Maybe the Issue is not Who Economists Are, but What Economics Is and How it's Taught: Changing Course Content and Structure to Improve Retention of Women in Undergraduate Economics*

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Abstract

Economics continues to struggle with gender representation throughout the education pipeline. One reason that has been highlighted for this problem is the presentation of economics in introductory courses. In contrast to prior interventions that were primarily messaging-centered around "who" economists are (e.g., nudging messages, instructor gender), we tested changing the content of the introductory courses' recitation sections, or "what" economics is, by implementing meaningful applied problems and structured groupwork to change perceptions about the nature of economics. Using institutional data of 8,727 students we find that, compared to historical baselines, the intervention improved grades overall, eliminated underperformance by women in grades (particularly in Macro), and greatly reduced the gap by gender in likelihood of continuing on to Intermediate economics. These effects are evidence that the content of introductory economics courses, not just the messaging around the gender of economists.

JEL Codes: A22, I21, I29, J16
Keywords: Economics Instruction, Undergraduate Education, Gender, Inclusion, Pipeline

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1 Introduction

Economics suffers from a "leaky pipeline" gender problem – along the academic pathway from introductory courses to full professorships, the proportion of women at each step decreases (Avilova and Goldin, 2018; Buckles, 2019).[1] Beginning in high school, 55% of all Advanced Placement (AP) tests are taken by women, but only 45% of all AP Micro test takers and 42% of all AP Macro test takers are women (College Board, 2020). Similarly, although women have consistently made up about 56% of US undergraduates from the 1990s to 2019 (US Department of Education, 2020), only about 42% of US students in introductory economics courses were women (Avilova and Goldin, 2018). Subsequently, only 31% of undergraduate economics degrees were granted to women and this proportion has declined from the 1990s to more recent years (Avilova and Goldin, 2018; Bayer and Wilcox, 2019).[2] Furthermore, 44% of incoming Masters students and 34% of incoming PhD students in Economics are women, and only 35% of economics PhDs are granted to women (Siegfried, 2010, 2020). In faculty careers, the pipeline continues to leak: 30% of assistant professors in economics are women, 26% of tenured faculty are women, and only 15% of full professors are women (Lundberg, 2017).

Many resources and much research have gone into understanding the causes and devising solutions to this gender pipeline problem. Allgood et al. (2015) found that the gender of instructors, mathematics aptitude, and prior math courses do not influence the gender gap in choosing to major in economics. In 2015, the Undergraduate Women in Economics Challenge (UWE), provided funds for a randomized control trial of interventions to improve the gender gap in economics in undergraduate institutions in the US, including disseminating information about the major and related career fields, providing female role models and mentoring, and explicitly encouraging women to major in economics (Avilova and Goldin, 2018). However, the results of such interventions are mixed: Li (2018) found that information about academic and professional career

[1] The economics profession also has large racial gaps in terms of outcomes and progression. While we can identify those gaps in our pre-intervention sample and we find evidence to support the closing of some of those gaps due to our intervention, the population of the University of Pittsburgh is such that we do not have a large enough sample of underrepresented minority students to have the power to detect such changes. While it was a goal of this project to also consider racial gaps in economics education outcomes, the structural pedagogical changes due to the Covid-19 pandemic and its associated shift to remote instruction has effectively cut off the clean post-intervention sample and has made it impossible to do that additional analysis in the future.

[2] At our own institution, while 55% of undergraduate students are women, just 41% of students in the introductory economics courses are women, and only 28% of undergraduate economics degrees are granted to women.

paths, along with information about relative academic standing and a "nudge" from a professor or advisor to encourage women to continue in economics increased the number of women who chose to take economics classes beyond the introductory courses, while Pugatch and Schroeder (2021) found that such nudges had no effect on women while increasing the likelihood that men would continue in economics and Porter and Serra (2020) found that a short exposure to female alumnae role models in the introductory classes increased the likelihood that women would major in economics while men's likelihood was not affected.[3] Most of these interventions might best be considered small non-pedagogical changes focused on encouraging women specifically to continue study in economics and choose economics-related careers.[4]

None of these interventions, however, actually address the longstanding critiques of how what is presented in undergraduate economics classes could dissuade participation by women, such as biased and narrow content matter (Ferber, 1995) that influences perceptions of relevance (Jensen and Owen, 2001) or non-inclusive teaching techniques that diminish a sense of self efficacy in students who are women (Jensen and Owen, 2001).[5] In essence, while many of these interventions have focused on changing how people view practitioners in that field of study (i.e. showing that economists are women), they have not focused on changing the course content and pedagogy to be more appealing to a broader range of students (i.e. showing that the topics encompassed by economics are of interest to women and that the classroom experience welcomes and includes them).

In this paper, we provide evidence that changing course content and presentation to be more focused on real-world applications and interactive learning decreases gender gaps in progression to subsequent economics courses thus plugging the leak in the pipeline between the introductory

[3]We do consider the impact of instructor gender and TA gender on gaps in male and female outcomes but do not find any compelling evidence that instructor or TA gender matters. However, this may be due to the demographics of the instructors for the introductory microeconomics and macroeconomics courses, with most of the introductory microeconomics instructors being female and almost all of the introductory macroeconomics instructors being male. Results available upon request.

[4]In STEM disciplines with similar or worse gender gaps, such as physics, computer science, and many areas of engineering, a variety of interventions have been tried to improve gender gaps by implementing changes in undergraduate courses. Many of these interventions have focused on showing women that they belong in that discipline, such as mentoring and same-gender instructors (Bettinger and Long, 2005; Carrell et al., 2010; Griffith, 2010), while others have focused on changing the pedagogical methods to emphasize interactive learning and collaboration in introductory physics courses (Lorenzo et al., 2006). There is evidence that these techniques have been effective in STEM disciplines, but not all of them have been tested in economics.

[5]The UWE Challenge suggested interventions include changing instructional content and presentation style, but so far none of the participating schools have reported on such an intervention.

courses and further study of economics at the undergraduate level. The University of Pittsburgh Economics department implemented an intervention in the recitations of large introductory microeconomics and macroeconomics courses in which students engaged in more group learning, with a greater focus on contributing ideas rather than just correct answers and in engaging with real-world data and examples. While the course content changes were primarily designed to generally increase student engagement in recitations and to help students understand the broader implications of the material learned in class (Josephson et al., 2019), we find evidence that such changes also decreased gender gaps in subsequent taking of economics courses, both at the introductory level and at the higher levels required for the major in economics.

In this study, we find that women's grades and progression in economics increases, relative to men, after the intervention is put into place. There were not substantial gender gaps in grades prior to the intervention despite women having stronger prior academic preparation on average. Women's grades increase by about 0.2 (on a 4.0 scale) after the intervention, with no change in men's grades. This is nearly the equivalent of moving from a minus to a whole grade or from a whole grade to a plus[6]. We then find evidence of decreases in the gender gap of taking subsequent economics courses. Prior to the intervention, we find that women are 14 percentage points less likely than men to take any future economics courses and 10 percentage points less likely to take an intermediate economics course. With the introduction of the intervention, we find that the gender gaps in taking further economics courses and in taking an intermediate economics course, which is required to major or minor in economics, decreases by 71% and 78%, respectively. This improvement in the gender gap in continuation rates held even when controlling for grades, which suggests that it is not the increase in grades experienced by women in economics relative to men that generates this closure of gender progression gaps. Instead, after the intervention, we find that men and women of all grades have a much more similar progression probability.

Prior research evaluating course-content interventions have often focused on large-scale changes that may not be feasible for all colleges and universities. For example, Owen and Hagstrom (2021) evaluate the impact of changing the undergraduate curriculum in economics to include classes

[6]At the University of Pittsburgh, plus and minus grades are increments of 0.25. So, while a B grade is 3.0 on a 4 point scale, a B+ is 3.25 and a B- is a 2.75.

focused on empirical economics and economic inequality, and find that women receive higher grades under the revised curriculum but are not more likely to proceed with economics as a major. Similarly, Espey (2018) finds that changing an introductory microeconomics course to include team-based learning increases performance of women. However, both of these changes may not be logistically or politically feasible in all departments. Our intervention, on the other hand, focuses on changing course content in recitations, which are often implemented by teaching assistants and do not require the instructors to drastically change the content of their courses.

We also contribute to the literature on how gender differences in grade sensitivity impact students' decisions to continue further study or select a major in a discipline. There is some evidence that women's decision to continue study in both STEM and economics are more sensitive to grades in introductory classes than men (Rask and Tiefenthaler, 2008; Li, 2018; Ahlstrom and Asarta, 2019; Arnold, 2020; Witherspoon and Schunn, 2020), but the evidence on whether men or women are more sensitive to the grade signal is mixed (Ehrenberg, 2010; Owen, 2010; Ahlstrom and Asarta, 2019; Mcewan et al., 2019; Witherspoon et al., 2019). Witherspoon and Schunn (2020) find that the women who switch out of STEM majors have grades equal to men who graduate in those STEM fields. Two possible explanations for gender differences in grade sensitivity do emerge: women are especially sensitive to multiple signals in male dominated STEM fields where women respond more strongly to grade signals when paired with other signals of poor fit (Kugler et al., 2017); and women tend to have more alternative majors, such that women feel they have more alternatives when faced with low grades in economics (Wang et al., 2013).

In this study, we present additional evidence that there is a gender difference in grade sensitivity, with women requiring higher grades than men to continue in economics. We also show that our intervention closes these gaps in grade sensitivity without an explicit nudge to that effect, though only partially. This is possibly further evidence of the Kugler et al. (2017) explanation that women are more sensitive to grades in male-dominated fields when they have additional indicators of poor fit. If our intervention helped women to see themselves as fitting well in economics because it enabled them to participate in the courses more completely, to get a clearer perspective of their understanding relative to their classmates, and to gain a broader understanding of the content encompassed in economics, then grade may not be as strong a signal of their potential for women relative to men as it was before the intervention.

The rest of the paper proceeds as follows: Part 2 presents a more thorough description of the intervention; Part 3 summarizes the data we collected; Part 4 analyzes the results of the intervention; and Part 5 presents our conclusions.

2 Intervention

As part of a university-wide effort to improve large lecture classes, in the fall of 2018 we implemented an intervention which changed the content and the pedagogical methods in our introductory microeconomics and macroeconomics classes with the goal of increasing student engagement and having students utilize more higher-level thinking skills. We increased the practice of applying economics to real world situations and used more interactive and collaborative learning. There is ample evidence in the STEM pedagogy literature that learning is improved by the use of real-world problems (for a review, see Hmelo-Silver, 2004) and collaborative learning strategies (Springer et al., 1999; Chi and Wylie, 2014). Because research shows that these practices improve learning and also increase the retention of women in these disciplines (Lewis, 2011; Rodriguez et al., 2016; Di Tommaso et al., 2020), we hoped that by utilizing such learning techniques to achieve our goal, we could improve the retention of women in our program.

We decided to focus on the recitation sections as the locus of these changes because research from the STEM disciplines shows that interactive learning is logistically challenging in large classes and tends to be more effective in smaller class settings (Walker and Warfa, 2017).[7] Our transformation of the recitations had two main components: (1) new lesson plans and materials for the entire semester in both Micro and Macro designed by the faculty and (2) enhanced teacher training for the graduate student teaching assistants.

2.1 Recitation Plans

Before the intervention, the content and format of the recitations had varied somewhat by faculty instructor. However, most commonly, the teaching assistant reviewed the traditional assigned homework problems or had students work individually on additional practice problems

[7]Using recitation as our medium for change also allowed us to focus on graduate student teaching assistant training which could yield benefits more broadly in the field as our graduate students move on to faculty jobs.

that were similar to the homework problems. Teaching assistants sometimes demonstrated problem solutions on the chalkboard or whiteboard, gave a review lecture, or lectured on supplementary material. Students received points towards their course grade for attending or participating in recitation.

For the intervention recitation plans, we collaborated with the instructional design experts at the University's Center for Teaching and Learning to design plans that involved applying economics to rich real-world problems. We specifically planned activities which included using mathematical economic models for problem-solving, applying these models to analyze economic situations in the real world, analyzing economic data, and practicing the application of economic concepts and skills in novel situations. Activities included analyzing current events found in newspaper articles and videos, analyzing real economic data, participating in economic simulations and experiments, discussing readings, and analyzing case studies (see Appendix B for an example recitation plan). The goal was to increase engagement and develop higher-order thinking skills, while changing the focus of course material away from the usual hypothetical economics examples and towards more real-world topics with a broader interest range and greater applicability to social issues, business, and other topics of students' interest.

In each recitation session, we gave students the opportunity to work with their peers in pairs or small groups. Groupwork pragmatically reduces the number of independent learners the TA needs to support, and a group will be less likely to get stuck than individuals working alone. Further, group work has generally been found to allow students to learn more content through interactive discussion (Chi and Wylie, 2014) and master more complex skills (Kirschner et al., 2009). The group work also allowed students to build connections with their peers and with the teaching assistant, which could potentially improve sense-of-belonging and present economics as a discipline that involved working with others — two factors that have been identified as relevant to retention (Werner et al., 2005; Morrow and Ackermann, 2012).

Each recitation had a learning product that could be assessed at the end of the session. Students thus received part of their course grade for this product and not just for attendance or participation. This was particularly important for assessing the higher-level skills in the course as the large lecture size made it difficult to include such non-standardized material on the exam assessments.

2.2 Teaching Assistant (TA) Training

Because the intervention was delivered in the recitation sections by TAs, the training of the TAs was a very important component in the success of the intervention. The Economics Department had an existing course for graduate students on teaching economics, which was required for all second-year graduate students. The course used an apprenticeship model focused on discussion, observation of practice lessons and feedback, but did not include instruction on pedagogical theory and techniques. We modified this course with the help of the Center for Teaching and Learning to focus on active learning teaching techniques with sessions on presentation skills, facilitating group work, and teaching case studies. Each teaching assistant was also taped in their classroom and then reviewed the recording with an expert at the Center for Teaching and Learning to receive feedback on their performance.

Faculty instructors then worked closely with the TAs on preparing to teach each lesson. They met weekly with their TAs to preview that week's recitation plan - explaining the teaching methods that were to be used and answering questions about the learning objectives, methods, and materials for that recitation. In these meetings, faculty also collected TA feedback on the previous week's recitations, encouraging the TAs to reflect on the extent to which the recitation had met the learning objectives of the plan and soliciting their suggestions on how to improve the lesson.

2.3 Discussion of Implementation

Several strategic elements were vital to the successful implementation of this large project. With the support of a grant from our provost, we were able to get cooperation from all the faculty who teach introductory micro and macro. This collective approach, in addition to enabling robust quantitative modeling of effects, allowed us to implement the new training for all of the teaching assistants, which simplified scheduling and also allowed us take advantage of economies of scale. Faculty shared the workload of developing the new recitation plans and specialized in particular topics. It also allowed faculty to design plans collaboratively which fostered innovation and an iterative revision process that we believe served to improve our results. The exchange of ideas through regular meetings and hallway conversations throughout the term was invaluable

to faculty. Similarly, teaching assistants benefitted from being in a teaching class with their peers and using the same lessons plans as their peers. They were able to assist each other since they were working on the same lessons at the same time. Finally, the collective approach will likely support sustainability of the revision since so many faculty are invested and personally connected to the revision.

3 Data Summary

This intervention was implemented in the economics department on the main campus of the University of Pittsburgh, a large, public, urban, residential R1 university in the northeastern United States with over 19,000 undergraduates enrolled each semester. Students at this university are representative of the typical residential public university student: 95% are full-time, 66% are in-state students, and 83% of students are age 18-21. As of Fall 2019, the undergraduate student body was 55% female, 68% white, 5% African American, 11% Asian American, and 5% international students of various origins.

The economics department is housed in the School of Arts and Sciences. While the School of Arts and Sciences is the largest school (58% by undergraduate enrollment in Fall 2019), the university hosts various other schools, the largest of which are the School of Engineering (15%) and the College of Business Administration (10%). Students are admitted into a school and must choose majors from within that school unless they switch schools. However, students can take classes across schools, and students from all schools can take introductory microeconomics and macroeconomics.

Depending on major and school, introductory microeconomics and macroeconomics may be required or may count towards general graduation requirements. Both introductory economics courses are required for Economics majors and minors and may be taken in either order. Undergraduates in the College of Business Administration are required to take both introductory courses and must start with microeconomics. In addition, either introductory course can be counted towards the general education requirement for students in the School of Arts and Sciences or the School of Engineering. Our study population consists of all full-time students at the main campus who were registered in any class from Fall 2015 through Fall 2019.

3.1 Demographics of the university vs. the introductory economic class population

In this section, we compare the demographics of students who take either introductory economics class to those who never take such an economics class. In order to analyze the impact of our intervention on students' decisions to take later economics courses, we only include in our sample full-time students at the main campus who have taken any class from Fall 2015 to Fall 2019.

Panel A of Table 1 compares the demographics of students in our sample who have ever taken an introductory economics class to those who have not. Students who take introductory economics classes are less likely to be female, more likely to be white, less likely to belong to an under-represented minority group, more likely to be Asian American, and more likely to be an international student compared to the general student body.[8] They are also less likely to be first generation students. These differences raise the issue of recruiting both female students and under-represented minority students into the introductory economics classes which will be necessary to close the gender gap at this step in the pipeline. Aside from possible enhanced reputational effects, which we expect will be minimal given the proportion of first-time freshman in the introductory economics courses, addressing this issue is beyond the scope of our intervention.

Students who take introductory economics classes seem to be marginally better prepared academically than their peers. While they do not have substantially different high school GPAs, students who take introductory economics courses have higher SAT verbal and math scores.[9] However, when looking at Advanced Placement tests, students who take either introductory economics course tend have lower scores conditional on taking the exam. This is because students who do well in these exams place out of the introductory classes.

Students from the School of Arts and Sciences and the College of Business Administration are well represented in the introductory economics courses. The representation of engineering students does not vary across the two groups.

[8]Under-represented minorities include those that identify as African American, Hispanic, American Indian, and Pacific Islander. Asian American includes both those that primarily identify as Asian and who identify as both Asian and White. First generation students are defined as having no parents who attended college.

[9]For students that took the ACT rather than SAT, scores were converted to their SAT equivalent using the 2018 College Board SAT/ACT concordance tables found here: https://collegereadiness.collegeboard.org/pdf/guide-2018-act-sat-concordance.pdf .

Table 1: Summary Statistics

	Panel A: School Sample			Panel B: Economics Sample		
Variables	No Intro Econ	Intro Econ	Difference	Pre-Incubator	Post-Incubator	Difference
Female	0.48 (0.00)	0.38 (0.01)	0.09 (0.01)***	0.38 (0.01)	0.39 (0.01)	-0.01 (0.01)
White	0.66 (0.00)	0.71 (0.00)	-0.06 (0.01)***	0.72 (0.01)	0.70 (0.01)	0.02 (0.01)**
URM	0.11 (0.00)	0.10 (0.00)	0.01 (0.00)***	0.10 (0.00)	0.11 (0.01)	-0.01 (0.01)
Asian American	0.08 (0.00)	0.10 (0.00)	-0.02 (0.00) ***	0.10 (0.00)	0.11 (0.01)	-0.01 (0.01)
International	0.03 (.00)	0.06 (0.00)	-0.03 (0.00)***	0.06 (0.00)	0.07 (0.00)	-0.01 (0.01)
HS GPA	3.87 (0.01)	3.89 (0.01)	-0.02 (0.01)**	3.87 (0.01)	3.94 (0.01)	-0.07 (0.01)***
SAT Verbal/100	6.42 (0.00)	6.53 (0.01)	-0.11 (0.01)***	6.52 (0.01)	6.55 (0.01)	-0.03 (0.01)**
SAT Math/100	6.47 (0.01)	6.68 (0.01)	-0.21 (0.01)***	6.66 (0.01)	6.73 (0.01)	-0.07 (0.02)***
First Generation	0.46 (0.00)	0.37 (0.01)	0.08 (0.01)***	0.38 (0.01)	0.36 (0.01)	0.02 (0.01)*
Took AP Micro	0.06 (0.00)	0.06 (0.00)	0.00 (0.00)	0.06 (0.00)	0.06 (0.00)	0.00 (0.01)
AP Micro Score	3.85 (0.03)	3.30 (0.05)	0.55 (0.05)***	3.33 (0.06)	3.23 (0.08)	0.10 (0.10)
Took AP Macro	0.06 (0.00)	0.07 (0.00)	-0.01 (0.00)***	0.07 (0.00)	0.08 (0.01)	-0.01 (0.01)
AP Macro Score	3.81 (0.03)	3.26 (0.05)	0.55 (0.05)***	3.25 (0.06)	3.28 (0.08)	-0.03 (0.10)
Arts & Sciences	0.54 (0.00)	0.69 (0.00)	-0.14 (0.01)***	0.69 (0.01)	0.67 (0.01)	0.03 (0.01)**
Engineering	0.13 (0.00)	0.13 (0.00)	0.00 (0.00)	0.14 (0.00)	0.11 (0.01)	0.02 (0.01)***
Business	0.06 (0.00)	0.17 (0.00)	-0.11 (0.00)***	0.15 (0.00)	0.20 (0.01)	-0.05 (0.01)***
First Time Freshman				0.58 (0.01)	0.66 (0.01)	-0.08 (0.01) ***
First Micro Grade				2.79 (0.02)	2.94 (0.02)	-0.15 (0.03)***
First Micro DFW				0.17 (0.00)	0.13 (0.01)	0.05 (0.01)***
Retook Micro				0.04 (0.00)	0.01 (0.00)	0.03 (0.00)***
First Macro Grade				2.88 (0.02)	3.07 (0.03)	-0.19 (0.03)***
First Macro DFW				0.15 (0.00)	0.08 (0.01)	0.07 (0.01)***
Retook Macro				0.03 (0.00)	0.01 (0.00)	0.02 (0.00)**
Took Intermediate				0.17 (0.00)	0.12 (0.01)	0.05 (0.01)***
Within Semester				0.04 (0.00)	0.03 (0.00)	0.02 (0.00)***
Within Year				0.11 (0.00)	0.10 (0.01)	0.01 (0.01)
Took any future econ classes				0.50 (0.01)	0.39 (0.01)	0.10 (0.01)***
Within Semester				0.37 (0.01)	0.29 (0.01)	0.09 (0.01)***
Within Year				0.43 (0.01)	0.37 (0.01)	0.06 (0.01)***
Took any non-intro class				0.30 (0.01)	0.25 (0.01)	0.05 (0.01)***
Within Semester				0.08 (0.00)	0.08 (0.01)	0.00 (0.01)
Within Year				0.17 (0.00)	0.20 (0.01)	-0.03 (0.01)***
Declared econ major				0.10 (0.00)	0.06 (0.00)	0.04 (0.01)***
Within Semester				0.03 (0.00)	0.03 (0.00)	0.00 (0.00)
Within Year				0.06 (0.00)	0.05 (0.00)	0.01 (0.01)*
N	29052	8727	37779	5860	2867	8727

Notes - Separately for Micro and Macro as well separately for overall grades and DFW rates, estimated regression beta coefficients (and standard errors) for the main effect of gender, main effect of intervention pre vs. post, and interaction of intervention by gender across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

3.2 Demographics of introductory economics students before and after the intervention

The intervention was implemented in Fall 2018. The pre-intervention data includes students who took their first introductory economics class from Fall 2015 through Spring 2018, and the post-intervention data includes students who took their first introductory economics class from Fall 2018 through Fall 2019. Panel B of Table 1 demonstrates the demographics of the pre-intervention and post-intervention samples. The primary demographic of concern in this paper, gender, does not change across this sample in this time frame. This allays any concerns about concurrent efforts to recruit more women into the economics major or substantial changes in recruitment by gender at the university. However, other demographics do vary across this time-period, specifically the population taking introductory economics classes becomes less white.

Academic preparedness seems to improve in this time-period as well. Students who take introductory economics courses have higher high school GPAs and math SAT scores in the post-intervention period compared to the pre-intervention period. However, the likelihood of having taken an Advanced Placement economics exam or the average score conditional on having taken the exam did not change in this period.

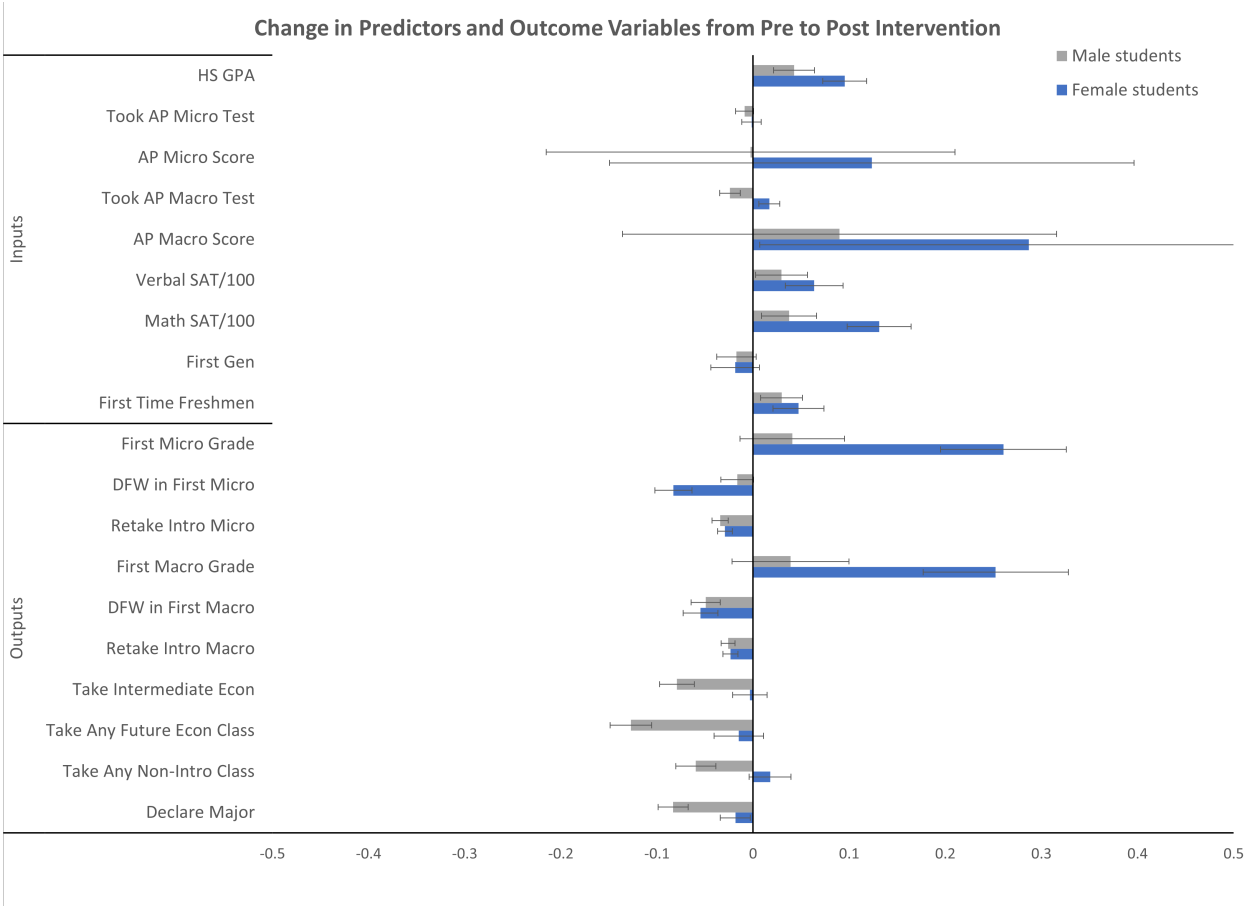
Students who take these courses are more likely to be from the College of Business Administration and less likely to be from the School of Arts and Sciences or the School of Engineering in the post-intervention period compared to the pre-intervention period. This may represent a greater shift within the school towards being in the College of Business Administration. Additionally, students who take introductory economics after the intervention are more likely to be first time freshmen.

Given the substantial changes in demographics and preparedness that occur across these two samples, we will include these controls in future analysis. For our analysis, however, we are primarily concerned with whether these controls change with the intervention differentially by gender. Figure 1 shows the pre- and post-intervention means for the academic preparation variables separately by gender.[10] Due to some small differences found in some of the coefficients, primarily in having taken the AP Macro exam, we specifically control for these incoming

[10]This is done only for our final sample, which is white students in the school of Arts and Sciences.

variables.

Figure 1: Pre- to post-intervention differences by student gender



Notes - Pre- to post-intervention differences by student gender on key inputs (academic resources and other demographic variables) and key outputs (course performance and subsequent enrollment patterns).

4 Results

In this section, we will discuss the impact of the pedagogical intervention on student outcomes, both overall and split by gender.

4.1 Outcomes of introductory economics students before and after the intervention

In this section, we will discuss how the outcomes of students who take introductory economics courses before and after the intervention vary. This analysis is cursory means-level com-

parisons and is only to get a sense of the general population effects of the intervention.

Panel B of Table 1 presents the means of grades and progression in the pre- and post-incubator groups. In general, it seems like outcomes in introductory courses are better after the intervention compared to before the intervention. Post-intervention students get 0.15 better grades in introductory microeconomics and 0.19 better grades in introductory macroeconomics on their first try, and are 5 (7) percentage points less likely to get a D or F or to withdraw intro micro (macro).[11] Additionally, students are 2 to 3 percentage point less likely to retake either microeconomics or macroeconomics conditional on getting a C.[12] This suggests fewer students are doing more poorly in the course than they want, conditional on their interest and investment.

Moving forward, we can consider whether students choose to continue to other economics courses and to the economics major. For this analysis, we consider whether students take these next steps at all, within a semester, and within a year. The reason for this is because we are limited in our post-intervention time frame, so lower continuation may be reflective of not enough time passing after the first introductory economics class is taken to see these progression outcomes.

One outcome to consider is taking either intermediate microeconomics or intermediate macroeconomics. These courses are indicators for progression through the major, but may also be taken by students in the School of Engineering to satisfy higher-level social science general education requirements. When considering taking intermediate ever, it seems like fewer students progress to this next step post-intervention; however, when restricting to either taking intermediate within a semester or within a year, we see smaller decreases in progression to the intermediates. We can also consider whether students take any future economics courses or any economics course that is not an introductory course, and we find similar results: decreases in progression with the intervention, but attenuation or reversal with more strict timeframes. Finally, when considering whether students decide to declare a major, it seems that students are slightly less to declare a major within a semester or a year. Two factors may be driving these decreases that have nothing to do with the intervention. For one, the post-intervention timeframe is limited, meaning that individuals have less time within which to reach these milestones to be counted. The fact that

[11] Grades are out of a 4 point scale, where grades are accorded given the following letters: A or A+ =4.0, A- = 3.75, B+ = 3.25, B = 3.0, B- = 2.75, C+ = 2.25, C =2.0, C- = 1.75, D+ = 1.25, D = 1.0, D- = 0.75, F=0.

[12] The student must get a C or better in the course for it to count towards most major, minor, and general education requirements.

restricting the timeframe to having taken a given future course within a semester or year attenuates any negative effects suggests that this is going on. Another possible reason is the shift to a greater portion of these introductory classes being from the College of Business Administration. These students are required to take the introductory courses, but no other economics courses. As such, there may be an independent shift going on in the university that is increasing the number of students entering these introductory courses that have no intention to continue to future economics courses.

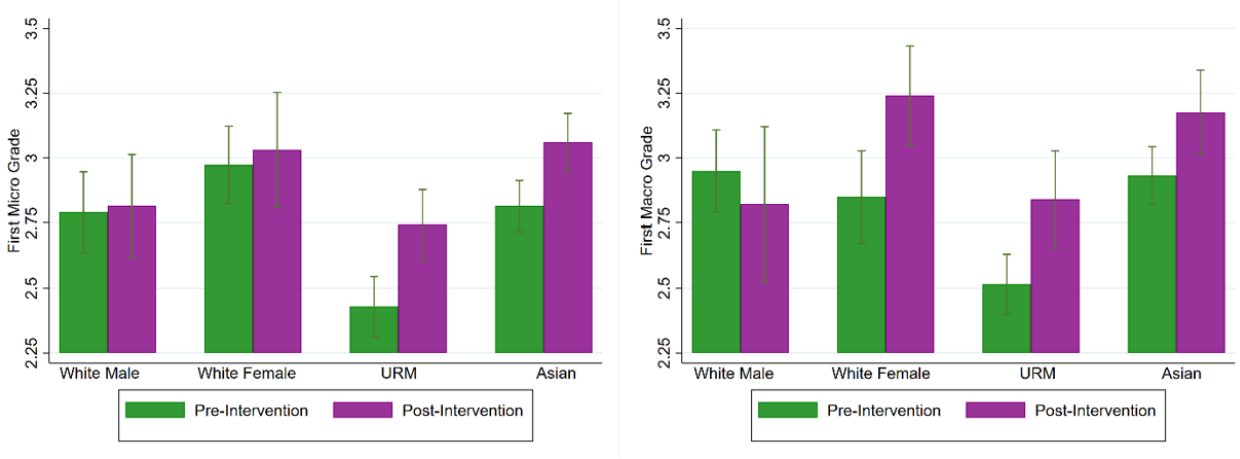
4.2 The Intervention Effects on Course Grades

Now that we have established that the intervention seems to have, overall, improved grades and progression outcomes, we can analyze how those outcomes depend on gender. We begin by analyzing the mean grades changes from pre- to post-intervention by gender and race. As we can see in Figure 2, there was minimal changes in grades among white male students, while all other demographic groups including white women showed improvements in mean grade, particularly for intro macro.[13] The lower panel of Figure 1 also reflects these outcomes, showing that women's grades in both courses differentially improve after the intervention. Additionally, Figure 3 presents these results for white students by year, and shows that for both the introductory courses the structural break is after the intervention, providing evidence that the intervention is likely the cause of this change. However, due to the differential change in incoming characteristics by gender that we found in Figure 1, we rely on regression results to fully evaluate this outcome.

We run regressions in which we can control for potentially varying student characteristics in order to evaluate the impact of the intervention on student grades. In Table 2, Models 1a-4a present the primary coefficients of interest for regressions evaluating the impact of the intervention on introductory microeconomics grades, and Models 1b-4b present the same for introductory macroeconomics grades. The different columns indicate different sets of controls, starting with a

[13]Figure A.1 shows the complete intersectionality of male/female within all four racial groups. The number of students in each category becomes very small and thus the means are poorly estimated, but the trends are suggestive of all groups except white males showing benefits of the intervention in at least one of the two courses. The remaining analyses presented below focus on the gender effect within white students because there are clear signs of gender x race/ethnicity intersectionality in the effects of the intervention but there is only enough power to estimate the gender effect among White students.

Figure 2: Grades by Group, Pre- and Post-Intervention



Notes - Mean grades pre- and post-intervention by ethnicity (and by gender for white students) for Micro (left) and Macro (right).

model with only structural controls to the last column including all of the controls. The controls of concern, those of high school GPA and Math SAT scores, are incorporated in Models 1b and 2b for introductory micro grade and introductory macro grade regressions, respectively.[14] Using these regressions, we first find evidence of gender disparities in grades in introductory macroeconomics, but not introductory microeconomics.[15] We also find no evidence of an impact of the intervention on the grades of male students. However, we find that the intervention raises grades for women by about 0.2 points (out of a 4.0 scale), and though this is marginally insignificant in some of the macroeconomics regressions. To put this change in context, a 0.2 point change could bring someone from a minus grade to a full grade, or from a full grade to a plus grade. Additionally, it more than closes any pre-existing gender gaps in grades and results in a reversal of such gaps, with women performing better than men in the classes.

We can also evaluate the impact of the intervention on the distribution of course grades. The top panel of Figure 4 presents the changes in the percent of students in each grade category

[14]See Tables A.1 and A.2 for the full set of estimated coefficients from each model.

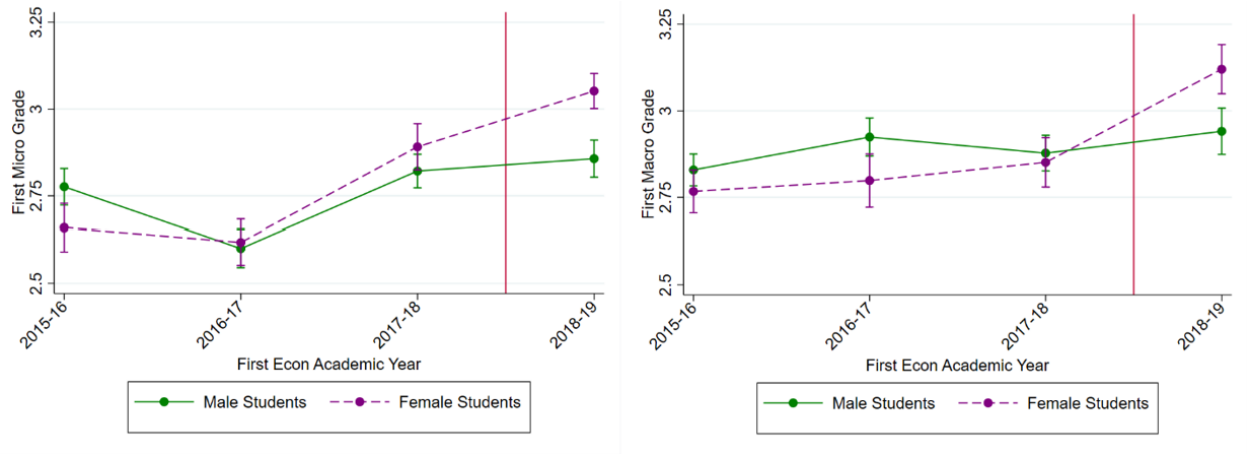
[15]While not our primary model of interest, we also evaluate the gender gaps in grade anomalies for these courses, defined as the gender gaps in grades conditional on the students' semester GPA excluding these classes. We find evidence of a gender gap in grade anomalies, with women performing significantly worse in both courses when controlling for their same-semester GPA from their other classes. This is true if we control for the entire same-semester GPA or only their Arts and Sciences GPA, their GPA in other social sciences class, or, for macroeconomics grade, their GPA in their sciences classes. These gaps are substantial, ranging from about a 0.2 gap in the microeconomics course grades to a 0.3 gap in the macroeconomics course grades. Results available upon request.

Table 2: Grades and DFW Rates

	(1)	(2)	(3)	(4)
Overall grades				
Micro	Model 1a	Model 2a	Model 3a	Model 4a
Female	-0.02	-0.03	-0.03	-0.03
	(0.04)	(0.05)	(0.05)	(0.05)
Intervention	0.04	0.01	0.02	0.02
	(0.05)	(0.05)	(0.05)	(0.05)
Female x Intervention	0.22**	0.15*	0.15*	0.15*
	(0.09)	(0.08)	(0.08)	(0.08)
Macro	Model 1b	Model 2b	Model 3b	Model 4b
Female	-0.08	-0.11**	-0.10**	-0.10*
	(0.05)	(0.05)	(0.05)	(0.05)
Intervention	0.03	-0.01	0.01	0.01
	(0.06)	(0.06)	(0.06)	(0.06)
Female x Intervention	0.22**	0.18*	0.15*	0.15
	(0.10)	(0.10)	(0.10)	(0.09)
DFW				
Micro	Model 1c	Model 2c	Model 3c	Model 4c
Female	-0.01	0.00	0.00	0.00
	(0.01)	(0.02)	(0.01)	(0.01)
Intervention	-0.02	-0.01	-0.03*	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)
Female x Intervention	-0.07**	-0.05**	-0.05**	-0.05**
	(0.03)	(0.03)	(0.03)	(0.03)
Macro	Model 1d	Model 2d	Model 3d	Model 4d
Female	-0.01	-0.01	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Intervention	-0.05***	-0.04***	-0.03**	-0.03**
	(0.02)	(0.02)	(0.02)	(0.01)
Female x Intervention	-0.01	0.01	0.01	0.00
	(0.02)	(0.02)	(0.02)	(0.02)

Notes - Separately for Micro and Macro as well separately for overall grades and DFW rates, estimated regression beta coefficients (and standard errors) for the main effect of gender, main effect of intervention pre vs. post, and interaction of intervention by gender across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 3: Grades Over Time by Gender

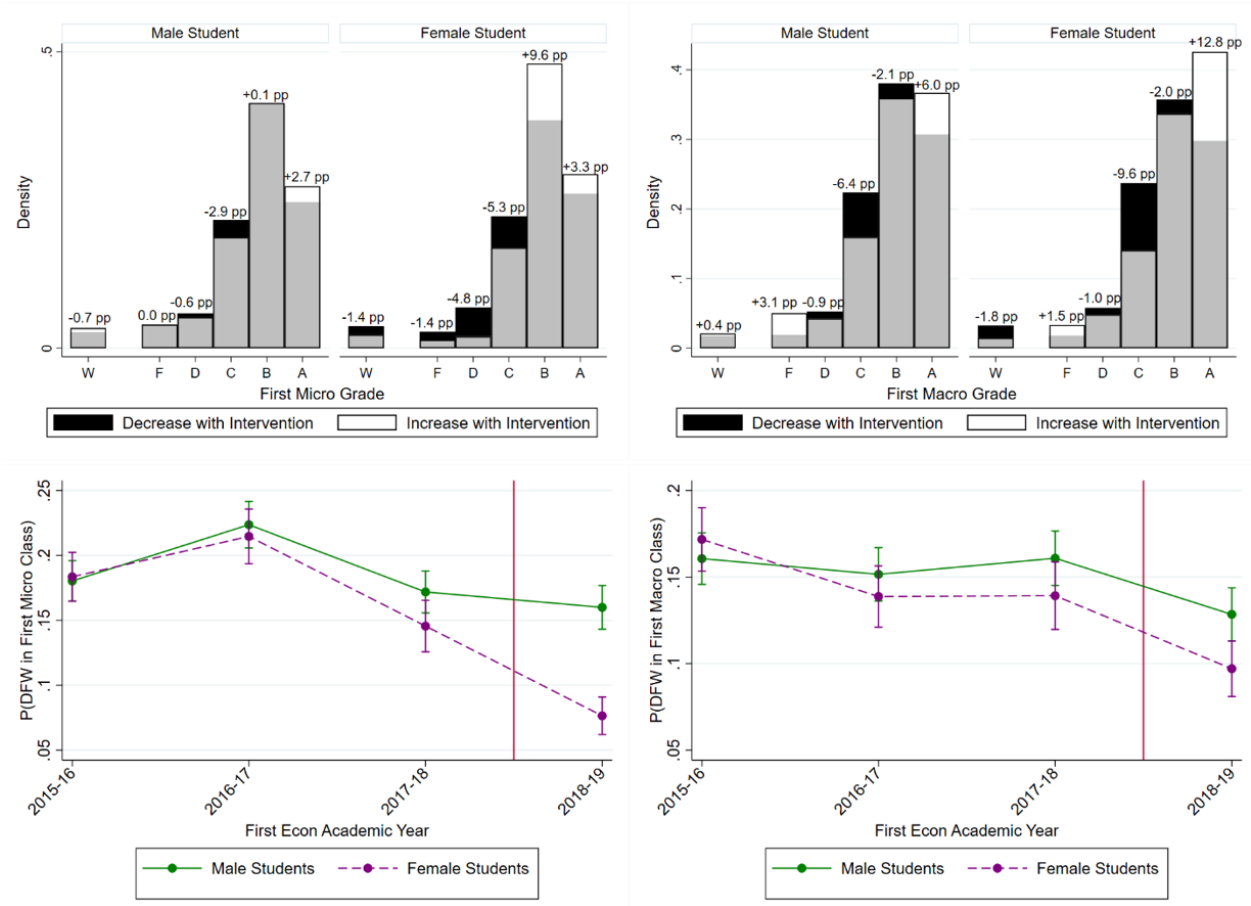


Notes - Mean grades (with SE bars) by year for Micro (left) and Macro (right). Vertical red line indicates pre- versus post-intervention.

that occurred with the intervention, split by course and the gender of the student. Both courses saw an increase at the top of the grade distribution and a decrease at the bottom of the grade distribution for both genders. For Micro, the growth was in As and Bs and is larger for female students. For Macro, the growth was specifically in As, and especially large for female students. We may also be concerned where these students are moving from. In particular, we would want these increases at the top end of the distribution to be coming from decreases in the bottom end of the distribution, in particular the Ds, Fs, and Ws (sometimes collected as DFW). We see that there is some decrease in the DFW rate, particularly for women, but much of the decrease is happening in the C grade range. This suggests that while some of the worst outcomes are being averted, particularly for women, most of the change in grades is coming from a hollowing out of the middle outcomes towards the better outcomes.

Turning specifically to these most negative outcomes, the DFW rate, we can evaluate if the intervention had any specific impact on these outcomes, and if so if it differentially impacted men and women. Considering the temporal trends, the lower panel of Figure 4 suggests that the intervention may differentially inhibited the overall decline in DFW rates for men but not for women in introductory microeconomics, while there were no differences for introductory macroeconomics. Columns 1c-4c and 1d-4d of Table 2 present regressions of the interaction between the intervention and gender for the DFW rate in introductory microeconomics (1c-4c)

Figure 4: Grade Distributions and DFW Evolution by Gender



Notes - Micro (left) and Macro (right) grade distributions (top) and DFW rates (bottom) by year for male and female students. Vertical red line indicates pre versus post intervention.

and macroeconomics (1d-4d) with the associated controls.[16] We can see here that there does not seem to be a differential DFW rate by gender prior to the intervention. In microeconomics, there seems to be no change in the DFW rate for men and a 5 to 7 percentage point decrease for women. However, this does indicate the generation of a gender gap in the DFW rate for introductory microeconomics with women having lower DFW rates than men. In introductory macroeconomics, there again seems to be an overall decrease in the DFW rate for both men and women, though this is likely due to ongoing trends. Unlike for introductory microeconomics, there is no gender gap in DFW rates generated with the intervention.

[16]Full regression outputs are presented in Tables A.3 and A.4. Logit regressions are presented in Tables A.5 and A.6. They present similar results.

4.3 Gender and the Path to Majoring in Economics

In this section we evaluate the impact of the intervention on progression in economics. As discussed in section 4.1, we see weak evidence that progression to future economics classes decreased for everyone with the intervention, possibly due to the foreshortened timeframe after the intervention and possibly due to an independent shift towards a larger percentage of students being from the College of Business Administration, who would be unlikely to take any non-introductory economics courses.

We consider how progression metrics varied across time in Figure 5. Pre-intervention, there was temporally stable differences by gender in continuing on to non-intro and intermediate Economics courses, but we see a closing of the gaps in taking any future economics course in the year pre-intervention. Post-intervention, there was a substantial reduction in the gender gap in the likelihood of enrolling in Intermediate Economics, the strongest course signal of intending to major in Economics.

Table 3 presents the results of the multiple regression models predict continuing into later coursework. Separate models were run for each of the three groupings of later coursework (any future economics courses, any future economics courses not including introductory classes, and any Intermediate economics courses.).[17] Given the temporal limitation on possible enrollment for the post-intervention cohorts, there was a robust negative main effect of post- intervention on enrollment in every model (i.e., this effect was a pure artifact of having fewer years to accumulate coursework experience). More interestingly, there was a robust interaction of gender by intervention on every later coursework category. Further, adding the various controls had little effect on the coefficient estimates for the interaction term. Additionally, there was no reduction in the size of this interaction when the prior economics course grade was added, suggesting none of the continuity effect came from receiving higher grades.

We may also be concerned about gender gaps in progression by grade. Prior literature suggests that women are as likely to progress in economics as men who get a full letter grade higher than them (Rask and Tiefenthaler, 2008; Li, 2018), and that women are particularly sensitive to lower grades because they are subject to other indicators of bad fit with economics that convince

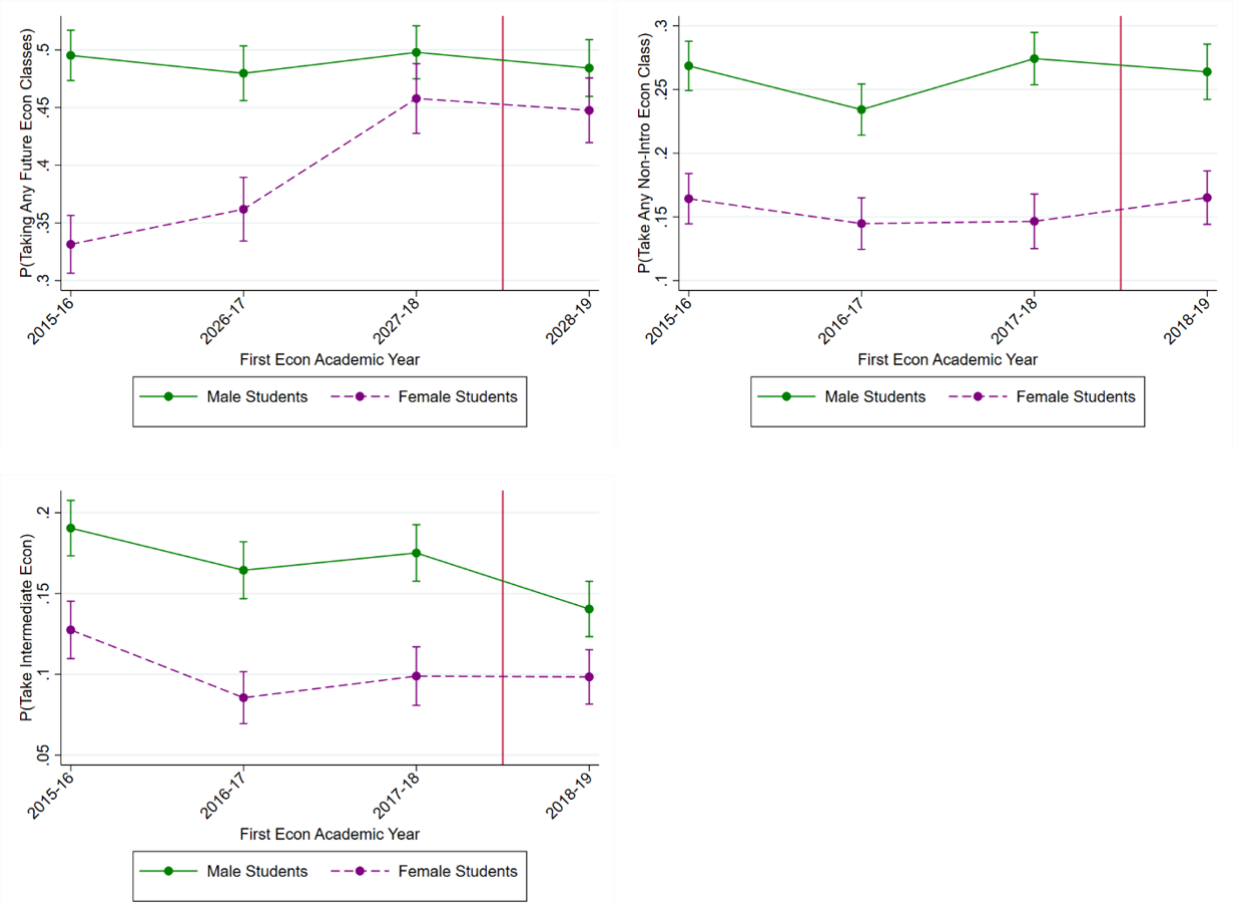
[17]The coefficients for the complete models are found in Tables A.7-A.9. Logit regressions can be found in Tables A.10-A.12. They present very similar results.

Table 3: Progression by Gender and Intervention

	(1)	(2) = (1)	(3)	(4)	(5)
Taking any future Econ class	Model 1a	Model 2a	Model 3a	Model 4a	Model 5a
Female	-0.14***	-0.14***	-0.14***	-0.14***	-0.14***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention	-0.12***	-0.12***	-0.13***	-0.13***	-0.13***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Female x Intervention	0.10***	0.10***	0.10***	0.10***	0.10***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Taking any non-intro Econ class	Model 1b	Model 2b	Model 3b	Model 4b	Model 5b
Female	-0.17***	-0.15***	-0.15***	-0.15***	-0.15***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention	-0.05**	-0.06**	-0.06***	-0.06***	-0.06***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Female x Intervention	0.06**	0.06*	0.06*	0.06*	0.06*
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Taking Intermediate Econ class	Model 1c	Model 2c	Model 3c	Model 4c	Model 5c
Female	-0.12***	-0.09***	-0.09***	-0.09***	-0.09***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention	-0.08***	-0.08***	-0.08***	-0.09***	-0.09***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Female x Intervention	0.07**	0.06**	0.07**	0.07**	0.07**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)

Notes - Separately for each next course outcome (any Economics course, any non-Intro Economics course, and Intermediate Economics), estimated regression beta coefficients (and standard errors) for the main effect of gender, the main effect of intervention pre vs. post, and the interaction of intervention by gender across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, (4) the addition of prior introductory economics grades, and (5) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 5: Progression Measures, by Gender and Year



Notes - By year and separately for male and female students who received a C or higher in their first introductory economics course, the probability of enrolling in (a) any future Economics classes, (b) any future non-Intro Economics classes, or (c) Intermediate Economics within a year . Vertical red line indicates pre versus post intervention.

them to not pursue economics (Kugler et al., 2017). Pre-intervention, in every aggregation of future course taking, male students were noticeably more likely than female students to go on to later Econ courses, regardless of whether they had As, Bs, or Cs in the first Introductory Econ class (see Figure 6). From the post-intervention frames, we have suggestive evidence that these progression-by-grade gaps have shrunk some, particularly for those receiving high (around 4.0 or an "A") and low (around 2.0 or a "C") grades, though the outcomes are noisy. Table 4 presents the regression results corresponding to the outcomes in Figure 6, though requiring a linear impact of grades on progression probability, rather than allowing for the flexible relationship in the

figure.[18] There is suggestive evidence that women are less likely to progress than men before the intervention at every grade level, though this is only marginally significant or is marginally insignificant in each of the regressions. This seems to be a level effect, with no gap between the responsiveness to grade changes by gender (i.e. the coefficient for the interaction of Female and First Econ grade is a fairly precise 0). This would suggest that at every grade, women are 14, 17, and 7 percentage points less likely to progress to taking any future economics course, any future non-intro economics course, or any intermediate economics course, respectively, than a man at that same grade level. When we look to the impact of the intervention on the probability of women progressing, we find positive but statistically insignificant effects for progressing to any future and any future non-intro economics courses, but not for intermediate, whereas for intermediate we find a positive, though also statistically insignificant, effect of higher grades leading to higher likelihood of progressing for women compared to men. This would translate to the intervention engendering a parallel shift up in the probability of women progressing to any future economics and any future non-intro economics class at every grade and a change in slope, with women being more likely to progress with higher grades, for progression to an intermediate economics course. All in all, these results present weak evidence that the intervention induced some closing of the progression gap at every grade level.

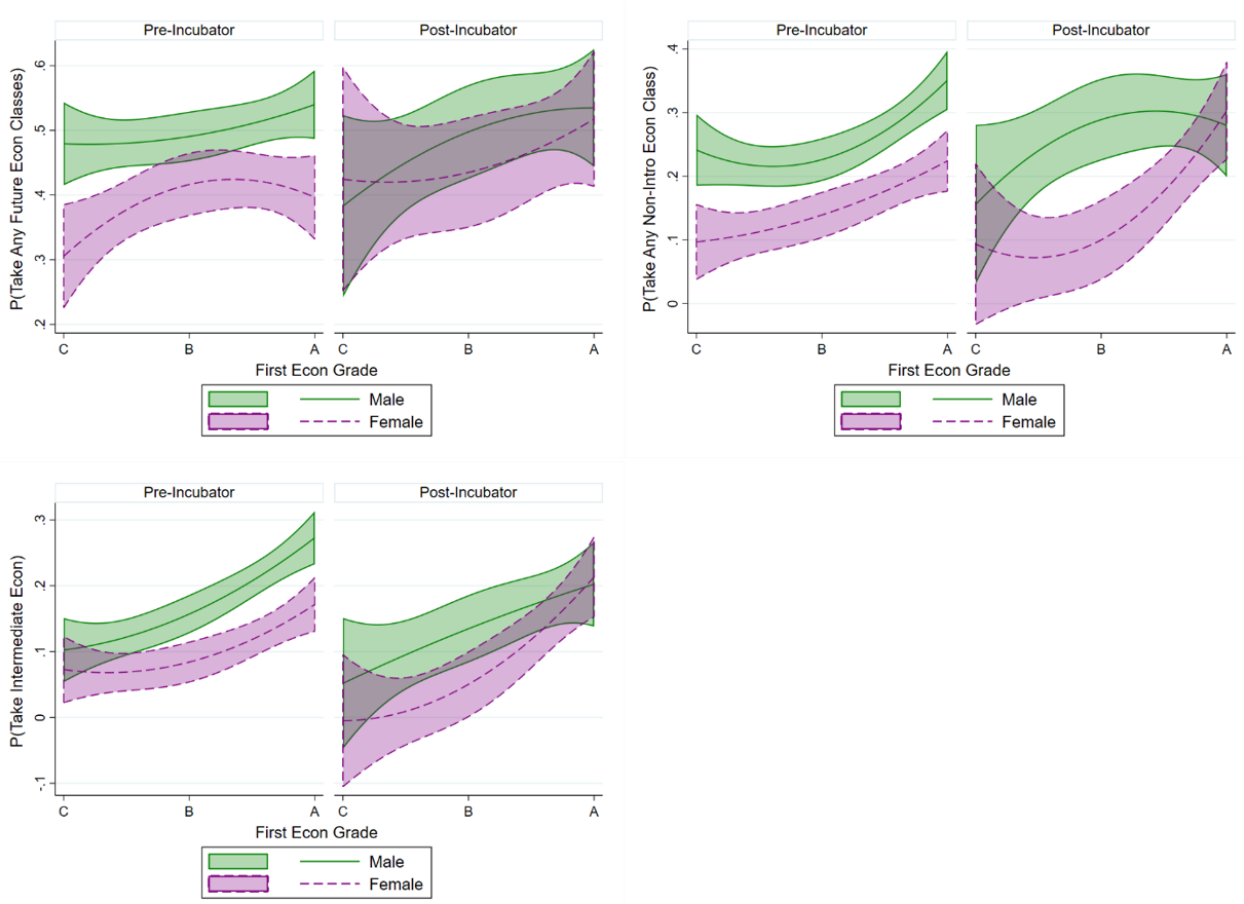
5 Discussion and Conclusion

Gender gaps in economics are pervasive and persistent and they start as early as the first economics course a student takes in their undergraduate studies. While there have been many interventions attempted at this level to change in students' minds the image of who an economist is (i.e. that economists are women) (Carrell et al., 2010; Griffith, 2010; Li, 2018; Porter and Serra, 2020), there have not been interventions that impact students' perceptions of what economics is (i.e. something that is interesting to women).

In this paper, we evaluate an intervention that changed the way content was presented and evaluated in the recitations of introductory microeconomics and macroeconomics courses. This intervention made recitations more focused on group work that involved solving real-world prob-

[18] Full regression results are in Table A.13.

Figure 6: Progression by Gender and Grade



Notes - Separately for male and female students, the probability of enrolling in (a) any future econ course, (b) any future non-intro econ course, and (c) any Intermediate Economics class within a year as a function of the first grade received in an introductory economics class, pre and post the Intervention.

lems using the economic models learned in class. Not only did this better integrate marginalized students, such as women, into the class discussion, but also provided a broader range of examples of how economics can be used. While the intervention was not designed to close gender or any other demographic gaps, we thought such changes may be possible given how the content of the course was broadened by the intervention.

We find that, prior to the intervention, women get similar grades to men in their introductory economics courses but are substantially less likely to pursue future economics courses at all grade levels. When the intervention was implemented, we found women's grades in their introductory economics courses exceeded similar men's and the gender gap in the probability of progressing to

Table 4: Progression by Gender, Grade and Intervention

Key Predictors	Any	Non-Intro	Intermediate
Female	-0.14	-0.17*	-0.07
	(0.10)	(0.09)	(0.08)
First Econ Grade	0.04*	0.05***	0.04***
	(0.02)	(0.02)	(0.02)
Female X First Econ Grade	0.00	0.01	-0.01
	(0.03)	(0.03)	(0.03)
Intervention	-0.36***	-0.12	-0.06
	(0.12)	(0.11)	(0.10)
Female X Intervention	0.22	0.10	-0.05
	(0.19)	(0.17)	(0.15)
Intervention X First Econ Grade	0.07*	0.02	-0.01
	(0.04)	(0.03)	(0.03)
Female X Intervention X First Econ Grade	-0.04	-0.01	0.04
	(0.06)	(0.05)	(0.05)

Notes - Separately for each next course outcome (taking any Economics course, any non-Intro Economics course, and Intermediate Economics), estimated regression beta coefficients (and standard errors) for the main effect and interactions among gender, prior course grade, and intervention pre vs. post, with models which included structural controls and prior academic experience controls. Only students who received a C or above in their first introductory economics course. Controls equivalent to model 3 in table above. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

future economics courses decreased by over 70%. We also find the partial closure of progression gaps along the grade distribution.

This intervention highlights the importance of considering course content when trying to understand why gender gaps emerge and persist in economics. The traditional framing in economics courses superficially focusing on business may be less interesting to women than other framings, such as those aimed at policy and welfare. However, this intervention also attends to pedagogy as a component of gender gaps.

In evaluating interventions, dimensions other than effect sizes should be considered, such as cost and sustainability. From a cost perspective, this intervention was expensive to develop (e.g., summer support for many faculty) but then inexpensive to sustain. The high development cost could have been distributed over more time by having a smaller team gradually change the contents of recitations. However, this might have produced an incoherent experience for students across the transition years. Further, training TAs on a new approach is important and hard to justify along the way when only a small proportion of recitation contents are changed. From a sustainability perspective, there were benefits of the adapted implementation strategy

of involving all relevant faculty in the development of the revision materials and then in the teaching using the revised materials: it created an institutional commitment that is important for sustain the revisions across the gradual replacement of faculty and introduction of new policy changes. The research literature on the process of changing teaching across a department suggests that curriculum/pedagogy-focused efforts can be more successful than other kinds of changes because faculty see the value of working collectively and sufficient data can be collected to robustly test the effects (Henderson et al., 2010). It is an open question, however, whether the faculty involved then also changed other aspects of their teaching (e.g., how they teach upper level undergraduate courses).

Another area of future research would be to evaluate how this intervention impacted other demographic gaps, such as racial gaps, in economics course outcomes and progression. While we are able to show evidence that suggests that racial gaps in course performance in Micro also improved given the intervention (Miller-Cotto and Schunn, 2020), we do not have the power to evaluate whether this was consistently the case across both courses or for progression into later courses. Further, it is unlikely that we will be able to further evaluate this program in the near run due to the Covid-19 pandemic. However, we anticipate that some of the mechanisms improving outcomes for women may also be a factor in improving outcomes for underrepresented minority students as well.

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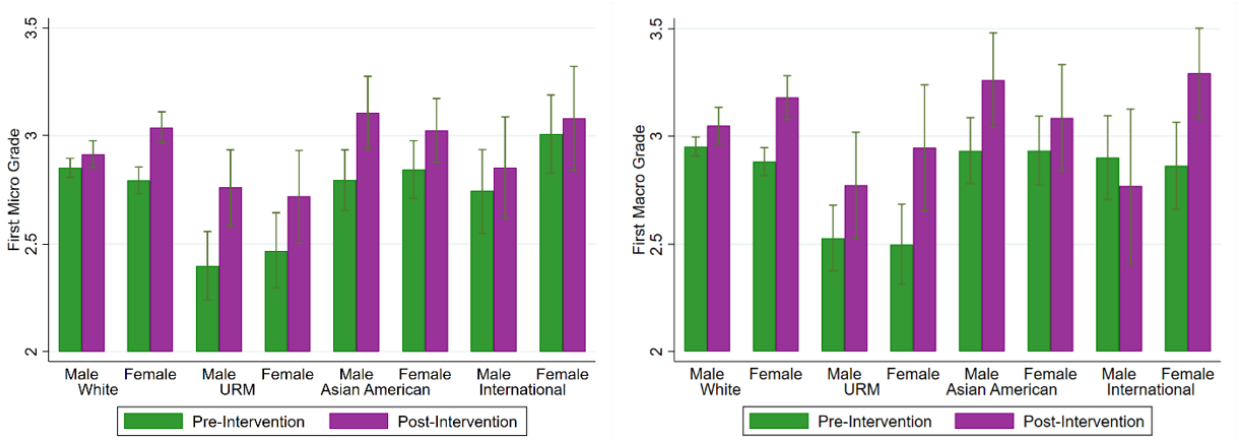
APPENDIX A

Appendix Figures

Figure A.1: Grades by Race, Gender, and Intervention



Notes - Mean grades pre and post intervention by ethnicity and gender for Micro (left) and Macro (right).

Appendix Tables

Table A.1: Full Regression Results - Outcome: First Micro Grade

	(1)	(2)	(3)	(4)
Female	-0.02	-0.03	-0.03	-0.03
	(0.05)	(0.05)	(0.05)	(0.05)
Intervention	0.04	0.01	0.02	0.02
	(0.05)	(0.05)	(0.05)	(0.05)
Intervention X Female	0.22**	0.15*	0.15*	0.15*
	(0.09)	(0.08)	(0.08)	(0.08)
Year = (Baseline = Freshman)				
Sophomore	-0.08*	-0.02	-0.00	-0.00
	(0.04)	(0.04)	(0.04)	(0.04)
Junior	-0.15**	-0.14**	-0.13**	-0.14**
	(0.07)	(0.06)	(0.07)	(0.07)
Senior	-0.42***	-0.21**	-0.19**	-0.20**
	(0.09)	(0.09)	(0.09)	(0.09)
HS GPA		0.70***	0.70***	0.70***
		(0.04)	(0.04)	(0.04)
Math SAT/100		0.31***	0.31***	0.31***
		(0.03)	(0.03)	(0.03)
Verbal SAT/100		0.10***	0.10***	0.10***
		(0.04)	(0.04)	(0.04)
Took AP Micro		0.24**	0.23*	0.23*
		(0.12)	(0.12)	(0.12)
Took AP Macro		0.20**	0.22**	0.22***
		(0.08)	(0.08)	(0.08)
Took Micro at Satellite Campus		-0.32	-0.31	-0.29
		(1.00)	(1.00)	(1.00)
Took Macro at Satellite Campus		0.57	0.57	0.57
		(0.39)	(0.39)	(0.39)
Took Micro First			0.04	0.04
			(0.07)	(0.07)
Took Macro First			0.15*	0.14*
			(0.08)	(0.08)
Low Income				-0.04
				(0.05)
First Generation				0.08
				(0.06)
3 or More in Family				0.05
				(0.09)
Constant	2.79***	-2.61***	-2.67***	-2.75***
	(0.03)	(0.24)	(0.24)	(0.26)
Observations	2881	2813	2813	2813
R-squared	0.02	0.21	0.21	0.21

Notes - Full regression results with the outcome variable of first micro grade across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.2: Full Regression Results - Outcome: First Macro Grade

	(1)	(2)	(3)	(4)
Female	-0.08	-0.11**	-0.10**	-0.10*
	(0.05)	(0.05)	(0.05)	(0.05)
Intervention	0.03	-0.01	0.01	0.01
	(0.06)	(0.06)	(0.06)	(0.06)
Intervention X Female	0.22**	0.18*	0.15*	0.15
	(0.10)	(0.09)	(0.09)	(0.09)
Year = (Baseline = Freshman)				
Sophomore	-0.12**	-0.03	0.00	-0.00
	(0.05)	(0.05)	(0.05)	(0.05)
Junior	-0.27***	-0.24***	-0.18**	-0.20***
	(0.08)	(0.08)	(0.08)	(0.08)
Senior	-0.43***	-0.40***	-0.31***	-0.34***
	(0.10)	(0.10)	(0.10)	(0.10)
HS GPA		0.63***	0.64***	0.64***
		(0.05)	(0.05)	(0.05)
Math SAT/100		0.17***	0.16***	0.16***
		(0.04)	(0.04)	(0.04)
Verbal SAT/100		0.04	0.05	0.05
		(0.04)	(0.04)	(0.04)
Took AP Micro		0.14	0.20**	0.20**
		(0.10)	(0.10)	(0.10)
Took AP Macro		0.16	0.12	0.13
		(0.11)	(0.11)	(0.11)
Took Micro at Satellite Campus		-0.56	-0.53	-0.54
		(0.49)	(0.48)	(0.48)
Took Micro First			0.24***	0.23***
			(0.08)	(0.08)
Took Macro First			0.01	-0.00
			(0.07)	(0.07)
Low Income				0.08
				(0.06)
First Generation				-0.01
				(0.06)
3 or More in Family				0.26***
				(0.10)
Constant	2.95***	-0.83***	-0.96***	-1.25***
	(0.03)	(0.27)	(0.28)	(0.29)
Observations	2454	2403	2403	2403
R-squared	0.02	0.13	0.14	0.15

Notes - Full regression results with the outcome variable of first macro grade across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.3: Full Regression Results - Outcome: D, F, or W in First Micro

	(1)	(2)	(3)	(4)
Female	-0.01	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Intervention	-0.02	-0.01	-0.03*	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)
Intervention X Female	-0.07**	-0.05**	-0.05**	-0.05**
	(0.03)	(0.03)	(0.02)	(0.02)
Year = (Baseline = Freshman)				
Sophomore	-0.02	-0.04***	-0.04***	-0.04***
	(0.01)	(0.01)	(0.01)	(0.01)
Junior	-0.03	-0.03*	-0.03*	-0.03*
	(0.02)	(0.02)	(0.02)	(0.02)
Senior	0.01	-0.04*	-0.03	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)
HS GPA		-0.15***	-0.15***	-0.15***
		(0.01)	(0.01)	(0.01)
Math SAT/100		-0.05***	-0.05***	-0.05***
		(0.01)	(0.01)	(0.01)
Verbal SAT/100		-0.04***	-0.03***	-0.03***
		(0.01)	(0.01)	(0.01)
Took AP Micro		-0.10***	-0.02	-0.02
		(0.03)	(0.03)	(0.03)
Took AP Macro		-0.04	-0.08***	-0.08***
		(0.03)	(0.03)	(0.03)
Took Micro at Satellite Campus		-0.16	-0.07	-0.067
		(0.17)	(0.16)	(0.16)
Took Macro at Satellite Campus		0.13	0.05	0.05
		(0.14)	(0.14)	(0.14)
Took Micro First			0.00	0.00
			(0.02)	(0.02)
Took Macro First			-0.19***	-0.19***
			(0.03)	(0.03)
Low Income				0.00
				(0.02)
First Generation				-0.00
				(0.02)
3 or More in Family				-0.03
				(0.03)
Constant	0.20***	1.35***	1.43***	1.45***
	(0.01)	(0.08)	(0.08)	(0.08)
Observations	4093	3992	3992	3992
R-squared	0.01	0.08	0.14	0.14

Notes - Full regression results with the outcome variable of getting a D, F, or W in the first micro class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.4: Full Regression Results - Outcome: D, F, or W in First Macro

	(1)	(2)	(3)	(4)
Female	-0.01	-0.01	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Intervention	-0.05***	-0.04***	-0.03**	-0.03**
	(0.02)	(0.02)	(0.01)	(0.01)
Intervention X Female	-0.01	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.02)
Year = (Baseline = Freshman)				
Sophomore	0.010	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Junior	0.01	0.00	-0.00	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Senior	0.01	0.00	-0.021	-0.017
	(0.02)	(0.02)	(0.02)	(0.02)
HS GPA		-0.12***	-0.12***	-0.12***
		(0.01)	(0.01)	(0.01)
Math SAT/100		-0.04***	-0.04***	-0.04***
		(0.01)	(0.01)	(0.01)
Verbal SAT/100		-0.00	-0.01	-0.01
		(0.01)	(0.01)	(0.01)
Took AP Micro		-0.02	-0.09***	-0.09***
		(0.03)	(0.03)	(0.03)
Took AP Macro		-0.06**	-0.014	-0.02
		(0.03)	(0.02)	(0.02)
Took Micro at Satellite Campus		0.41***	0.34**	0.34**
		(0.15)	(0.15)	(0.15)
Took Macro at Satellite Campus		-0.41***	-0.31**	-0.31**
		(0.13)	(0.13)	(0.13)
Took Micro First			-0.22***	-0.22***
			(0.02)	(0.02)
Took Macro First			-0.04	-0.04
			(0.02)	(0.02)
Low Income				-0.02
				(0.02)
First Generation				0.00
				(0.02)
3 or More in Family				-0.05*
				(0.0262)
Constant	0.16***	0.91***	1.04***	1.10***
	(0.01)	(0.07)	(0.07)	(0.08)
Observations	4093	3992	3992	3992
R-squared	0.01	0.05	0.12	0.12

Notes - Full regression results with the outcome variable of getting a D, F, or W in the first macro class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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Table A.5: Full Logit Regression Results - Outcome: D, F, or W in First Micro

	(1)	(2)	(3)	(4)
Female	-0.05	0.04	0.05	0.05
	(0.10)	(0.11)	(0.12)	(0.12)
Intervention	-0.11	-0.09	-0.22*	-0.22*
	(0.11)	(0.12)	(0.13)	(0.13)
Intervention X Female	-0.59***	-0.56***	-0.55**	-0.55**
	(0.201)	(0.215)	(0.223)	(0.223)
Year = (Baseline = Freshman)				
Sophomore	-0.13	-0.31***	-0.35***	-0.35***
	(0.10)	(0.10)	(0.11)	(0.11)
Junior	-0.20	-0.27*	-0.28*	-0.28*
	(0.15)	(0.16)	(0.17)	(0.17)
Senior	0.03	-0.36*	-0.32	-0.32
	(0.17)	(0.19)	(0.20)	(0.21)
HS GPA		-1.16***	-1.29***	-1.29***
		(0.11)	(0.12)	(0.12)
Math SAT/100		-0.38***	-0.49***	-0.49***
		(0.08)	(0.09)	(0.09)
Verbal SAT/100		-0.29***	-0.22**	-0.23**
		(0.09)	(0.09)	(0.09)
Took AP Micro		-1.27***	-0.74*	-0.74*
		(0.39)	(0.41)	(0.41)
Took AP Macro		-0.32	-0.63**	-0.63**
		(0.26)	(0.27)	(0.27)
Took Micro at Satellite Campus		-1.08	-0.16	-0.15
		(1.17)	(1.23)	(1.23)
Took Macro at Satellite Campus		0.34	-0.46	-0.45
		(0.97)	(0.98)	(0.98)
Took Micro First			0.03	0.04
			(0.18)	(0.18)
Took Macro First			-1.89***	-1.89***
			(0.21)	(0.21)
Low Income				-0.00
				(0.14)
First Generation				-0.03
				(0.14)
3 or More in Family				-0.24
				(0.22)
Constant	-1.39***	7.37***	8.67***	8.92***
	(0.07)	(0.62)	(0.68)	(0.71)
Observations	4093	3992	3992	3992

Notes - Full logit regression results with the outcome variable of getting a D, F, or W in the first micro class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** p<0.01, ** p<0.05, * p<0.1

Table A.6: Full Logit Regression Results - Outcome: D, F, or W in First Macro

	(1)	(2)	(3)	(4)
Female	-0.05	-0.06	-0.01	-0.02
	(0.11)	(0.12)	(0.12)	(0.12)
Intervention	-0.43***	-0.39***	-0.29**	-0.30**
	(0.14)	(0.14)	(0.15)	(0.15)
Intervention X Female	-0.08	0.05	0.00	0.01
	(0.22)	(0.23)	(0.24)	(0.24)
Year = (Baseline = Freshman)				
Sophomore	0.05	-0.09	-0.18	-0.19
	(0.10)	(0.11)	(0.12)	(0.12)
Junior	0.06	0.02	-0.05	-0.02
	(0.16)	(0.17)	(0.17)	(0.17)
Senior	0.06	-0.02	-0.21	-0.18
	(0.19)	(0.20)	(0.21)	(0.21)
HS GPA		-1.03***	-1.09***	-1.10***
		(0.12)	(0.12)	(0.12)
Math SAT/100		-0.40***	-0.36***	-0.37***
		(0.09)	(0.09)	(0.09)
Verbal SAT/100		-0.01	-0.07	-0.07
		(0.09)	(0.10)	(0.10)
Took AP Micro		-0.16	-0.76**	-0.75**
		(0.31)	(0.32)	(0.32)
Took AP Macro		-0.80***	-0.42	-0.44
		(0.31)	(0.32)	(0.32)
Micro at Satellite Campus		1.99*	1.29	1.34
		(1.21)	(1.21)	(1.23)
Took Micro First			-1.92***	-1.90***
			(0.18)	(0.18)
Took Macro First			-0.22	-0.21
			(0.17)	(0.17)
Low Income				-0.18
				(0.15)
First Generation				0.02
				(0.15)
3 or More in Family				-0.40*
				(0.22)
Constant	-1.70***	4.91***	6.26***	6.76***
	(0.08)	(0.64)	(0.70)	(0.74)
Observations	4093	3985	3985	3985

Notes - Full logit regression results with the outcome variable of getting a D, F, or W in the first macro class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, and (4) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.7: Full Regression Results - Outcome: Taking Any Future Econ Class

	(1)	(2)	(3)	(4)	(5)
Female	-0.14***	-0.14***	-0.14***	-0.13***	-0.13***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention	-0.13***	-0.14***	-0.14***	-0.15***	-0.15***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention X Female	0.11***	0.11***	0.11***	0.09***	0.09***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Year= (Baseline=Freshman)					
Sophomore	-0.18***	-0.17***	-0.17***	-0.17***	-0.17***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Junior	-0.20***	-0.19***	-0.19***	-0.18***	-0.19***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Senior	-0.32***	-0.33***	-0.33***	-0.29***	-0.30***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
HS GPA		0.02	0.02	-0.05**	-0.04**
		(0.02)	(0.02)	(0.02)	(0.02)
Math SAT/100		0.02*	0.02	-0.00	-0.00
		(0.01)	(0.01)	(0.01)	(0.01)
Verbal SAT/100		0.00	0.01	0.00	0.00
		(0.02)	(0.02)	(0.02)	(0.02)
Took AP Micro		0.12***	0.14***	0.12***	0.11***
		(0.04)	(0.04)	(0.04)	(0.04)
Took AP Macro		0.05	0.04	0.04	0.04
		(0.04)	(0.04)	(0.04)	(0.04)
Micro at Satellite Campus		-0.06	-0.03	0.00	0.01
		(0.22)	(0.22)	(0.22)	(0.22)
Macro at Satellite Campus		0.04	0.03	-0.02	-0.03
		(0.19)	(0.19)	(0.18)	(0.18)
Took Micro First			-0.07*	-0.03	-0.04
			(0.03)	(0.03)	(0.03)
Took Macro First			-0.12***	-0.09***	-0.10***
			(0.03)	(0.03)	(0.03)
First Econ Grade				0.09***	0.09***
				(0.01)	(0.01)
Low Income					0.02
					(0.02)
First Generation					0.00
					(0.02)
3 or More in Family					0.01
					(0.04)
Constant	0.63***	0.37***	0.45***	0.62***	0.59***
	(0.01)	(0.10)	(0.11)	(0.11)	(0.12)
Observations	4093	3992	3992	3820	3820
R-squared	0.07	0.07	0.08	0.10	0.10

Notes - Full regression results with the outcome variable of taking any future economics class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, (4) the addition of prior introductory economics grades, and (5) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** p<0.01, ** p<0.05, * p<0.1

Table A.8: Full Regression Results - Outcome: Taking Any Non-Intro Econ Class

	(1)	(2)	(3)	(4)	(5)
Female	-0.16***	-0.14***	-0.14***	-0.13***	-0.13***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention	-0.06***	-0.07***	-0.07***	-0.07***	-0.07***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention X Female	0.08**	0.07**	0.07**	0.05*	0.05*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Year= (Baseline=Freshman)					
Sophomore	-0.06***	-0.04**	-0.05***	-0.05***	-0.05***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Junior	-0.05**	-0.04	-0.04*	-0.04	-0.04
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Senior	-0.13***	-0.12***	-0.14***	-0.11***	-0.11***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
HS GPA		0.04**	0.04**	-0.01	-0.01
		(0.02)	(0.02)	(0.02)	(0.02)
Math SAT/100		0.06***	0.06***	0.04***	0.04***
		(0.01)	(0.01)	(0.01)	(0.01)
Verbal SAT/100		0.02	0.02	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)
Took AP Micro		0.15***	0.15***	0.13***	0.13***
		(0.04)	(0.04)	(0.04)	(0.04)
Took AP Macro		0.11***	0.12***	0.12***	0.12***
		(0.03)	(0.03)	(0.03)	(0.03)
Micro at Satellite Campus		0.07	0.08	0.11	0.12
		(0.20)	(0.20)	(0.20)	(0.20)
Macro at Satellite Campus		0.18	0.19	0.16	0.15
		(0.17)	(0.17)	(0.17)	(0.17)
Took Micro First			-0.23***	-0.20***	-0.20***
			(0.03)	(0.03)	(0.03)
Took Macro First			-0.23***	-0.21***	-0.21***
			(0.03)	(0.03)	(0.03)
First Econ Grade				0.07***	0.07***
				(0.01)	(0.01)
Low Income					0.02
					(0.02)
First Generation					-0.03
					(0.02)
3 or More in Family					-0.01
					(0.04)
Constant	0.40***	-0.24**	-0.03	0.09	0.11
	(0.01)	(0.09)	(0.10)	(0.10)	(0.11)
Observations	4093	3992	3992	3820	3820
R-squared	0.03	0.06	0.07	0.09	0.09

Notes - Full regression results with the outcome variable of taking any non-introductory economics class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, (4) the addition of prior introductory economics grades, and (5) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** p<0.01, ** p<0.05, * p<0.1

Table A.9: Full Regression Results - Outcome: Taking Any Intermediate Econ Class

	(1)	(2)	(3)	(4)	(5)
Female	-0.11***	-0.09***	-0.08***	-0.08***	-0.08***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention	-0.08***	-0.08***	-0.08***	-0.09***	-0.09***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Intervention X Female	0.08***	0.06**	0.06**	0.06**	0.06**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Year= (Baseline=Freshman)					
Sophomore	-0.04**	-0.02	-0.03**	-0.03**	-0.03**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Junior	-0.03	-0.02	-0.03	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Senior	-0.10***	-0.09***	-0.10***	-0.09***	-0.09***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
HS GPA		0.04**	0.04***	0.01	0.01
		(0.01)	(0.01)	(0.02)	(0.02)
Math SAT/100		0.08***	0.08***	0.07***	0.07***
		(0.01)	(0.01)	(0.01)	(0.01)
Verbal SAT/100		-0.00	-0.00	-0.00	-0.00
		(0.01)	(0.01)	(0.01)	(0.01)
Took AP Micro		0.11***	0.10***	0.09***	0.09***
		(0.03)	(0.03)	(0.03)	(0.03)
Took AP Macro		0.11***	0.12***	0.12***	0.12***
		(0.03)	(0.03)	(0.03)	(0.03)
Micro at Satellite Campus		0.14	0.14	0.16	0.17
		(0.17)	(0.17)	(0.17)	(0.17)
Macro at Satellite Campus		0.27*	0.28*	0.27*	0.26*
		(0.15)	(0.15)	(0.15)	(0.15)
Took Micro First			-0.20***	-0.18***	-0.18***
			(0.03)	(0.03)	(0.03)
Took Macro First			-0.19***	-0.18***	-0.18***
			(0.03)	(0.03)	(0.03)
First Econ Grade				0.05***	0.05***
				(0.01)	(0.01)
Low Income					0.03
					(0.02)
First Generation					-0.02
					(0.02)
3 or More in Family					0.00
					(0.03)
Constant	0.26***	-0.41***	-0.23***	-0.18**	-0.19**
	(0.01)	(0.08)	(0.08)	(0.09)	(0.09)
Observations	4093	3992	3992	3820	3820
R-squared	0.02	0.06	0.07	0.09	0.09

Notes - Full regression results with the outcome variable of taking any intermediate economics class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, (4) the addition of prior introductory economics grades, and (5) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** p<0.01, ** p<0.05, * p<0.1

Table A.10: Full Logit Regression Results - Outcome: Taking Any Future Econ Class

	(1)	(2)	(3)	(4)	(5)
Female	-0.61***	-0.59***	-0.58***	-0.57***	-0.57***
	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)
Intervention	-0.57***	-0.60***	-0.62***	-0.66***	-0.65***
	(0.09)	(0.09)	(0.09)	(0.10)	(0.10)
Intervention X Female	0.47***	0.47***	0.47***	0.43***	0.43***
	(0.14)	(0.15)	(0.15)	(0.15)	(0.15)
Year= (Baseline=Freshman)					
Sophomore	-0.74***	-0.70***	-0.72***	-0.75***	-0.75***
	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)
Junior	-0.83***	-0.81***	-0.81***	-0.80***	-0.82***
	(0.12)	(0.12)	(0.12)	(0.13)	(0.13)
Senior	-1.44***	-1.52***	-1.53***	-1.40***	-1.43***
	(0.15)	(0.17)	(0.17)	(0.18)	(0.18)
HS GPA		0.07	0.07	-0.22**	-0.21**
		(0.08)	(0.08)	(0.09)	(0.09)
Math SAT/100		0.11*	0.10	-0.02	-0.02
		(0.06)	(0.06)	(0.07)	(0.07)
Verbal SAT/100		0.01	0.02	0.00	0.00
		(0.07)	(0.07)	(0.07)	(0.07)
Took AP Micro		0.55***	0.64***	0.52***	0.51***
		(0.18)	(0.19)	(0.19)	(0.19)
Took AP Macro		0.22	0.17	0.15	0.16
		(0.16)	(0.16)	(0.17)	(0.17)
Micro at Satellite Campus		-0.40	-0.28	-0.19	-0.18
		(1.17)	(1.17)	(1.20)	(1.20)
Macro at Satellite Campus		0.19	0.11	-0.08	-0.09
		(0.88)	(0.89)	(0.89)	(0.89)
Took Micro First			-0.29*	-0.16	-0.16
			(0.15)	(0.15)	(0.15)
Took Macro First			-0.52***	-0.43***	-0.43***
			(0.15)	(0.16)	(0.15)
First Econ Grade				0.43***	0.43***
				(0.04)	(0.04)
Low Income					0.09
					(0.11)
First Generation					0.00
					(0.11)
3 or More in Family					0.05
					(0.18)
Constant	0.54***	-0.57	-0.21	0.55	0.43
	(0.06)	(0.45)	(0.47)	(0.49)	(0.52)
Observations	4093	3992	3992	3820	3820

Notes - Full logit regression results with the outcome variable of taking any future economics class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, (4) the addition of prior introductory economics grades, and (5) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.11: Full Logit Regression Results - Outcome: Taking Any Non-Intro Econ Class

	(1)	(2)	(3)	(4)	(5)
Female	-0.81***	-0.73***	-0.71***	-0.71***	-0.70***
	(0.09)	(0.10)	(0.10)	(0.10)	(0.10)
Intervention	-0.28***	-0.31***	-0.32***	-0.35***	-0.35***
	(0.09)	(0.10)	(0.10)	(0.10)	(0.10)
Intervention X Female	0.38**	0.32**	0.33**	0.29*	0.28*
	(0.16)	(0.16)	(0.17)	(0.17)	(0.17)
Year= (Baseline=Freshman)					
Sophomore	-0.29***	-0.21**	-0.26***	-0.28***	-0.28***
	(0.08)	(0.08)	(0.08)	(0.09)	(0.09)
Junior	-0.24*	-0.20	-0.23*	-0.20	-0.19
	(0.12)	(0.13)	(0.13)	(0.14)	(0.14)
Senior	-0.66***	-0.69***	-0.77***	-0.64***	-0.63***
	(0.16)	(0.17)	(0.18)	(0.19)	(0.19)
HS GPA		0.18**	0.18**	-0.09	-0.09
		(0.09)	(0.09)	(0.09)	(0.09)
Math SAT/100		0.29***	0.29***	0.20***	0.20***
		(0.07)	(0.07)	(0.07)	(0.07)
Verbal SAT/100		0.08	0.09	0.06	0.05
		(0.07)	(0.07)	(0.08)	(0.08)
Took AP Micro		0.67***	0.68***	0.58***	0.58***
		(0.18)	(0.18)	(0.19)	(0.19)
Took AP Macro		0.50***	0.53***	0.51***	0.51***
		(0.16)	(0.16)	(0.16)	(0.16)
Micro at Satellite Campus		0.23	0.29	0.41	0.43
		(1.21)	(1.22)	(1.24)	(1.25)
Macro at Satellite Campus		0.88	0.97	0.82	0.80
		(0.90)	(0.91)	(0.90)	(0.90)
Took Micro First			-1.03***	-0.94***	-0.93***
			(0.15)	(0.15)	(0.15)
Took Macro First			-1.05***	-0.98***	-0.97***
			(0.15)	(0.16)	(0.16)
First Econ Grade				0.42***	0.42***
				(0.04)	(0.04)
Low Income					0.12
					(0.12)
First Generation					-0.19
					(0.12)
3 or More in Family					-0.06
					(0.19)
Constant	-0.40***	-3.61***	-2.71***	-2.12***	-2.02***
	(0.06)	(0.49)	(0.50)	(0.52)	(0.55)
Observations	4093	3992	3992	3820	3820

Notes - Full logit regression results with the outcome variable of taking any non-intro economics class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, (4) the addition of prior introductory economics grades, and (5) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.12: Full Logit Regression Results - Outcome: Taking Any Intermediate Econ Class

	(1)	(2)	(3)	(4)	(5)
Female	-0.76***	-0.60***	-0.58***	-0.59***	-0.59***
	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)
Intervention	-0.51***	-0.54***	-0.56***	-0.60***	-0.60***
	(0.11)	(0.12)	(0.12)	(0.12)	(0.12)
Intervention X Female	0.47**	0.40**	0.41**	0.42**	0.41**
	(0.20)	(0.20)	(0.20)	(0.21)	(0.21)
Year= (Baseline=Freshman)					
Sophomore	-0.24**	-0.15	-0.21**	-0.21**	-0.21**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Junior	-0.19	-0.16	-0.20	-0.14	-0.15
	(0.14)	(0.15)	(0.15)	(0.16)	(0.16)
Senior	-0.74***	-0.74***	-0.85***	-0.80***	-0.82***
	(0.20)	(0.22)	(0.23)	(0.25)	(0.25)
HS GPA		0.26**	0.26**	0.01	0.02
		(0.10)	(0.10)	(0.11)	(0.11)
Math SAT/100		0.58***	0.59***	0.50***	0.50***
		(0.08)	(0.08)	(0.08)	(0.08)
Verbal SAT/100		-0.03	-0.03	-0.04	-0.04
		(0.09)	(0.09)	(0.09)	(0.09)
Took AP Micro		0.56***	0.52***	0.43**	0.42**
		(0.19)	(0.19)	(0.20)	(0.20)
Took AP Macro		0.58***	0.65***	0.61***	0.62***
		(0.17)	(0.17)	(0.17)	(0.17)
Micro at Satellite Campus		0.85	0.90	0.96	0.98
		(1.28)	(1.29)	(1.31)	(1.31)
Macro at Satellite Campus		1.72*	1.89**	1.79*	1.78*
		(0.94)	(0.94)	(0.94)	(0.93)
Took Micro First			-1.17***	-1.06***	-1.06***
			(0.16)	(0.16)	(0.16)
Took Macro First			-1.09***	-1.00***	-0.99***
			(0.16)	(0.17)	(0.17)
First Econ Grade				0.42***	0.43***
				(0.06)	(0.06)
Low Income					0.22
					(0.14)
First Generation					-0.17
					(0.14)
3 or More in Family					0.01
					(0.23)
Constant	-1.01***	-5.80***	-4.86***	-4.45***	-4.53***
	(0.07)	(0.58)	(0.59)	(0.61)	(0.65)
Observations	4093	3992	3992	3820	3820

Notes - Full logit regression results with the outcome variable of taking any intermediate economics class across models which included (1) only structural controls, (2) the addition of prior academic experience controls, (3) the addition of prior economics coursework controls, (4) the addition of prior introductory economics grades, and (5) the addition of family characteristic controls. Only includes students who received a C or higher in their first introductory economics course. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.13: Full Regression Results - Progression by Gender, Grade and Intervention

	(1)	(2)	(3)
	Any	Non-Intro	Intermediate
Female	-0.134	-0.17*	-0.07
	(0.101)	(0.0945)	(0.0818)
First Econ Grade	0.04*	0.05***	0.04***
	(0.02)	(0.02)	(0.02)
Female X First Econ Grade	0.00	0.01	-0.01
	(0.03)	(0.03)	(0.03)
Intervention	-0.36***	-0.12	-0.063
	(0.12)	(0.11)	(0.10)
Female X Intervention	0.22	0.10	-0.05
	(0.19)	(0.17)	(0.15)
Intervention X First Econ Grade	0.07*	0.02	-0.01
	(0.04)	(0.03)	(0.03)
Female X First Econ Grade X Intervention	-0.04	-0.01	0.04
	(0.06)	(0.05)	(0.05)
HS GPA	-0.03	-0.00	0.02
	(0.02)	(0.02)	(0.02)
Math SAT/100	0.01	0.04***	0.08***
	(0.02)	(0.02)	(0.01)
Verbal SAT/100	-0.01	0.01	-0.00
	(0.02)	(0.02)	(0.01)
Took AP Micro	0.09*	0.11**	0.07*
	(0.04)	(0.04)	(0.04)
Took AP Macro	0.05	0.13***	0.13***
	(0.04)	(0.04)	(0.03)
Took Micro First	-0.05	-0.23***	-0.20***
	(0.04)	(0.03)	(0.03)
Took Macro First	-0.10***	-0.23***	-0.19***
	(0.04)	(0.04)	(0.03)
Micro at Satellite Campus	-0.25	-0.15	-0.07
	(0.37)	(0.34)	(0.30)
Macro at Satellite Campus	-0.28	-0.13	-0.01
	(0.26)	(0.24)	(0.21)
Year= (Baseline=Freshman)			
Sophomore	-0.17***	-0.05***	-0.03*
	(0.02)	(0.02)	(0.02)
Junior	-0.20***	-0.04	-0.02
	(0.03)	(0.03)	(0.03)
Senior	-0.28***	-0.10**	-0.08**
	(0.04)	(0.04)	(0.03)
Constant	0.74***	0.11	-0.24**
	(0.13)	(0.12)	(0.11)
Observations	3237	3237	3237
R-squared	0.07	0.07	0.07

Notes - Separately for each next course outcome (taking any Economics course, any non-Intro Economics course, and Intermediate Economics), full regression results, with models which included structural controls and prior academic experience controls. Only students who received a C or above in their first introductory economics course. Controls equivalent to model 3 in table above. *** p<0.01, ** p<0.05, * p<0.1

APPENDIX B: Example Recitation Plan and Student Worksheet

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