

Panel B of Table 3 repeats the exercise for the subsample of students earning a B- or better. The increase in the first generation/URM proportion under the treatment scenario is now even more dramatic, given the greater response to treatment among better-performing first generation/URM students (Table 2, column 4). The first generation/URM proportion rises from 0.14 to 0.35, an increase of 151% over the control scenario.

A potential objection to this counterfactual exercise is that the absolute numbers of students are relatively small. Yet the exercise is based on relatively precise point estimates—particularly for first generation students—generated from an experiment involving more than 2,200 students at a large public university. Additionally, this exercise suffers from the well-known limitations of policy simulations in partial equilibrium. Nor do we account for further changes to the demographic mix of Economics students which might occur between the Principles courses and graduation, particularly in the absence of other efforts to retain underrepresented students. Our results nevertheless suggest that a simple informational nudge can increase socioeconomic diversity in the Economics major.

5 Conclusion

Our simple information intervention increased Economics majors among first generation students. The contrast between this result and findings from the literature on women in Economics highlights the importance of understanding the experiences of different underrepresented groups and the factors that may limit interest in Economics. Women have earned the majority of bachelor□s degrees in the US for the past 40 years. First-generation college students, on the other hand, enter college with less exposure to higher education than their peers. A short, informational message about majoring in Economics would be expected to have the strongest impact where knowledge gaps are largest. After

the gains from an initial amount of information are achieved, more intensive work may be required to further increase participation in Economics among underrepresented students.

In this study and Bayer, Bhanot, and Lozano (2019), a one-time message was sufficient to change behavior among first generation and URM students. By contrast, successful approaches to increase female interest in Economics (e.g., Li 2018; Porter and Serra 2019) included personal engagement with students, whereas less successful approaches used only light-touch interventions (Bayer, Bhanot, and Lozano 2019; Antman, Flores, and Skoy 2020; Pugatch and Schroeder 2021). Together, these results suggest the promise and limitations of nudges to increase diversity in Economics. The approaches more likely to succeed address the distinct barriers faced by different groups.

Despite the dramatic results of our experiment among first generation/URM students, we acknowledge that light-touch interventions alone are unlikely to sustain increased representation of these groups among economists. Within our sample, underrepresented minorities cite lack of diversity as the biggest drawback of Economics at more than twice the rate of non-URM students. These findings echo the exclusion felt by underrepresented students in Economics documented elsewhere (Bayer, Bhanot, et al. 2020; Bayer, Hoover, and Washington 2020). Targeted support programs to students underrepresented in the discipline offer promise but remain relatively rare, with the most effective program elements still unknown. Shifting the content of Principles courses (e.g., Bayer et al. 2020; Benjamin, Cohen, and Hamilton 2020; Bowles and Carlin 2020) may also complement targeted messaging and engagement to increase diversity in Economics. Future work may determine whether these changes complement or substitute for marketing efforts to diversify the student population. Pursuing these questions will help to better understand how to promote diversity in Economics.

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7 Tables

Table 1: Summary statistics

	1st gen or URM		1st generation		URM	
	no	yes	no	yes	no	yes
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: baseline characteristics						
female	0.36	0.33	0.35	0.35	0.36	0.31
white	0.65	0.24***	0.61	0.37***	0.65	0.00***
First generation	0.00	0.64***	0.00	1.00	0.07	0.40***
underrepresented minority	0.00	0.6***	0.07	0.38***	0.00	1.00
underrepresented minority (inc. multiple race)	0.07	0.64***	0.13	0.44***	0.07	1.00***
high school GPA	3.49	3.40***	3.48	3.41**	3.48	3.37***
GPA at Oregon State, previous terms	3.09	2.94***	3.08	2.95***	3.08	2.92***
Expected grade: A	0.51	0.46*	0.51	0.44*	0.51	0.45*
Expected grade: B	0.44	0.46	0.44	0.48	0.44	0.48
Economics major	0.02	0.03	0.02	0.03	0.02	0.02
Intends to minor in Economics (0/1)	0.05	0.02***	0.05	0.02**	0.05	0.00***
Intends to major in Economics (0-100)	19.1	15.0***	18.9	14.5**	18.9	14.2***
Intends to minor in Economics (0-100)	27.5	21.6***	27.2	20.7***	27.0	22.4**
Biggest appeal of Economics major:						
fun to study	0.18	0.20	0.18	0.19	0.18	0.20
income	0.37	0.32*	0.37	0.31*	0.37	0.31*
rewarding career	0.21	0.17**	0.21	0.17	0.21	0.18
Biggest drawback of Economics major:						
boring	0.23	0.21	0.23	0.18**	0.23	0.20
too difficult	0.38	0.34	0.38	0.37	0.38	0.34
too focused on making money	0.07	0.06	0.07	0.06	0.07	0.06
lack of diversity	0.03	0.05	0.04	0.03	0.03	0.08**
Panel B: outcomes						
completed endline survey	0.87	0.85	0.87	0.86	0.87	0.85
course grade (0-4)	2.40	2.17***	2.39	2.17***	2.40	2.08***
Economics major	0.03	0.04	0.03	0.04	0.03	0.03
Intends to minor in Economics (0/1)	0.04	0.02**	0.04	0.02	0.04	0.02**
Intends to major in Economics (0-100)	18.5	15.2**	18.2	15.7	18.4	14.3**
Intends to minor in Economics (0-100)	26.2	21.9**	25.8	22.8	25.9	21.6**
Biggest appeal of Economics major:						
fun to study	0.15	0.14	0.15	0.14	0.15	0.13
income	0.40	0.33**	0.40	0.31**	0.39	0.34
rewarding career	0.18	0.19	0.18	0.19	0.18	0.20
Biggest drawback of Economics major:						
boring	0.26	0.26	0.26	0.25	0.26	0.25
too difficult	0.40	0.38	0.40	0.40	0.40	0.38
too focused on making money	0.06	0.06	0.06	0.06	0.06	0.06
lack of diversity	0.04	0.06	0.04	0.06	0.04	0.09**
took Economics course (after Principles)	0.03	0.06*	0.03	0.05	0.03	0.06
N	1,908	369	2,041	236	2,054	223
Proportion	0.84	0.16	0.90	0.10	0.90	0.10

Table shows baseline characteristics and outcomes by first generation and underrepresented minority (URM) status. Sample is all students who participated in study. Underrepresented minority is defined as American Indian or Alaska Native, Balck or African American, Hispanic, or Native Hawaiian or Pacific Islander. URM status does not include multiracial or international students. Data sources: administrative data and baseline and endline surveys. Stars indicate significant differences with column to left. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 2: Results

Outcome	Major in Economics											
Group	First generation or URM				First generation				URM			
Sample	All		B- or above		all		B- or above		all		B- or above	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
basic information	0.006		0.019		0.011		0.029*		0.015		0.038**	
	(0.009)		(0.016)		(0.009)		(0.017)		(0.009)		(0.018)	
earnings information	0.011		0.025		0.012		0.027		0.015		0.033*	
	(0.010)		(0.020)		(0.010)		(0.019)		(0.010)		(0.019)	
AEA video	0.003		0.010		0.004		0.012		0.008		0.020	
	(0.008)		(0.016)		(0.008)		(0.017)		(0.008)		(0.016)	
OSU video	-0.003		-0.004		-0.002		-0.003		0.005		0.010	
	(0.008)		(0.014)		(0.008)		(0.015)		(0.008)		(0.015)	
basic info*group	0.081**		0.188**		0.080*		0.188*		0.045		0.100	
	(0.033)		(0.083)		(0.046)		(0.114)		(0.037)		(0.104)	
earnings*group	0.023		0.064		0.021		0.052		0.005		0.030	
	(0.020)		(0.058)		(0.021)		(0.059)		(0.023)		(0.082)	
AEA video*group	0.048*		0.128*		0.059*		0.155		0.033		0.110	
	(0.025)		(0.075)		(0.034)		(0.097)		(0.031)		(0.115)	
OSU video*group	0.041		0.108		0.056*		0.134*		-0.006		-0.022	
	(0.027)		(0.073)		(0.029)		(0.077)		(0.032)		(0.117)	
group	-0.043**	-0.043**	-0.104*	-0.102*	-0.038*	-0.038*	-0.081	-0.080	-0.024	-0.024	-0.072	-0.069
	(0.019)	(0.019)	(0.054)	(0.054)	(0.021)	(0.021)	(0.058)	(0.058)	(0.020)	(0.020)	(0.078)	(0.078)
treatment		0.004		0.013		0.006		0.017		0.011		0.025**
		(0.007)		(0.012)		(0.007)		(0.012)		(0.007)		(0.012)
treatment*group		0.048**		0.120**		0.052**		0.126*		0.020		0.061
		(0.021)		(0.059)		(0.024)		(0.065)		(0.024)		(0.085)
N	2,238	2,238	1,003	1,003	2,238	2,238	1,003	1,003	2,238	2,238	1,003	1,003
Control mean	0.023	0.023	0.037	0.037	0.023	0.023	0.037	0.037	0.023	0.023	0.037	0.037
all interactions=0	0.09	0.02	0.15	0.04	0.11	0.03	0.16	0.05	0.52	0.40	0.64	0.47

Sample is all students who consented to participate in study. Outcome is dummy for majoring in Economics, from administrative data in Winter 2020 or most recent available. Underrepresented minority (URM) is defined as American Indian or Alaska Native, Balck or African American, Hispanic, or Native Hawaiian or Pacific Islander. URM status does not include multiracial or international students. All regressions include strata dummies and control for baseline outcom. Robust standard errors in parenthesis. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 3: Economics majors, counterfactual exercises

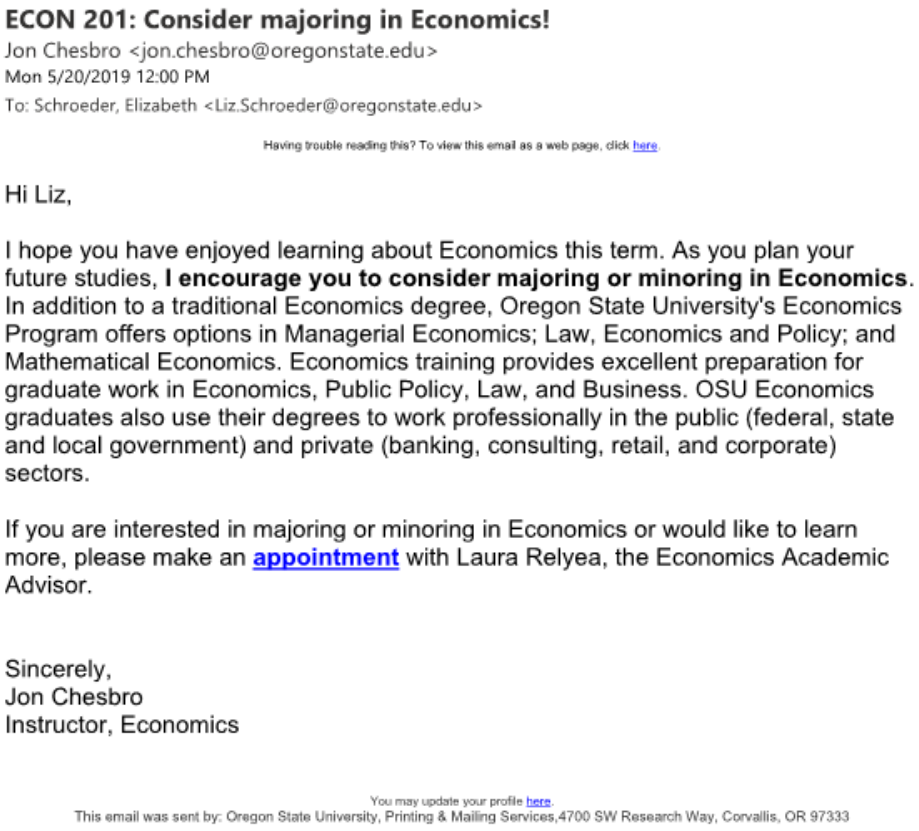
	not first generation or URM			first generation or URM			projected
	base	major		base	major		first-gen/URM
	population	proportion	projected	population	proportion	projected	proportion
scenario	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: all students							
control	1,882	0.022	41	356	0.025	9	0.18
treatment	1,882	0.026	49	356	0.077	28	0.36
Panel B: B- or better							
control	874	0.036	31	129	0.042	5	0.14
treatment	874	0.049	43	129	0.175	23	0.35

Table shows projected proportions and numbers of Economics majors under scenarios listed in first column. "Control" scenario based on proportions majoring in Economics among control group. "Treatment" scenario based on change in proportion majoring in Economics in response to treatment. Base population refers to sample size within the study population. Column (7) shows projected first generation or URM student proportion among Economics majors, i.e., column (6)/(column (6)+column(3)).

Pugatch & Schroeder, A Simple Nudge Increases Socioeconomic Diversity in Undergraduate Economics: Appendix

1 Intervention messages

Figure A1(a): Phase One: basic information



ECON 201: Consider majoring in Economics!

Jon Chesbro <jon.chesbro@oregonstate.edu>
Mon 5/20/2019 12:00 PM
To: Schroeder, Elizabeth <Liz.Schroeder@oregonstate.edu>

Having trouble reading this? To view this email as a web page, click here.

Hi Liz,

I hope you have enjoyed learning about Economics this term. As you plan your future studies, **I encourage you to consider majoring or minoring in Economics**. In addition to a traditional Economics degree, Oregon State University's Economics Program offers options in Managerial Economics; Law, Economics and Policy; and Mathematical Economics. Economics training provides excellent preparation for graduate work in Economics, Public Policy, Law, and Business. OSU Economics graduates also use their degrees to work professionally in the public (federal, state and local government) and private (banking, consulting, retail, and corporate) sectors.

If you are interested in majoring or minoring in Economics or would like to learn more, please make an **appointment** with Laura Relyea, the Economics Academic Advisor.

Sincerely,
Jon Chesbro
Instructor, Economics

You may update your profile here.
This email was sent by: Oregon State University, Printing & Mailing Services,4700 SW Research Way, Corvallis, OR 97333

Figure A1(b): Phase One: earnings information

ECON 201: Consider majoring in Economics!

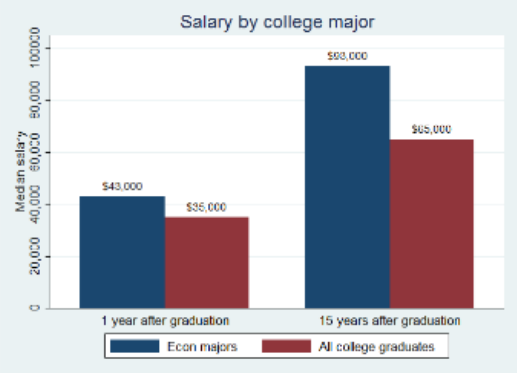
Camille Nelson <camille.nelson@oregonstate.edu>
Mon 5/20/2019 12:00 PM
To: Schroeder, Elizabeth <Liz.Schroeder@oregonstate.edu>

Having trouble reading this? To view this email as a web page, click here.

Hi Liz,

I hope you have enjoyed learning about Economics this term. As you plan your future studies, **I encourage you to consider majoring or minoring in Economics.** In addition to a traditional Economics degree, Oregon State University's Economics Program offers options in Managerial Economics; Law, Economics and Policy; and Mathematical Economics. Economics training provides excellent preparation for graduate work in Economics, Public Policy, Law, and Business. OSU Economics graduates also use their degrees to work professionally in the public (federal, state and local government) and private (banking, consulting, retail, and corporate) sectors.

Majoring in Economics can be a smart career decision. Average earnings for economics majors are higher than the overall average for college graduates, both at the start of their careers and throughout their lives.



Source: hamiltonproject.org/charts/career_earnings_by_college_major/

If you are interested in majoring or minoring in Economics or would like to learn more, please **make an appointment with Laura Relyea, the Economics Academic Advisor.**

Sincerely,
Camille Nelson
Senior Instructor, Economics

You may update your profile here.
This email was sent by: Oregon State University, Printing & Mailing Services,4700 SW Research Way, Corvallis, OR 97333

Figure A1(c): Phase One: AEA video

ECON 202: Consider majoring in Economics!

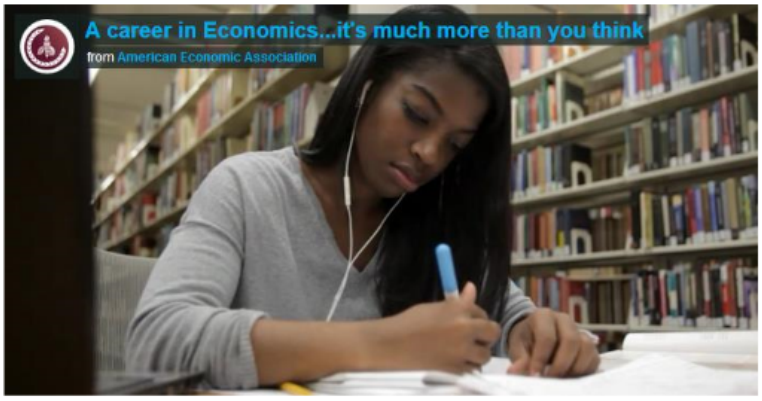
Mike Nelson <mike.nelson@oregonstate.edu>
Mon 5/20/2019 12:00 PM
To: Schroeder, Elizabeth <Liz.Schroeder@oregonstate.edu>

Having trouble reading this? To view this email as a web page, click here.

Hi Liz,

I hope you have enjoyed learning about Economics this term. As you plan your future studies, **I encourage you to consider majoring or minoring in Economics**. In addition to a traditional Economics degree, Oregon State University's Economics Program offers options in Managerial Economics; Law, Economics and Policy; and Mathematical Economics. Economics training provides excellent preparation for graduate work in Economics, Public Policy, Law, and Business. OSU Economics graduates also use their degrees to work professionally in the public (federal, state and local government) and private (banking, consulting, retail, and corporate) sectors.

Learn more in this video about careers in Economics...it's much more than you think!



If you are interested in majoring or minoring in Economics or would like to learn more, **please make an appointment with Laura Relyea, the Economics Academic Advisor.**

Sincerely,
Mike Nelson
Senior Instructor, Economics

You may update your profile here.
This email was sent by: Oregon State University, Printing & Mailing Services,4700 SW Research Way, Corvallis, OR 97333

Figure A1(d): Phase One: OSU video

ECON 201: Consider majoring in Economics!

Camille Nelson <camille.nelson@oregonstate.edu>
Mon 5/20/2019 12:00 PM
To: Schroeder, Elizabeth <Liz.Schroeder@oregonstate.edu>

Having trouble reading this? To view this email as a web page, click here.

Hi Liz,

I hope you have enjoyed learning about Economics this term. As you plan your future studies, **I encourage you to consider majoring or minoring in Economics**. In addition to a traditional Economics degree, Oregon State University's Economics Program offers options in Managerial Economics; Law, Economics and Policy; and Mathematical Economics. Economics training provides excellent preparation for graduate work in Economics, Public Policy, Law, and Business. OSU Economics graduates also use their degrees to work professionally in the public (federal, state and local government) and private (banking, consulting, retail, and corporate) sectors.

Learn more in this video about what it's like to major in Economics at Oregon State!

If you are interested in majoring or minoring in Economics or would like to learn more, **please make an appointment with Laura Relyea, the Economics Academic Advisor.**

Sincerely,
Camille Nelson
Senior Instructor, Economics

You may update your profile here.
This email was sent by: Oregon State University, Printing & Mailing Services,4700 SW Research Way, Corvallis, OR 97333

2 Tables

Table A1: Baseline balance

	Treatment arm					
	control	Basic information	AEA video	earnings information	OSU video	F-test (p-value)
	(1)	(2)	(3)	(4)	(5)	(6)
female	0.32	0.41	0.36	0.35	0.33	0.05
	[0.47]	[0.49]	[0.48]	[0.48]	[0.47]	
white	0.57	0.58	0.59	0.58	0.61	0.84
	[0.49]	[0.49]	[0.49]	[0.49]	[0.49]	
Asian	0.08	0.08	0.06	0.06	0.07	0.67
	[0.27]	[0.27]	[0.24]	[0.24]	[0.26]	
Hispanic	0.10	0.08	0.09	0.10	0.07	0.41
	[0.30]	[0.27]	[0.28]	[0.30]	[0.25]	
1st generation	0.14	0.08	0.09	0.09	0.12	0.03
	[0.35]	[0.27]	[0.29]	[0.29]	[0.32]	
High school GPA	3.46	3.50	3.45	3.49	3.46	0.20
	[0.40]	[0.37]	[0.42]	[0.37]	[0.42]	
Oregon State GPA	3.05	3.05	3.07	3.10	3.05	0.52
	[0.56]	[0.56]	[0.56]	[0.52]	[0.58]	
expected grade: A	0.48	0.49	0.48	0.54	0.52	0.22
	[0.50]	[0.50]	[0.50]	[0.50]	[0.50]	
expected grade: B	0.46	0.45	0.47	0.41	0.42	0.22
	[0.50]	[0.50]	[0.50]	[0.49]	[0.49]	
intends to major in Economics	0.03	0.02	0.03	0.04	0.05	0.18
	[0.17]	[0.14]	[0.18]	[0.19]	[0.21]	
intends to minor in Economics	0.05	0.03	0.04	0.06	0.03	0.28
	[0.22]	[0.18]	[0.20]	[0.24]	[0.18]	
likelihood of majoring in Economics (0-100)	17.45	17.25	19.16	20.12	18.07	0.38
	[24.40]	[24.34]	[26.13]	[26.09]	[25.27]	
likelihood of minoring in Economics (0-100)	26.23	25.68	27.18	27.37	26.22	0.87
	[26.91]	[27.18]	[27.11]	[28.03]	[25.85]	
completed endline survey	0.87	0.85	0.86	0.89	0.87	0.51
	[0.34]	[0.36]	[0.35]	[0.31]	[0.34]	
N	456	455	455	460	451	2,277

Table shows mean of baseline characteristics, by study arm. Standard deviations in brackets. Column (6) report p-values of joint test of treatment dummies on baseline characteristic, controlling for strata dummies.

Table A2: Take-up and knowledge

	not 1st generation or URM						1st generation or URM					
	control	placebo email	earnings information	AEA video	OSU video	F-test (p-value)	control	placebo email	earnings information	AEA video	OSU video	F-test (p-value)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
opened encouragement email	0.00	0.65	0.73	0.69	0.65	0.00	0.00	0.63	0.63	0.62	0.74	0.00
	[0.00]	[0.48]	[0.45]	[0.46]	[0.48]		[0.00]	[0.49]	[0.49]	[0.49]	[0.44]	
clicked link in email	0.00	0.00	0.02	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.92
	[0.00]	[0.00]	[0.14]	[0.00]	[0.10]		[0.00]	[0.12]	[0.00]	[0.00]	[0.00]	
made appointment with Economics advisor	0.00	0.01	0.01	0.01	0.01	0.27	0.00	0.03	0.00	0.00	0.00	0.76
	[0.05]	[0.09]	[0.11]	[0.11]	[0.10]		[0.00]	[0.17]	[0.00]	[0.00]	[0.00]	
viewed AEA video (self-report)	0.16	0.19	0.20	0.23	0.22	0.10	0.16	0.20	0.26	0.23	0.24	0.75
	[0.37]	[0.39]	[0.40]	[0.42]	[0.42]		[0.37]	[0.40]	[0.44]	[0.42]	[0.43]	
viewed OSU video (self-report)	0.16	0.19	0.21	0.24	0.21	0.22	0.18	0.23	0.28	0.21	0.26	0.87
	[0.37]	[0.39]	[0.41]	[0.43]	[0.40]		[0.39]	[0.43]	[0.45]	[0.41]	[0.44]	
1st year salary range correct	0.22	0.21	0.20	0.24	0.27	0.17	0.28	0.23	0.28	0.29	0.29	0.92
	[0.41]	[0.41]	[0.40]	[0.43]	[0.44]		[0.45]	[0.43]	[0.45]	[0.46]	[0.46]	
15th year salary range correct	0.17	0.25	0.21	0.22	0.19	0.14	0.19	0.13	0.21	0.24	0.29	0.35
	[0.37]	[0.43]	[0.41]	[0.42]	[0.39]		[0.40]	[0.34]	[0.41]	[0.43]	[0.46]	
N	372	385	389	384	378		84	70	71	71	73	

Table shows mean of listed characteristic in each treatment arm (standard deviations in brackets). Sample is all students who participated in study. Underrepresented minority is defined as American Indian or Alaska Native, Balck or African American, Hispanic, or Native Hawaiian or Pacific Islander. URM status does not include multiracial or international students. Columns (6) & (12) report p-value of F-test of joint hypothesis that all treatment arms predict characteristic. p-values adjust for stratification of treatment

Table A3: Major in Economics, intensity of treatment

Outcome	Major in Economics: Intensity of treatment regressions											
Group	First generation or URM				First generation				URM			
Sample	all		B- or above		all		B- or above		all		B- or above	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
total basic information	0.006		0.020		0.010		0.027		0.012		0.033*	
	(0.008)		(0.017)		(0.008)		(0.018)		(0.008)		(0.017)	
total earnings information	0.006		0.001		0.006		0.002		0.008		0.004	
	(0.009)		(0.015)		(0.008)		(0.014)		(0.008)		(0.014)	
total AEA video	0.005		0.014		0.005		0.014		0.007		0.018	
	(0.008)		(0.017)		(0.007)		(0.016)		(0.007)		(0.016)	
total OSU video	-0.004		-0.004		-0.005		-0.004		0.000		0.004	
	(0.007)		(0.014)		(0.007)		(0.013)		(0.007)		(0.014)	
total basic info*group	0.058		0.142*		0.058		0.161		0.032		0.058	
	(0.036)		(0.082)		(0.041)		(0.104)		(0.050)		(0.122)	
total earnings*group	0.002		0.022		0.001		0.005		-0.008		0.001	
	(0.014)		(0.031)		(0.014)		(0.031)		(0.014)		(0.042)	
total AEA video*group	0.021		0.047		0.038		0.090		0.012		0.030	
	(0.019)		(0.054)		(0.028)		(0.078)		(0.020)		(0.067)	
total OSU video*group	0.017		0.041		0.031		0.057		-0.016		-0.041	
	(0.022)		(0.051)		(0.026)		(0.057)		(0.024)		(0.069)	
group	-0.028*	-0.025	-0.067*	-0.056	-0.026	-0.020	-0.049	-0.026	-0.012	-0.010	-0.030	-0.024
	(0.016)	(0.015)	(0.039)	(0.039)	(0.020)	(0.019)	(0.047)	(0.047)	(0.015)	(0.013)	(0.047)	(0.039)
total treatments		0.004		0.008		0.005		0.010		0.007		0.014
		(0.005)		(0.010)		(0.005)		(0.010)		(0.005)		(0.010)
total treatments*group		0.020		0.048		0.022		0.041		0.004		0.009
		(0.015)		(0.038)		(0.018)		(0.041)		(0.015)		(0.042)
N	1,883	1,883	864	864	1,883	1,883	864	864	1,883	1,883	864	864
Control mean	0.027	0.027	0.042	0.042	0.027	0.027	0.042	0.042	0.027	0.027	0.042	0.042
all interactions=0	0.48	0.19	0.52	0.21	0.45	0.22	0.49	0.32	0.68	0.81	0.86	0.84

Sample is all students who consented to participate in study. Outcome is dummy for majoring in Economics, from administrative data in Winter 2020 or most recent available. Specifications for "intensity of treatment remove duplicate observations of student and keep only last term observed. Explanatory variables in intensity of treatment specifications represent number of times exposed to treatment. All regressions include strata dummies, baseline outcome, and controls having taken a previous economics course. Robust standard errors in parenthesis.

Table A4: Major in Economics, with controls for baseline imbalances

Outcome	Major in Economics											
Group	First generation or URM				First generation				URM			
Sample	all		B- or above		all		B- or above		all		B- or above	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
basic information	0.006		0.020		0.012		0.030*		0.016*		0.039**	
	(0.009)		(0.016)		(0.009)		(0.017)		(0.009)		(0.018)	
earnings information	0.011		0.025		0.012		0.028		0.015		0.034*	
	(0.010)		(0.020)		(0.010)		(0.019)		(0.010)		(0.019)	
AEA video	0.003		0.010		0.004		0.013		0.008		0.021	
	(0.008)		(0.016)		(0.008)		(0.017)		(0.008)		(0.017)	
OSU video	-0.003		-0.004		-0.003		-0.003		0.005		0.010	
	(0.008)		(0.014)		(0.008)		(0.015)		(0.008)		(0.015)	
basic info*group	0.087**		0.214**		0.080*		0.187		0.046		0.106	
	(0.034)		(0.085)		(0.045)		(0.114)		(0.037)		(0.103)	
earnings*group	0.026		0.082		0.021		0.054		0.004		0.032	
	(0.021)		(0.059)		(0.021)		(0.059)		(0.023)		(0.081)	
AEA video*group	0.052**		0.144*		0.061*		0.157		0.033		0.112	
	(0.026)		(0.075)		(0.034)		(0.096)		(0.031)		(0.114)	
OSU video*group	0.042		0.118		0.057**		0.137*		-0.006		-0.013	
	(0.027)		(0.072)		(0.029)		(0.077)		(0.032)		(0.117)	
group	-0.060***	-0.056**	-0.169**	-0.156**	-0.039*	-0.008	-0.083	-0.013	-0.027	-0.026	-0.082	-0.079
	(0.023)	(0.023)	(0.066)	(0.066)	(0.021)	(0.006)	(0.057)	(0.012)	(0.022)	(0.022)	(0.080)	(0.080)
treatment		0.004		0.013		0.006		0.017		0.011		0.026**
		(0.007)		(0.012)		(0.007)		(0.012)		(0.007)		(0.012)
treatment*group		0.051**		0.135**		0.053**		0.127*		0.020		0.066
		(0.021)		(0.060)		(0.024)		(0.065)		(0.024)		(0.085)
N	2,238	2,238	1,003	1,003	2,238	2,238	1,003	1,003	2,238	2,238	1,003	1,003
Control mean	0.0225	0.0225	0.0365	0.0365	0.0225	0.0225	0.0365	0.0365	0.0225	0.0225	0.0365	0.0365
all interactions=0	0.0717	0.0174	0.104	0.0254	0.102	0.0285	0.151	0.0507	0.506	0.408	0.622	0.439

Sample is all students who consented to participate in study. Outcome is dummy for majoring in Economics, from administrative data in Winter 2020 or most recent available. All regressions include strata dummies, baseline outcome, and controls for variables imbalanced at baseline (first generation student dummy and female dummy). Robust standard errors in parenthesis.

Table A5: Minor in Economics

Outcome	Minor in Economics											
Group	First generation or URM				First generation				URM			
Sample	all		B- or above		all		B- or above		all		B- or above	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
basic information	-0.001		0.001		0.001		0.007		0.001		-0.000	
	(0.012)		(0.019)		(0.012)		(0.019)		(0.012)		(0.018)	
earnings information	0.023		0.031		0.021		0.029		0.023*		0.030	
	(0.015)		(0.020)		(0.014)		(0.020)		(0.014)		(0.019)	
AEA video	0.002		-0.009		0.004		-0.005		0.001		-0.009	
	(0.013)		(0.017)		(0.012)		(0.017)		(0.012)		(0.016)	
OSU video	-0.006		-0.012		-0.006		-0.012		-0.002		-0.004	
	(0.011)		(0.014)		(0.011)		(0.014)		(0.011)		(0.015)	
basic info*group	0.016		0.031		0.004		-0.030		0.002		0.069	
	(0.031)		(0.044)		(0.045)		(0.045)		(0.038)		(0.056)	
earnings*group	-0.030		-0.026		-0.029		-0.023		-0.041		-0.017	
	(0.022)		(0.022)		(0.026)		(0.024)		(0.030)		(0.023)	
AEA video*group	-0.013		0.041		-0.034		0.009		-0.007		0.076	
	(0.024)		(0.031)		(0.026)		(0.020)		(0.033)		(0.052)	
OSU video*group	0.016		0.070		0.020		0.097		-0.024		0.006	
	(0.027)		(0.045)		(0.034)		(0.060)		(0.029)		(0.026)	
group	0.000	0.001	-0.012	-0.011	0.004	0.004	-0.013	-0.012	0.013	0.013	-0.018	-0.016
	(0.017)	(0.017)	(0.013)	(0.013)	(0.022)	(0.021)	(0.014)	(0.014)	(0.028)	(0.028)	(0.019)	(0.019)
treatment		0.005		0.004		0.005		0.006		0.006		0.005
		(0.010)		(0.013)		(0.010)		(0.013)		(0.009)		(0.013)
treatment*group		-0.003		0.028		-0.010		0.018		-0.017		0.035
		(0.020)		(0.021)		(0.025)		(0.025)		(0.029)		(0.028)
N	1,976	1,976	953	953	1,976	1,976	953	953	1,976	1,976	953	953
Control mean	0.0328	0.0328	0.0270	0.0270	0.0328	0.0328	0.0270	0.0270	0.0328	0.0328	0.0270	0.0270
all interactions=0	0.248	0.872	0.157	0.199	0.312	0.695	0.301	0.484	0.324	0.569	0.252	0.213

Table reports coefficients of regressions of self-reported intention to minor from endline survey in Economics on treatment status. Sample is all students who consented to participate in study. All regressions include strata dummies and baseline outcome. Robust standard errors in parenthesis. * significant at 10%, ** significant at 5%, *** significant at 1%

Table A6: Perceptions of Economics: group = first-generation or URM

	Biggest appeal of Economics major						Biggest drawback of Economics major					
	fun to study		future income		rewarding career		focused on money		boring		lack of diversity	
basic information	-0.009		0.001		-0.023		-0.011		0.013		-0.017	
	(0.026)		(0.036)		(0.029)		(0.018)		(0.031)		(0.015)	
earnings information	-0.006		0.025		-0.003		-0.024		0.018		-0.001	
	(0.025)		(0.036)		(0.029)		(0.017)		(0.032)		(0.016)	
AEA video	-0.025		0.054		-0.043		-0.016		0.050		-0.002	
	(0.025)		(0.037)		(0.029)		(0.017)		(0.032)		(0.016)	
OSU video	-0.019		0.027		-0.002		0.027		0.068**		-0.026*	
	(0.025)		(0.036)		(0.030)		(0.020)		(0.031)		(0.014)	
basic info*group	-0.017		0.127		-0.031		-0.015		-0.068		-0.003	
	(0.059)		(0.084)		(0.070)		(0.041)		(0.080)		(0.045)	
earnings*group	0.052		0.052		-0.019		0.018		-0.062		0.018	
	(0.062)		(0.084)		(0.073)		(0.045)		(0.079)		(0.050)	
AEA video*group	-0.005		0.002		0.009		0.000		0.080		-0.072*	
	(0.060)		(0.085)		(0.071)		(0.042)		(0.084)		(0.039)	
OSU video*group	0.038		-0.043		0.036		-0.002		-0.053		0.020	
	(0.058)		(0.082)		(0.073)		(0.050)		(0.076)		(0.047)	
group	-0.023	-0.023	-0.077	-0.078	0.028	0.028	0.004	0.004	0.038	0.037	0.025	0.025
	(0.038)	(0.038)	(0.055)	(0.055)	(0.050)	(0.049)	(0.030)	(0.030)	(0.054)	(0.054)	(0.031)	(0.031)
treatment		-0.015		0.027		-0.018		-0.006		0.037		-0.011
		(0.020)		(0.029)		(0.024)		(0.014)		(0.025)		(0.012)
treatment*group		0.017		0.034		-0.001		0.001		-0.024		-0.009
		(0.045)		(0.064)		(0.056)		(0.034)		(0.062)		(0.036)
N	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976	1,976
control mean	0.159	0.159	0.361	0.361	0.189	0.189	0.0606	0.0606	0.232	0.232	0.0530	0.0530
all interactions == 0	0.796	0.704	0.356	0.591	0.909	0.980	0.965	0.980	0.398	0.696	0.0688	0.792

Table reports coefficients of regressions of indicated outcome on treatment status. Outcomes are responses to endline survey questions on biggest appeal/drawback of Economics major. Sample is all study participants who completed endline survey. All regressions include strata dummies and baseline outcome. Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%./

3 Phase Two Intervention: Description and Results

In Phase Two, students who participated in Phase One and earned a grade of at least B- or above were enrolled in the study. We randomly assigned these students to receive one of two emails:

1. *Control*: message of congratulations on their course performance, with encouragement to major in Economics.
2. *Treatment*: control message content, plus "resilience" message acknowledging that Economics can be difficult and encouraging adoption of a growth mindset.

Phase Two messages were sent once, at the beginning of the academic term following the Phase One course, from the email account of the Economics Academic Advisor. Both messages had the subject, "ECON invite." Figure A2 shows each message. Treatment assignment stratified by course section, class year (freshman/sophomore/other), and course grade.

Figure A2(a): Phase Two: control

ECON invite

Laura Relyea <laura.relyea@oregonstate.edu>
Tue 1/8/2019 12:01 PM
To: Schroeder, Elizabeth <Liz.Schroeder@oregonstate.edu>

Having trouble reading this? To view this email as a web page, click here.

Hi Liz,

Your principles of economics instructor indicated that you performed well in a recent class-congratulations! As a result, the economics faculty would like to encourage you to major in Economics.

We have four choices for you: the regular economics major, and options in managerial economics, mathematical economics, and law, economics and policy. We also offer an economics minor to complement your current major.

Why Economics?

- A Career in Economics...it's much more than you think.
- Look at what economists do.
- OSU economics graduates go on to:
  - public sector: federal, state, and local government
  - private sector: banking, consulting, retail, and corporate sectors.
  - advanced study: economics, public policy, law, and business.
- Career earnings - what economists can expect to earn in different fields

Please make an appointment with me if you would like to learn more about our program. To set up a conversation, click here or on the yellow "schedule your appointment" post-it-note below. I look forward to sharing the opportunities in economics with you!

Best,
Laura

Laura Relyea, Academic Advisor
School of Public Policy | Economics Program
Oregon State University | Bexell Hall, 418E
Laura.Relyea@oregonstate.edu
P: (541) 737-2369 | **F:** (541) 737-2289
http://liberalarts.oregonstate.edu/spp/econ/

Students please include your name and OSU ID# on all inquiries.

You may update your profile here.
This email was sent by: Oregon State University, Printing & Mailing Services,4700 SW Research Way, Corvallis, OR 97333

Figure A2(b): Phase Two: treatment

ECON invite

Laura Relyea <laura.relyea@oregonstate.edu>
Tue 1/8/2019 12:00 PM
To: Schroeder, Elizabeth Liz.Schroeder@oregonstate.edu

Having trouble reading this? To view this email as a web page, click here.

Hi Liz,

Your principles of economics instructor indicated that you performed well in a recent class-congratulations! As a result, the economics faculty would like to encourage you to major in Economics.

Even if your grade was not as high as you had hoped, we encourage you to take additional Economics courses. Economics can be a challenging subject. Your Economics ability can grow with dedication and hard work. Adopting this "growth mindset" can help you continue to improve and succeed as you take more advanced courses.

We have four choices for you: the regular economics major, and options in managerial economics, mathematical economics, and law, economics and policy. We also offer an economics minor to complement your current major.

Why Economics?

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Best,
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Laura Relyea, Academic Advisor
School of Public Policy | Economics Program
Oregon State University | Bexell Hall, 418E
Laura.Relyea@oregonstate.edu
P: (541) 737-2369 | **F:** (541) 737-2289
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Students please include your name and OSU ID# on all inquiries.

Table A7: Phase Two

	Outcome: major in Economics			
sample	all	A students	B students	disappointed
	(1)	(2)	(3)	(4)
first generation or URM	-0.009	-0.010	-0.035	-0.021
	(0.032)	(0.052)	(0.027)	(0.029)
Phase Two treatment	0.000	-0.015	0.005	0.005
	(0.012)	(0.022)	(0.012)	(0.017)
Phase Two treatment * first generation/URM	0.003	0.024	0.030	-0.032
	(0.053)	(0.123)	(0.046)	(0.047)
N	974	368	600	354
control mean	0.06	0.10	0.03	0.04

Sample is students receiving B- or above in Economics Principles. Outcome is majoring in Economics from administrative data. Sample in column (2) is students receiving at least A- in Economics Principles. Sample in column (3) is students receiving B+, B, or B- in Economics Principles. Sample in Panel D is "disappointed" students, defined as students who expected an A grade in course but received a B+ or below. All regressions control for Phae One treatment. Robust standard errors in parenthesis. * significant at 10%, ** significant at 5%, *** significant at 1%