

# An experiment to include gender-related material in introductory microeconomics

Rachel Heath, Yael Jacobs and Melissa Knox

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## 1 Introduction

Under-represented students' sense of relevance and belonging has emerged as an important component of those students' representation in Economics and other STEM fields (Bayer et al., 2020*b*; Master, Cheryan and Meltzoff, 2016). Retaining women students who express interest in introductory economics classes is an important first step in fixing the "leaky pipeline" of women out of economics at every stage, from introductory economics to full professor (CSWEP, 2018). The economics department at the University of Washington has accordingly been concerned about its ability to attract and retain women majors. While UW has historically achieved considerably better gender diversity than the national rate of less than one-third women majors (Buckles, 2019), it is cognizant that the fraction of its majors who are women has fallen from 53% in 2013 to 46% currently, even as the proportion of women in the College of Arts and Sciences and other "STEM" majors at UW has risen during this period.

We propose a randomized control trial that assesses whether including gender material in introductory economics classes increases students' sense of belonging, test grades, and continuation in further economics classes, as well as related fields such as mathematics. This intervention is distinct from interventions that have provided information on future earnings (Li, 2018) or role models (Porter and Serra, 2020) to introductory economics students. Instead, we seek to determine whether the content of introductory economics – in particular, whether it is applied to gender issues – can itself improve the performance and retention of women students. Recent work on changing introductory coursework to close the gender achievement gap in STEM education has focused on increasing student interaction and engagement through "active learning" in the classroom (Lorenzo, Crouch and Mazur, 2006; Theobald et al., 2020). By contrast, we seek to change not only how material is taught, but what material is taught, focusing on material that is particularly relevant to women students. Our study thus builds on recent work that finds that redesigning introductory economics to present the topic through the lens of "social problems" increases student diversity in introductory courses, at least partially through increasing students' personal connection to the material (Bayer et al., 2020*a*).

There are several reasons to believe that exposure to economic models and their application to real-world issues relating to women in the labor market, including the gender wage gap, labor market discrimination, and motherhood wage penalties will improve women students' sense that the study of economics is relevant to their academic and career goals and their sense of belonging in the field. A lesson students learn from the study of labor market discrimination is that understanding the causes of discrimination suggests strategies to counteract it. For instance, exposure to empirical evidence suggesting that pay transparency can reduce gender wage gaps (as found by

Baker et al. (2019)) can prompt women students to seek out information on comparison strategies during their own job search or negotiation, as students who took PI Heath’s economics of gender class reported to her. Indeed, students in PI Heath’s economics of gender class frequently mention that they never expected the material to be so relevant to their daily lives. More broadly, the presentation of gender-related material signals that economics cares about and welcomes women and in general, cares about equity and disadvantaged populations. Our module thus stands in contrast to the stereotypical economics curriculum, which primarily focuses on male economists and male decision-makers (Stevenson and Zlotnik, 2018), and is primarily focused on aggregate efficiency and topics that are not directly relevant to students’ future decision-making (Bowles and Carlin, 2020).

## 2 Intervention design

### 2.1 Setting

The University of Washington Seattle Campus (UW) is a public university that enrolls approximately 33,000 undergraduate students, 55% of whom are women. The Department of Economics is located in the College of Arts and Sciences and had approximately 600 undergraduate majors in the Fall of 2022. Women are 46% of undergraduate majors, an outlier compared to the average economics undergraduate program, but not representative of the gender balance in the university, nor in the College of Arts and Sciences (63%) or among “STEM” majors (51%). Additionally, the representation of women has been declining, falling from 56% in 2013, even as the proportion of women in these other categories has risen.

The department offers Introduction to Microeconomics (Econ 200) as the first course for prospective economics majors. The course is also required for prospective students in the UW Foster School of Business, as well as fulfilling College of Arts and Sciences core curriculum requirements. Between these groups, approximately 2,200 students take Econ 200 every year. Of those, approximately 1,600 students take the course in the large lecture format from one of two faculty instructors.

Intervention at the level of Econ 200 is appropriate for addressing gender gaps for a number of reasons. First, both faculty instructors of Econ 200 are women, reducing any potential effect of instructor gender on outcomes. Second, both instructors use the same textbook and assign the same readings and problem sets to students. Third, Econ 200 reaches a large proportion of entering students (about 30% of students entering the UW eventually enroll in Econ 200, over 50% of these are women), making it the most appropriate place to change student perceptions of the field. Finally, over 80% of Econ 200 students are in their first or second year, giving the experiment ample time to affect students’ subsequent course selection and academic outcomes in economics and math if it is successful.

After Econ 200, approximately 40% of students go on to take Introduction to Macroeconomics (Econ 201). The next course in the sequence for Economics majors is Intermediate Microeconomics (Econ 300). Only 6% of Econ 200 students enroll in Econ 300, and half of those who take Econ 300 apply to the major. As students progress from Econ 200 to 201 to 300, the proportion who are women declines, so that only 44% of Econ 300 students and 47% of department applicants are women. Additionally, the statistic that 46% of Economics majors are women hides significant heterogeneity. Over half of Economics majors are international students and women make up about 60% of this group. Consequently, the proportion of non-international Economics majors

who are women is around 30%, close to the national average in Economics departments. This disparity in interest in the major between international and non-international women suggests that U.S. cultural perceptions of Economics as a field may be partially responsible for enrollment gaps in U.S. universities with fewer international students. For example, one study finds that U.S. college students perceive that Economics is more biased against women than other fields (Ganley et al., 2018). These considerations support our hypothesis that changing students' perceptions of Economics, especially its relevance to their lives and the extent to which they belong in the field, will improve women's representation in economics and related fields, such as mathematics.

## 2.2 Intervention

We conduct a randomized control trial in which the sample is students taking Econ 200 in a large lecture class format<sup>1</sup>. We will begin fall 2023 and continue throughout the academic year 2023-2024 and possibly longer. Students will be assigned to treatment (gender economics curriculum) or control (labor economics curriculum), which consists of two lectures lasting approximately as long as a regular class session (1 hour and 20 minutes). The gender curricula was developed by PI Heath, whose research focuses on gender and labor markets in low-income countries, and who teaches a gender in economics undergraduate course. The material in that course can frequently be explained using simple tools developed in introductory microeconomics, and the gender in economics module in particular focuses on:

- introduce models of labor market discrimination, explain statistical versus taste-based discrimination, and explore empirical evidence on policies designed to close gender wage gaps (pay transparency, flexibility in wage setting). (Lecture 1)
- introduce models of family economics and the economics of fertility, including the impacts of access to contraception (Lecture 2)

We randomly saturate TA sections, treating 25%, 50%, and 75% of students. Following Banerjee et al. (2020), we conduct 10 randomizations and choose the randomization that contains the fewest differences between treatment and control among the following variables: student gender,<sup>2</sup> status as an underrepresented minority, first generation, and location of origin (US/international).

Students were told that we are testing out modules for future Econ 200 classes and that one week's worth of in-class lectures will be replaced with recorded lectures on various special topics. The instructors explain that the material will appear on the final exam in the same way that other course material does; there will be separate test questions for each module.<sup>3</sup>

We plan for the treatment to run throughout the academic year 2023-2024, and possibly longer.

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<sup>1</sup>The minority of Econ 200 students – 29% in calendar year 2021 – who take the class in smaller sections with graduate student instructors will not be included in the experiment because of the increased possibility for spillovers in smaller classes and the administrative difficulty of coordinating with multiple instructors per quarter.

<sup>2</sup>We group students who identify as nonbinary with students who identify as women

<sup>3</sup>Because it is not administratively feasible to give students the version of the exam that corresponds to their treatment assignment, we give modules innocuous names like Module A and Module B and instruct students to answer the question assigned to their module.

## 3 Empirical strategy, mechanisms, and outcomes of interest

### 3.1 Outcomes

Our primary outcomes track students’ perception of belonging, learning in the course, and continuation of coursework in economics and mathematics:

- A survey-based measure of “relevance, belonging, and growth mindset”, similar to Bayer et al. (2020b). We calculate an “RBG index” that averages together fifteen questions intended to measure a student’s sense of relevance, belonging, and growth. The index is defined to be the equally weighted average of z-scores of its components. Each question’s z-score is calculated by subtracting that question’s mean from the student’s response and dividing by that question’s standard deviation. See appendix table A1 for a list of all fifteen questions.
- Final exam score, exclusive of questions on the supplementary material.
- Enrollment in intermediate microeconomics (Econ 300), which serves as a gateway to the economics major.

Our secondary outcomes are:

- Enrollment in introductory macroeconomics (Econ 201)
- Application to the economics major
- Acceptance to the economics major
- Successful completion of graduation requirements (within 4 and 5 years).
- Enrollment in math courses that serve as gateway courses to the major (Math 300 or Applied Math 301).
- Application to the math major
- Acceptance to the math major

Because several of these outcomes take years after the experiment to develop (given that approximately 70% of surveyed students in fall 2023 are first-years), we may reserve some of these for follow-up research.

### 3.2 Estimation strategy and heterogeneity

Our estimation strategy regresses these outcomes on assignment to treatment, our baseline measure of the outcome, as available<sup>4</sup> as well as quarter  $\times$  instructor dummies and any covariates unbalanced at baseline:

$$Y_i = \beta Treatment_i + X_i' \delta + \varepsilon_i$$

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<sup>4</sup>Namely, midterm score as a control for final exam score; RBG score for those who completed the baseline survey and a dummy for missing baseline data.

While our motivation focuses on outcomes for women students, we believe that there is the potential that men students also respond to the treatment. For instance, they may also care about whether economics cares about social inequities. We will accordingly begin our analysis with a specification that pools both genders, but then proceed to examine heterogeneous treatment effects based on gender, as well as students' location of origin (US vs International), status as an under-represented minority (URM), and status as a first generation student. We will also examine heterogeneity by midterm exam score. Because we don't have a strong prior on the nature of the relationship between midterm score and treatment, we will examine various functional forms (linear, terciles, etc.).

We will utilize the whole sample for administrative outcomes (with IRB permission to do so), but will assess robustness to a specification that only includes those who filled out the endline survey, for whom we have RBG measures.

### 3.3 Channels

We envision several channels through which our treatment affects these outcome variables. One channel is by illustrating to students that economics cares about gender disparities, which are of particular interest to women students. For instance, in PI Heath's Economics of Gender class over the past two academic years, enrollment has been 96% women (66 of 70 students). Relatedly, we also expect that the gender in economics material signals that economics can be applied to other outcomes like racial disparities and economic inequality that are not always apparent in introductory classes. Given evidence from laboratory settings that women display more prosocial behavior (Eckel and Grossman, 2008), we expect that women will be particularly interested in these outcomes as well.

Another channel is that teaching gender and economics material can signal to students the field is not entirely the domain of men. This is particularly relevant, because economists cited in media are disproportionately male (Diamond, 2015) and introductory textbooks disproportionately use men in their examples (Stevenson and Zlotnik, 2018). Illustrating this channel, girls in high school showed a 28% increase in interest in computer science classes if the classroom had neutral decorations compared to stereotypical decorations such as Star Wars posters (Master, Cheryan and Meltzoff, 2016).

Through both of these channels, we expect that students, especially women students, will feel a greater sense of belonging and thus be more likely to continue studying economics if they receive the gender module. We also believe that these effects will improve test scores. One mechanism is by decreasing "stereotype threat", which is the phenomenon through which minorities who are reminded of negative stereotypes about their aptitude in a subject perform worse in that subject (Inzlicht and Ben-Zeev, 2000; Hoff and Pandey, 2014). Students may also spend more time studying the material if they find it more interesting and relevant to their lives.<sup>5</sup>

We also believe that it is plausible that our outcomes affect students' enrollment in mathematics classes. Approximately 30% of Economics majors choose to double major in either Math or Applied Math, and so we anticipate that stimulating interest in economics will also prompt students to enroll in courses to learn the mathematical tools useful to study economics. Moreover, we also anticipate that promoting a sense of belonging within economics will carry over towards other quantitative fields such as mathematics.

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<sup>5</sup>Because our test score outcome doesn't consider questions about the gender material, this channel would be driven by students' perception of the relevance of economics material overall.

### 3.4 Power calculations

Based on enrolment during the 2022-2023 school year, we predict there will be 1537 students in the large sections of Econ 200 in during the 2023-2024 school year; based on the response rates in the baseline, we conservatively assume 74% participation in the endline survey.<sup>6</sup> We assume, based on past rates, that 6% of students in econ 200 ultimately take Econ 300. We then have power to detect, assuming half the students are assigned to treatment, a  $\beta$  (power) of 0.8,  $\alpha$  (type I error) of 0.05 with a conservative Bonferroni correction for multiple testing with three outcomes:

Outcome	Minimum Detectable Effect (MDE)
Index of relevance, belonging, and growth mindset (sd's)	0.192
Test scores (sd's)	0.165
Take Econ 300	0.045

Note that these results are also conservative because they don't reflect the fact that we include baseline predictors.<sup>7</sup>

### 3.5 Ethical considerations

The experiment was approved by the Institutional Review Board at the University of Washington, including the fact that we did not inform students that the surveys they were taking related to the material they were involved in testing in the video lectures and our use of administrative outcomes even if students did not fill out the informed consent in the survey.

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<sup>6</sup>We anticipate that response rates will be higher at endline, because students will be particularly responsive to extra credit opportunities after seeing midterm grades. Further, we can include administrative outcomes for students who consent at either time period.

<sup>7</sup>E.g. in fall 2021, there was a 0.73 correlation between midterm 1 and midterm 2 grades in Econ 200.

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## 4 Appendix

### 4.1 RBG Questions

Table A1: Measures of Relevance, Belonging, and Growth<sup>1</sup>

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*Relevance*

The textbook used examples that were relatable to my life.

The professor used examples that were relatable to my life.

We discussed important real-world issues in class.

The class gave me a useful framework for thinking about important issues.

We overlooked important aspects of the issues we studied.<sup>2</sup>

*Belonging*

My ECON 200 class was collegial.

I felt that the students in ECON 200 supported one another.

I felt the professor cared about whether I was learning the material.

I felt comfortable asking questions in class.

I felt comfortable asking questions at TA office hours and in quiz sections.

The economics department values UW students.

People like me can become economists.

I feel different from the typical economics student.<sup>2</sup>

*Growth*

I felt the professor believed I could learn the material.

While taking the course, I believed I could learn the material.

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<sup>1</sup> All questions are asked on a five-point scale from “strongly disagree” to “strongly agree”.

<sup>2</sup> The sign of negatively-worded questions is reversed when constructing the RBG index so that more beneficial outcomes have higher scores.