

Seeking the “Missing Women” of Economics with the Undergraduate Women in Economics Challenge

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The economics undergraduate major has traditionally been large and popular at most of the highest-ranked US undergraduate institutions. It has also been predominantly male. In 2013, when the project we will describe was first conceived, there were almost three male economics majors for every female major, relative to overall numbers of male to female bachelor's degrees across the United States. Yet, female undergraduates had greatly increased as a fraction of all college students; in fact, their numbers exceeded those of male undergraduates around 1980 (in this journal, Goldin, Katz, and Kuziemko 2006). Economics was seemingly ignoring the change in student representation and not considering ways to attract more women. At that time, Goldin was the incoming president of the American Economic Association, and she raised the issue in various ways. She was soon persuaded by the Alfred P. Sloan Foundation to create a program to encourage more women to major in economics.

To prepare for this undertaking, Goldin obtained administrative data for a highly ranked undergraduate institution, dubbed “Adams College.” In 2013, the fraction female among its economics majors was 0.35, similar to the ratio at Adams's

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peer institutions. At a number of institutions, incoming first-year students are asked, before they arrive at the college, what they believe their primary major will be. At Adams, twice as many men as women listed economics as their most probable primary major. Similar results held for its peer institutions. Therefore, even before students unpacked their bags, the die had been cast: two men planned to major in economics for every woman who did the same. The first lesson from the Adams data was that useful treatments must occur soon after students arrive on campus.

In 2014, we commenced work on a far-reaching project we termed the *Undergraduate Women in Economics* (UWE, pronounced “you”) *Challenge*. The project was conceived as a randomized controlled trial, and it eventually included 88 schools (20 randomly chosen to be “treatment” schools and 68 in the control group). Its purpose was to understand why women were not majoring in economics to the same extent as were men and to create and evaluate “light-touch” and inexpensive interventions to address that gender gap.

We have written several papers about the reasons for creating the program, its implementation, and many offshoots of the program, and we will draw to some extent on those earlier papers here (Ailova and Goldin 2018, 2020; Goldin 2015). Now that undergraduate cohorts treated by the interventions have graduated, we can provide an assessment using nationwide data from the National Center for Education Statistics.

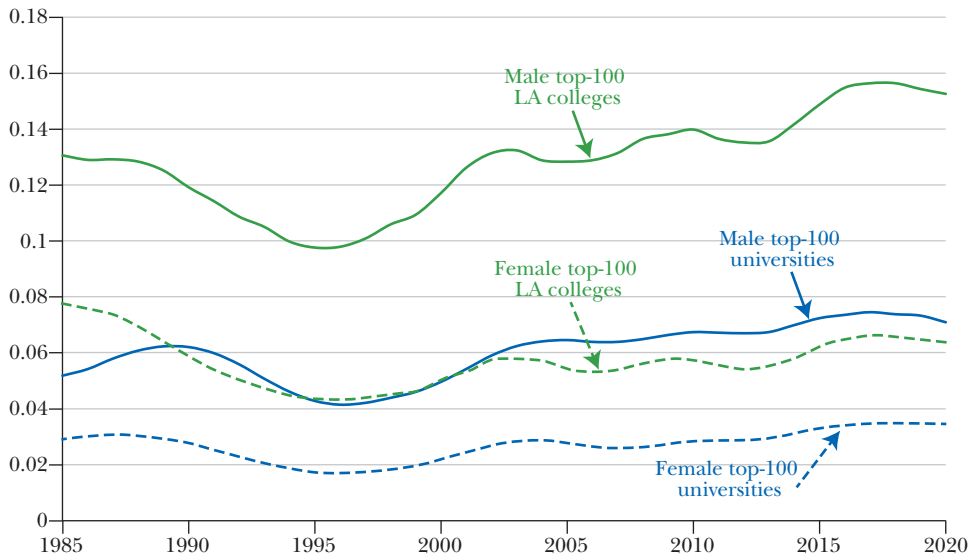
We begin describing the gender gap among economics majors and its trend across the last 35 years. We discuss in detail how the *UWE Challenge* was set up. We review some of the hypotheses, both from participants in the study and from the broader literature, on why a gender gap exists for economics majors. We then turn to the actual interventions. The bottom line is that UWE interventions were effective in increasing the fraction of female BAs who majored in economics relative to men in liberal arts colleges. Large universities as a group did not show an impact of the treatment. However, among the universities that implemented their own interventions as randomized control trials (what we call “RCTs within the RCT”), UWE interventions were moderately successful in encouraging more women to major in economics. We will speculate about why the interventions worked in some institutions but not in others, including the likelihood that control schools—which had already expressed interest in exploring ways to encourage more women to major in economics—may also have made efforts to increase women’s enrollment in economics after being assigned to the control group.

The Gender Gap for Undergraduate Majors in Economics

Data on bachelor’s degrees granted (either a Bachelor of Arts or a Bachelor of Science) and choice of college major are available from the Integrated Postsecondary Education Data System (IPEDS), which in turn is based on inter-related surveys conducted annually by the National Center for Education Statistics. Figure 1 shows the fractions of male and female students graduating from one of

Figure 1

Fraction Economics Majors among BAs by Gender for Top-100 Universities and Liberal Arts (LA) Colleges: 1985 to 2020



Source: NCES, IPEDS online.

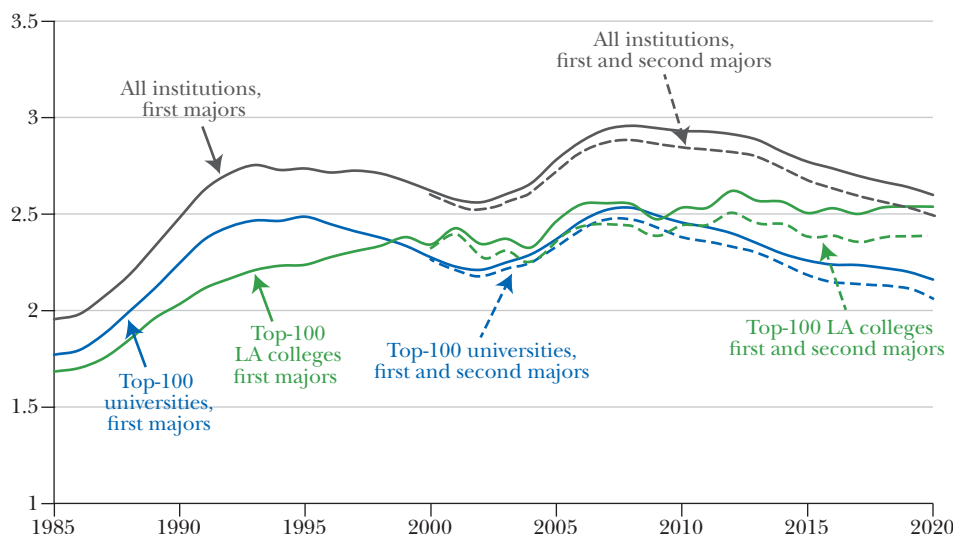
Note: The lists of “top-100” institutions (universities or liberal arts colleges) are from the combined 2011 and 2013 *US News & World Report* rankings. Both first and second economics majors are included (second majors are reported in the IPEDS data starting in 2001). Economics includes all fields under NCES CIP code 45.06. Years are from 1984 to 2021 and a three-year centered moving average is computed resulting in data for 1985 to 2020.

the top-100 universities or top-100 liberal arts colleges who majored in economics since 1985. Our definition of an economics major is that the field is included in National Center for Education Statistics (NCES) Classification of Instructional Programs code 45.06, which does not include business majors. We will soon see that even though our UWE program was open to all institutions, the vast majority with sufficient economics majors were in one of the two top-100 groups.

The gap in majors between men and women is clear from Figure 1. Around 6.5 percent of women BAs at the top-100 liberal arts colleges majored in economics in 2020, but 15.3 percent of men did. For the top-100 universities, the figures are 3.4 percent for women and 7.1 percent for men. Another feature of the graph is that there does not appear to be much overall change across the 35-year period for female economics majors. Although all the lines increase from the mid-1990s to the present, the increase followed an earlier decrease. The figures for men in both types of institutions are, however, significantly higher in 2020 than in 1985.

Our preferred measure of the gender gap in undergraduate economics majors will be the ratio of the male to female fractions just mentioned, for each type of

Figure 2
Male to Female Conversion Ratios: 1985 to 2020



Source: NCES, IPEDS online.

Note: The male to female conversion ratio is given by $\left[\frac{\sum_i \text{Male_Economics_Majors}_{iy}}{\sum_i \text{Male_BAs}_{iy}} / \frac{\sum_i \text{Female_Economics_Majors}_{iy}}{\sum_i \text{Female_BAs}_{iy}} \right]$, which is the ratio of male to female economics majors divided by the ratio of male to female BAs across the institutions (i) included in each of the three groups in each year (y). Therefore, it is a national average for these institutions and aggregates all students. For the “top-100” groups, see note for Figure 1. “All” is for the entire United States. Solid lines give the conversion rate for the “first majors” only and dashed lines give the number for “first” and “second” majors, starting in 2001 (when the IPEDS began to report data on second majors). Note that adding second majors generally decreases the conversion ratio since relatively more women have economics as a second major. Schools are included only if they granted an undergraduate degree in economics. Economics includes all fields under NCES CIP code 45.06. The number of schools in each year for “all institutions” varies from about 1,500 to 1,900, and the average across the years is 1,758. Years are from 1984 to 2021 and a three-year centered moving average is computed resulting in data for 1985 to 2020.

institution or for all institutions. For example, in 2020 our measure of the gender gap would be $(15.3/6.5) = 2.35$ for top liberal arts colleges and $(7.1/3.4) = 2.1$ for top universities. When we analyze institutions separately, we will use a variant of the measure that uses the ratio of female to total majors, rather than female to male majors. Because these measures are scaled by the number of degree recipients, they show the extent to which male or female or all undergraduates are “converted” into economics majors. In consequence, we call the measure the “conversion ratio.” In the example just given for liberal arts colleges, this means that in 2020, 2.35 times more men than women majored in (or were converted to) economics, adjusting for the greater number of female bachelor’s degrees overall.

Figure 2 shows the conversion ratio for all institutions of higher education, as well as separately for the top-100 universities and top-100 liberal arts colleges presented in Figure 1. A complexity arises in the data that we highlight here. We have referred to the concept of a “major.” But schools have increasingly allowed students to have double (or even triple) majors. Thus, total bachelor’s degrees will not equal the sum of all majors when each graduate is allowed to have more than one major. The IPEDS began collecting information on multiple majors in 2001.

Majors are designated in the Integrated Postsecondary Education Data System as “first” and “second,” even if representatives from economics departments have told us that majors at their institutions are of equal importance for each graduate and that there are no firsts or seconds. To explore whether the addition of second majors matters to the conversion rate, the solid lines of Figure 1 give only the “first” major and the dashed lines include both majors, “first” and “second,” after 2001. We provide both to show that the differences are small but that women, more than men, take an additional major in economics when given the option.¹ Therefore, the number of male to female economics majors decreases somewhat when all majors are included rather than just the first major. It is not clear to us how the IPEDS allocates majors between first and second major when the institution treats them equally.² However, we will focus on the results for both majors, because the two lines are sufficiently similar.

In the most recent years, the number of male to female economics majors (adjusted for the number of BAs) exceeded 2.5 across all institutions, 2.35 for top liberal arts colleges, and 2.1 for top universities. As we noted before, these are the ratios of the fractions given in Figure 1 and demonstrate that men at US institutions outnumber women as economics majors more than 2.5 to 1.

The fraction of male and female BAs who majored in economics fluctuated across the 35-year period and, in consequence, so did the conversion rate. Although the proportion of women choosing to major in economics is higher now than 20 years ago in 2002, we are back to the levels achieved a decade earlier, in 1992. But in the last decade shown, with the exception of liberal arts colleges, there has been a relative increase in female economics majors. The Great Recession of 2007–2009 apparently led to an increase in economics majors in general, as economics often seems to attract more majors when the economy is malfunctioning

¹When the IPEDS first reported multiple majors in 2001, about 10 percent of all economics majors in our 88-school sample took it as a second major. At that time, the figure was about the same for men and women. But by 2021, about 19 percent of all female economics majors (first plus second) had economics as their second major, whereas 14 percent of the men did. The difference is even greater in the 23 liberal arts colleges in our sample, for which 24 percent of all female economics majors in 2021 had economics as their second major whereas 17 percent of the men did.

²The 2022/2023 IPEDS instructions do not include a clear way for schools to list double majors. The instructions are: “Double Majors: When a student receives a single degree with majors in two (or more) program specialties, report the degree in one program (1st major); you should report the second program specialty as a second major” (NCES 2022–2023). There is no guidance regarding which program to put first and second. If these are listed alphabetically, first majors will be a biased group. See also the discussion in Stock (2017).

in headline-grabbing ways. But the Great Recession also seems to have increased the *relative* number of female economics majors, except at liberal arts colleges.

The Birth of UWE

Given the historically low numbers of women relative to men in undergraduate economics, it is surprising how little attention was given to the subject. For example, in 1988, the American Economic Association (AEA) created the Commission on Graduate Education in Economics (COGEE) chaired by Anne Krueger (Goldin was one of the twelve members). The 18-page report allotted one paragraph to the fraction female among graduate students and applauded the increase of women among doctorates, which was 9 percent in 1977 but 19 percent in 1986. A smattering of articles explored why the representation of women in the undergraduate major had been low (for example, Canes and Rosen 1995; Dynan and Rouse 1997; Kahn 1995). The AEA Committee on the Status of Women in the Economics Profession (CSWEP) has collected survey data on the representation of women at different stages of the economics academic pipeline, including undergraduates, for several decades (Siegfried 2007). However, there was no major effort, of which we are aware, to change the status quo.

In the summer 2014, the Alfred P. Sloan Foundation generously funded a grant through the National Bureau of Economic Research that enabled the implementation of a randomized controlled trial, later named the *Undergraduate Women in Economics* (UWE) *Challenge*. The purpose of the randomized controlled trial was to uncover why women do not major in economics to the same degree as men and to assess what could be done about the disparity.³

In January 2015, UWE sent a letter, by email, to the department chair (or the undergraduate program coordinator) of every US college and university that had graduated at least 15 economics majors on average between the 2010–2011 and 2012–2013 academic years, asking if their department was willing to implement a set of interventions meant to increase the number of female majors.⁴ Although there were around 1,600 institutions at that time that granted a bachelor's major in economics, only 344 met our criterion on the number of majors (and also being coeducational). In addition, we did not have correct email addresses for all departments and many of our emails did not reach the intended person. Despite that, we received 167 affirmative responses, an astonishingly large number.

The letter we sent listed the most recent conversion rate at that institution, because it was discovered that many department chairs and undergraduate program directors did not know about the large gender imbalance at their schools. The heads of the departments or undergraduate programs were also asked if they would

³Tatyana Avilova was hired as the project manager for two years and then matriculated as a graduate student in economics at Columbia University, from which she received her PhD in 2022.

⁴Because Goldin was based at Harvard University, it was omitted from the sample.

be willing to cooperate in the collection of aggregated data that would not require Institutional Review Board approval. Finally, they were told that they would be given \$12,500 if they were selected to be part of the program and were informed that the funds could be used in any reasonable way that might further the stated objective. A list of possible light-touch (and inexpensive) interventions was included (see Appendix 1 for the letter and the list of interventions).

The exceptionally large number of positive replies allowed us to limit the sample to 88 schools with a larger aggregate number of economics majors (around 30) and a modicum of female majors. The 88-school sample, therefore, is not a small group of volunteer institutions. The group from which the 88 were drawn was large among US institutions granting a bachelor's in economics. By excluding schools with very few economics majors, most of our sample schools were in the top-100 universities or top-100 liberal arts colleges. (However, it should be noted that although the aggregate number of majors among the sample institutions was increased, the fraction of bachelor's majoring in economics in many of the schools was still occasionally quite small.)

Of the 88 schools in the sample, 20 were randomly chosen as treatments, and the rest became controls. For the randomization process, the schools were ordered from highest to lowest ranked using a combination of the 2011 and 2013 *US News & World Report* rankings and then divided into four "clusters" or strata of 22 schools ($22 \times 4 = 88$). The selection involved taking five schools *randomly* from each of four clusters. Appendix 2 lists the schools in the treatment and control groups and the method used to select the treatments. We will return to the issue of clusters again in the empirical estimation, although because we randomized within the cluster they should not have any meaningful significance with regard to the treatment variable. Their relevance is that the clusters enabled us to obtain a highly diverse sample of treatment schools, even though there are only 20 in the group. Seven of the 20 are state flagship institutions, four are large state universities, five are small liberal arts colleges, three are Ivy League institutions, and one is a large private institution. A few have business schools with undergraduate programs that include an economics major.

In spring 2015, UWE leadership met with primary investigators (faculty and teaching staff) of the 20 treatment schools to discuss what might work at their institutions. During the following academic year, treatment institutions used the funding and guidance from the project organizers to propose and initiate interventions that would disproportionately increase the number of female economics majors. The treatment institutions were encouraged, although not obligated, to continue the interventions going forward, but funding was provided only in the treatment year.⁵

⁵In fall 2018/winter 2019, remaining funds from the Sloan grant were made available to the schools as mini-grants for additional interventions. Six schools received grants ranging from \$1,500 to \$3,000. One treatment school (University of Central Florida) was granted a one-year extension to begin the program due to a personnel problem.

Why Are Women Underrepresented as Economics Majors?

The experiences of the schools in the *UWE Challenge* and their undergraduates revealed several issues concerning the provision of accurate information to all students about economics and regarding the career possibilities of an economics major.

One set of issues involves the considerable lack of knowledge about the field of economics among undergraduates. For example, many potential majors did not know that economics concerns subjects such as economic development, health, education, inequality, economic history, and population change and thought that economics was mainly or solely the study of financial markets.⁶ That view often dissuades women from majoring in economics, at the same time that it encourages men to do so.⁷ Another little-known fact is that there is a large and causal earnings premium for majoring in economics, independent of gender (Black, Sanders, and Taylor 2003; Bleemer and Mehta 2022).

A second set of issues is that underrepresentation can feed on itself. If fewer women are already economics majors, the field may seem less welcoming to women considering the field. Given the history of fewer women economics majors, there are also fewer women as economics alumnae or economics faculty, which again can make it harder for women who might be interested in economics to commit to the major. We also learned from many faculty and students that because economics is considered a conservative major and is criticized (unfairly, in our opinion), female undergraduates (who may be more sensitive than their male counterparts) could be dissuaded by some of their peers from majoring in the field. Economics clubs, for women or for all undergraduates, can provide strength in numbers and help foster a more welcoming environment.

Third, an often-heard hypothesis for fewer women majoring in economics is that it is rooted in less interest or ability in mathematical reasoning. However, the data from Adams College were clear: mathematical ability had little to do with the initial decision to major in economics and with the choice of an eventual major. This evidence is backed up by the fact that the fraction of female majors in economics is lower than in some fields of science, technology, engineering, and mathematics (in this journal, Bayer and Rouse 2016). Indeed, it does not appear that differences in aptitude, earlier course performance, or demographic characteristics play an important role in the fraction of women relative to men majoring in economics (Emerson, McGoldrick, and Siegfried 2018).

⁶The recognition that undergraduates do not know the range of careers, led the American Economic Association to produce the video, “Economics: it’s much more than you think.” The AEA video is at <https://www.aeaweb.org/resources/students/careers/video/career-in-economics>.

⁷In this way, gender imbalances also change the nature of economics, especially at the PhD level, since women and men gravitate to different fields within economics. On differences in economics fields by gender, see Fortin, Lemieux, and Rehavi (2021). On differences in opinions about economic policy by gender, see May, McGarvey, and Whaples (2014).

Finally, women’s greater sensitivity to feedback from grades appears to be an important factor that has led many to exit the field after taking the principles sequence, even when they have the *same* grades as men who remain with the major. Grading in economics is often akin to grading in the hard sciences, and less generous than grading in other social sciences or the humanities. Women who take principles but do not eventually major in the subject are disproportionately among those who obtained a grade below an A– in the course (Goldin 2015). The relationship holds even among those who, when entering college, gave economics as their probable major.

At “Adams,” 43 percent of the male students who received an A in the introductory course eventually majored in economics and 41 percent of the female students did. But 40 percent of the men who received a B+ eventually majored in economics, whereas 26 percent of the women did. The difference is even greater for those who got a B. Male undergraduates at “Adams” majored in economics almost regardless of their grade in principles. Therefore, conditional on the grade received, female students have a far steeper gradient (in other words, greater “grade sensitivity”) regarding their likelihood of majoring in economics. Similar results have been found by Patnaik et al. (2023) for the University of Wisconsin–Madison and by Antman, Skoy, and Flores (2022) for the University of Colorado Boulder. Butcher, McEwan, and Weerapana (in this journal, 2014) show how a college-wide anti-grade inflation policy increased economics majors at an all-women’s college.

It is possible that female students work harder in subjects at which they excel (or are told they excel), whereas male students take subjects they know will eventually benefit them. Female students may seek more comfort in their selection of a major, whereas male students stick with their goal even if they do poorly. Another possibility is that female students consider their grade in an introductory course to be an indicator of their future success in the discipline, whereas male students do not interpret it as such.

One factor seemed clear and imperative. Because majoring in economics requires taking many courses in sequence, accurate information about the major must be delivered early for it to have an impact on the choice of major.

Light-Touch Interventions and Their Effects on Choice of Economics as a Major

Types of Interventions

Most randomized controlled trials have specific treatments. But one size would not fit all the circumstances of our treatment institutions, which varied by size, resources, commitment of faculty, and the use of instructors and adjuncts. Instead, a list of potential light-touch and inexpensive treatments in three (somewhat overlapping) areas was assembled (again, see Appendix 1 for a fuller list) and treatment schools were requested to use several of them. Some schools designed their own inspired by the proposed interventions. Treatment schools submitted proposals and

progress reports, and these have informed our knowledge of the treatments each used. The treatments can be broadly grouped into three categories.

- (1) *Better Information*: These interventions were meant to provide more accurate information about economics and the career paths open to economics majors. Treatment schools in this category held pre-major department information sessions. Some created eye-catching flyers to give to first-year and upper-class students, either at academic fairs or at pre-major advising meetings. Some schools ensured that female professors, instructors, and/or upper-year students were at informational fairs. Prominent female alumnae, especially those working in exciting and diverse fields, were invited to speak at events.
- (2) *Mentoring and Role Models*: The intent of these interventions was to create networks among students and to show support for their decision to major in the field. Many of the treatment schools initiated “Undergraduate Women in Economics” clubs and the *UWE Challenge* sponsored several regional conferences. Departments organized clubs that either focused on recruiting women to economics or opened membership to all students but made promoting diversity in economics a central mission. The clubs were resource-intensive but appeared to be useful at both the larger departments and the liberal arts colleges. Schools that regularly had seminars invited more female speakers. The online Appendix lists many of the undergraduate conferences that were sparked by the *UWE Challenge*. Departments were encouraged to create programs to hire undergraduate research assistants, particularly women.
- (3) *Instructional Content and Presentation Style*: These interventions were intended to improve economics courses (primarily introductory courses, but not only those) to make them more relevant to a wider range of students. Four treatment schools (Connecticut College; University of California, Berkeley; University of Connecticut; and University of Richmond) created courses that expanded the topics discussed to demonstrate the wide range of economics and its broad concern with individual well-being.

Many schools also used a variety of nudge methods to encourage students. If women are more dissuaded from majoring in economics when they get below an A– in the principles course, then a treatment that involves sending an email to all B+ or B students after the midterm explaining that economics is difficult and that they received a very good grade should positively impact women more than men.

The Randomized Controlled Trial

The UWE randomized controlled trial began in fall 2015. The target treatment group consisted of first-year undergraduates and sophomores who had not yet selected their majors. Even juniors and seniors could have been “treated” if the treatments incentivized them to change their major to economics or to declare

a second major in economics. Much would have depended on the type of treatment, whether it was part of a class (such as having a female guest lecturer in principles) or a broader department event.

Again, schools elected to have a variety of treatments, some of which would have had an impact on all undergraduates and some of which would have affected only students in certain courses, such as principles. It is possible that majors graduating as early as the 2015–2016 academic year could have been “treated.” However, most of the impact would have been experienced among those who entered as first-years during the treatment year and graduated in academic year 2018–2019 or later, and for the existing sophomores, those graduating in academic year 2017–2018 or later. Of course, because many students take more than four years to complete their bachelor’s degree, the impact of the treatment could last beyond the cohorts’ expected graduation years.

To provide some broader empirical context to the analysis, Figure 3, panel A, graphs the fraction female among economics majors in the 88 institutions in the analysis sample from 2001 to 2021 and separately for the 23 liberal arts colleges and the 65 universities. Note that the institution is the unit of analysis in Figure 3 and all institutions are treated equally. (This is in contrast to Figures 1 and 2, in which students are aggregated by type of institution.) The fraction female among economics majors by institution in Figure 3, panel A, varies from around 0.29 to 0.32 and is higher for the liberal arts colleges than the others. The fraction declined leading up to 2008 and then rose somewhat. (Our measure here uses both “first” and “second” majors, for students with more than one major.)

But again, the fraction of *all* undergraduates and among *all* bachelor’s who are female also increased in this period and varied across institutions. Thus, we calculate a version of the conversion ratio used earlier. In this case, we calculate the share of female economics majors out of total female bachelor’s degrees and divide by the share of total economics majors out of total bachelor’s degrees. We use this version when individual schools are the unit of observation (here and in our regression analysis), because the number of female economics majors in some schools will be fairly small, and the earlier conversion ratio from Figure 2 is highly sensitive to observations with a very small number of female economics majors.

This alternative conversion ratio is graphed in panel B of Figure 3. The level varies from around 0.52 to 0.62, and the time trend, not surprisingly, is similar to that for the fraction female among economics majors. This ratio is, like that in panel A, higher for the liberal arts colleges.

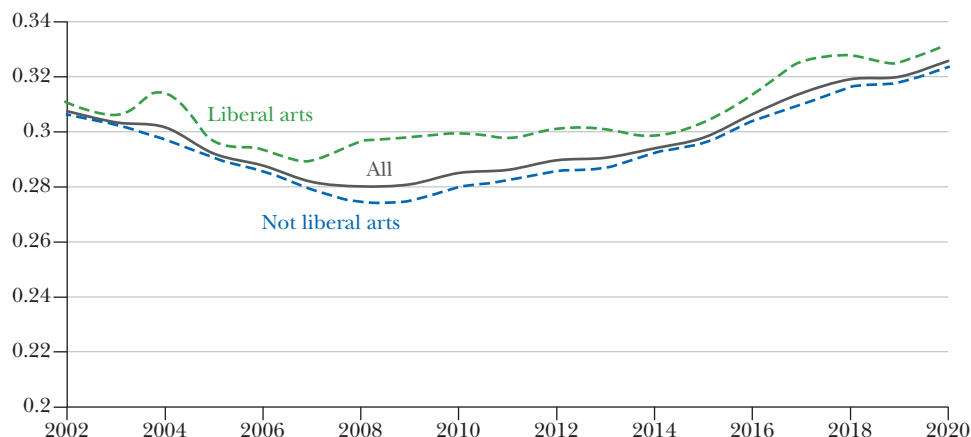
Table 1 summarizes our evaluation of our year-long interventions and whether they increased the adjusted ratio of female majors to all majors. We present the analysis in a series of four regressions. Data for all 88 schools are included in column 1; liberal arts colleges (five treatments and 18 controls) are in column two; all institutions other than the liberal arts colleges (15 treatments and 50 controls) are in columns 3 and 4.

The first two rows of Table 1 show, for purposes of context, the average value of the dependent variable, which is the total conversion ratio, and the average value

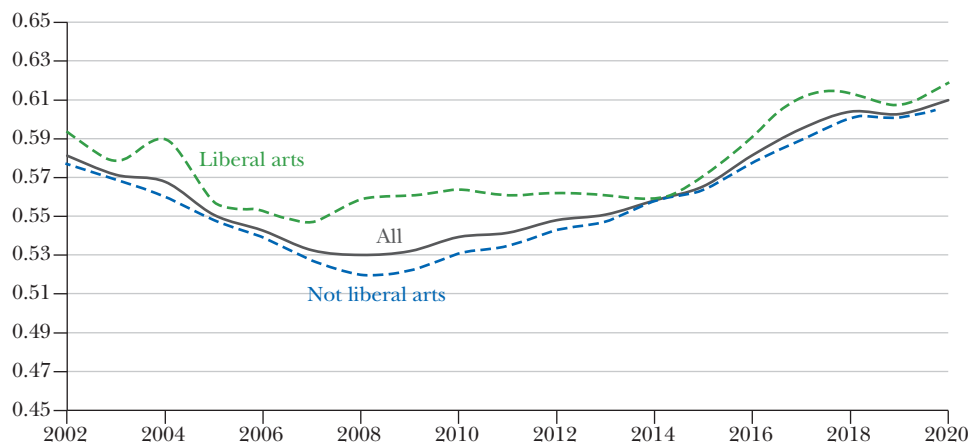
Figure 3

**Fraction Female and Female to Total Conversion Ratio:
88 Treatment and Control Schools, 2001–2021**

Panel A. Fraction female among economics majors in the 88 treatment and control schools



Panel B. Conversion ratio of female BAs relative to total BAs among the 88 treatment and control schools



Source: See Table 1.

Note: School data are not weighted and each institution is an observation. Part B: Conversion ratio is given by $\left[\frac{(\text{Female_Econ_Majors} / \text{Total_Econ_Majors})}{(\text{Female_BAs} / \text{Total_BAs})} \right]_{iy}$ and is the dependent variable in Table 1 (includes double majors since 2001). All series are three-year centered moving averages.

of the female share of economics majors. These averages, not unsurprisingly, are similar across the four columns.

We set the variable *Treatment* equal to one for each of the treatment schools and zero for the controls. The variable *Post* is set equal to one in each of the post-treatment academic years from academic years 2017–2018 to 2020–2021 (because of the small number of observations in each year, we follow this approach rather

Table 1

Evaluating the UWE Treatment on the Female to Total Conversion Ratio

	All institutions (1)	Liberal arts colleges (2)	All except LA colleges (3)	All except LA colleges (4)
Mean of the dependent variable	0.567	0.580	0.562	0.562
Mean of (female econ/total econ) ^a	0.300	0.308	0.297	0.297
Treatment school	0.0051 (0.0087)	0.0332 (0.0160)	−0.0109 (0.0103)	0.00811 (0.0128)
Post	0.0479 (0.0171)	0.0210 (0.0229)	0.0630 (0.0235)	0.0715 (0.0238)
Treatment × post	0.0127 (0.0197)	0.101 (0.0353)	−0.0169 (0.0234)	−0.0511 (0.0291)
Own RCT				−0.0471 (0.0185)
Own RCT × post				0.0846 (0.0426)
Liberal arts	−0.139 (0.0138)			
Public	0.0250 (0.0144)		0.0577 (0.0159)	0.0560 (0.0159)
log(Total BAs)	−0.0599 (0.00861)	−0.0473 (0.0228)	−0.0646 (0.00962)	−0.0635 (0.00962)
Constant	1.106 (0.0640)	0.858 (0.140)	1.167 (0.0716)	1.154 (0.0718)
R^2 (adjusted)	0.287	0.132	0.338	0.341
Number of observations	1,848	483	1,365	1,365

Source: NCES, IPEDS; first and second majors combined.

Note: Standard errors are in parentheses. Dependent variable is the female to total (= female + male) conversion ratio defined as $\left[\frac{\text{Female_Econ_Majors}/\text{Total_Econ_Majors}}{\text{Female_BAs}/\text{Total_BAs}} \right]_{iy}$ for each institution (i) in year (y). Treatment = 1 for the 20 treatment schools (see Appendix 1). The sample is from AY 2000-01 to AY 2020-21. Post = 1 for AY 2017-18 to AY 2020-21. Own RCT = 1 for the six treatment schools that did their own RCTs (see text): Colorado State University; University of California, Santa Barbara; University of Illinois Urbana-Champaign; University of Colorado Boulder; Southern Methodist University; and University of Wisconsin–Madison. Treatment was delayed for one year at the University of Central Florida, and the Post indicator has been changed accordingly. “Cluster” dummies (see Appendix 2) and their interaction with Post are included in all columns (see the online Appendix for the coefficients). Observations = number schools × years.

^aThe fraction of all economics majors who are female, *not* scaled by the fraction of BAs who are female. See also Figure 3, panel A.

than doing an event study estimating separate effects for each of the years). The key variable for interpreting our results is the interaction ($Treatment \times Post$), where the coefficient measures whether the conversion ratio at the treatment schools shows a meaningful change in the after-treatment period relative to the controls, as in a standard difference-in-differences analysis.

The main finding in Table 1 is that a treatment effect of the UWE intervention is discernable and substantial for the liberal arts colleges (column 2), but not for the

entire group of treatment schools (column 1) or the non-liberal arts institutions more broadly (column 3). The coefficient on $(Treatment \times Post)$ for the liberal arts colleges is 10 percentage points or 17 percent of the mean for the dependent variable. However, for the entire sample, the coefficient on $(Treatment \times Post)$ is only about 1.3 percentage points (with a large standard error) or 2 percent of the mean for the dependent variable, and for the “All Other” sample the coefficient on $(Treatment \times Post)$ is negative—and not statistically significant in either case.

Before discussing potential reasons for the different impact by type of institution, it will be useful to mention the other control variables. All columns include a variable to adjust for the total size of the institution as measured by (log) bachelor’s degrees granted. When relevant we also include a variable for whether the school is a liberal arts college, and whether the school is public or private. Note that the coefficient on liberal arts college in column 1 is negative because of the addition of the log of bachelor’s degrees and the cluster dummies. The negative coefficient on the log of bachelor’s degrees is also why the constant term is large (there are no schools with just a few students!). None of these controls has much, if any, impact on the coefficient of interest, that on $(Treatment \times Post)$.

We turn now to the interesting findings in column 2. One possible reason for the larger effect of treatments in the liberal arts colleges is their higher faculty–student ratio. In addition, the greater commitment from those faculty to the treatments may have enhanced the effects at liberal arts colleges. Several of the larger universities that attempted multiple interventions struggled to get broader faculty buy-in, despite the enthusiasm of the faculty and staff who were directly involved in the *UWE Challenge*. Most faculty participated in one-time interventions, but were less enthusiastic about those that demanded continued commitment. Department chairs at larger institutions were more likely to express concern about increased burdens on their female and underrepresented minority faculty.

Liberal arts colleges had other advantages as well. Their smaller size made it easier to reach potential majors. The relative size of the major may have also made a difference. In 2020, for example, just one out of every 200 bachelor’s degrees at the University of Central Florida, the largest of the treatment institutions, majored in economics, and 1 out of 100 did so at Illinois State University. At the University of California, Berkeley, 1 out of 12 majored in economics, and at Princeton, 1 out of 10 did. But at Williams College and Connecticut College, 1 in 5 graduates majored in economics. (Again, anyone with an economics major is included in these computations, even if they had another major as well.)

Adding to the problems of attracting more majors at large universities is the fact that in some public universities (such as the University of California, Berkeley), total enrollment in economics is limited by the institution. Also, some larger state universities have sizeable and prestigious (compared to other programs at the school) undergraduate business majors that compete directly with economics as a major.

But although there are ample reasons why the light-touch interventions could have reached too few undergraduates at some of the larger institutions, six

of the treatment universities did their own randomized controlled trial and evaluated them using administrative records from the schools (for which they each had approval from their own Institutional Review Board). We will discuss these randomized controlled trials (we called them “RCTs within the RCT”), and their findings, in more detail below. The deliberate implementation of experimental treatments and the presence of invested faculty may have enhanced the effect of the UWE treatment.

Here, we explore this possibility in column 4 of Table 1, where we have added a dummy variable (*Own RCT*) for the six treatment institutions that implemented their own UWE trials in the form of a randomized control trial within their own institution and interacted it with *Post*. The effect of their trial on the impact of the UWE intervention was 8.5 percentage points, or about 15 percent of the mean of the dependent variable. Note that all of the six are treatment schools. We do not have enough information about the control schools to include a similar variable, although we will discuss interventions by the few we have learned about. It should also be noted that the six treatment institutions had been below-average regarding their conversion rate (the coefficient on *Own RCT* is negative) and may have been prompted to do their own randomized controlled trial by a sense that they were laggards and that there was low-hanging fruit.

We should note an important, but not easily resolved, issue with our conclusion about the liberal arts colleges. First, our estimation for the five liberal arts colleges in the treatment group indicates that the increase in the conversion ratio preceded the treatment period. (The online Appendix provides a graph of the year dummies interacted with the treatment dummy.) There appear to be parallel trends for treated and untreated liberal arts colleges from 2001 to 2011, but from 2012 to 2014, the five liberal arts colleges in the treatment group show a higher conversion ratio before the treatments even began. We have sought to understand these anomalous findings, but given the size of our sample, we cannot.

Randomized Control Trials within the Challenge

As we noted above, six treatment schools—Southern Methodist University; University of Wisconsin–Madison; Colorado State University; University of California, Santa Barbara; University of Illinois Urbana-Champaign; and University of Colorado Boulder—executed their own randomized controlled trials. These interventions had mixed results.

Two of the most successful randomized controlled trials focused on role model interventions. At Southern Methodist University, Porter and Serra (2020) ran a field experiment to evaluate the effect of visits from two female alumnae of the economics department. This role model intervention increased the fraction of women taking the intermediate course within a year by 11 percentage points (on a base of 12 percent) and increased the fraction of women majoring in economics by more than 6 percentage points (on a base of less than 9 percent). These effects seem very large, perhaps because the two visitors were carefully selected by considering their occupations, appreciation for the field of economics, communication

skills, and overall “charisma.”⁸ There was no statistically significant effect on male students.

Building on the Porter and Serra (2020) findings, Patnaik et al. (2023) implemented a similar intervention at the University of Wisconsin–Madison and confirmed that an alumni visit can encourage female students to persist in economics by increasing their likelihood of taking an intermediate microeconomics course. Furthermore, they show that the effect is strongest when there is a gender match: a female role model increases the likelihood that female students take intermediate microeconomics by 5.0 percentage points (on a base of 12 percent), with no effect on male students. A male role model increases taking intermediate microeconomics for male students by 8.1 percentage points (on a base of about 23 percent), with no effect on female students. In addition, the effect of the role models, all of whom were white and two of whom worked at a Wisconsin-based company, was strongest for white, in-state Wisconsin residents.

The four remaining randomized controlled trials used informational nudge interventions. One achieved great success at attracting women to the field, whereas the others, for various reasons, did not.

At Colorado State University, Li (2018) tested the effect of three interventions in two of our three categories: better information and mentoring. Students in the principles course were first randomized to receive information about potential career paths and earnings of economics majors. The treated students were further randomized to receive information about the grade distribution in the course, and female students who received a grade above the median for the course were randomized to receive an additional (nudge) message encouraging them to major in economics. Finally, all female students, regardless of their grade, were randomized to participate in peer mentoring activities throughout the semester. The aggregate impact of the treatments on the decision to major in economics was substantial. The largest effect was for female students with grades in economics principles above the median: their probability of declaring economics as a major in the following year increased by 5.4 to 6.3 percentage points, a substantial change given baseline levels of around 15 percent.

At the University of California, Santa Barbara, in an experiment by Bedard, Dodd, and Lundberg (2021), principles students who earned a C or higher were sent personalized emails after the final exam inviting them to attend an informational session about the major. All students who earned a B or higher were randomized to receive an additional nudge message of encouragement to major in economics. The nudge message increased the number of women in the Economics and Accounting major and the number of men in the Economics major (generally perceived to be the more rigorous of the two). But overall, the authors did not find a statistically significant aggregate effect for the probability that a male or female student would choose any one of the economics majors. Although the heterogeneity analysis is

⁸Both alumnae visited all treatment classes, so it is not possible to disentangle their individual effects on the treated students.

imprecise due to small sample sizes, they did find that nudges were effective in increasing the fraction of students majoring in Economics and Accounting among Hispanic students, especially women.

At the University of Illinois Urbana-Champaign, Halim, Powers, and Thornton (2022) compared the effect of a nudge message that emphasized either the earnings benefits or the wide career benefits of majoring in economics. They found that neither treatment message had an effect on female students’ propensity to take another economics course or their likelihood of majoring in economics. Likewise, they found no effect on men’s likelihood of majoring in economics, although the earnings-information treatment did increase the probability that male students would take another economics course by 3.2 percentage points (on a base of 63 percent).

At the University of Colorado Boulder, Antman, Skoy, and Flores (2022) tested the effect of two interventions: one that elicited students’ beliefs about their relative performance in a microeconomics principles course they recently took and another that elicited their beliefs *and* provided information about their actual relative performance in that course. The authors found that women in the first treatment group were about 16 percentage points (on a base of 8.3 percent) *less* likely to major in economics, consistent with the idea that women are more sensitive to grades than are men. Women in the second treatment group were no more likely to major in economics than women in the control group, suggesting that accurate information about relative performance counteracted the negative impact of asking students to recall their actual grade and then self-evaluate their relative performance. Both interventions, oddly enough, substantially increased men’s probability of dropping out of college (!), but had no effect on either men’s likelihood of majoring in economics or women’s decision to drop out.

Three of the six randomized controlled trial interventions had large positive effects on female majors, and those that leveraged successful alumnae did best. Although these experiments were not uniformly successful in encouraging more women to major in economics, they were, in their defense, all creative and inexpensive interventions that built on the findings of the UWE project.

More important is the fact that faculty at these six institutions were more dedicated to the cause of advancing undergraduate women in economics. That may be why our investigation of the impact of the UWE treatment reveals that these six schools had a boost in the female to total conversion ratio in the post-treatment period.

Interventions at Control Schools

Our 88-school study sample consisted of institutions that had expressed interest in an initiative to encourage more women to major in economics. All the schools—both control and treatment institutions—received our suggested interventions, although the control group did not receive further guidance, nor opportunities to network with other departments, nor funding from the *UWE Challenge*.

However, other published work suggests that, consistent with their initial interest, at least some of the control institutions dedicated time and resources to addressing the gender gap in economics with methods resembling those at the treatment schools. At Oregon State University, a UWE control school, Pugatch and Schroeder (2021) found that simple nudge emails were enormously successful at encouraging students to major in economics. However, these interventions increased the majors only of the male students. Bayer, Bhanot, and Lozano (2019) conducted a field experiment at nine liberal arts colleges, testing the effects of one nudge message encouraging students to major in economics and of another message about the diversity of topics studied by economists. They found a positive and moderately significant effect of the broader message on students' likelihood of completing another economics course, but no difference by gender. We do not know the identity of the treatment schools in their study, but Bayer and Bhanot are both at Swarthmore College, a UWE control school.

Faculty at three other control institutions either used administrative data to learn about the factors that affect students' choice of major or conducted overviews of initiatives to encourage more women to join and persist in economics. At Georgetown University, Kugler, Tinsley, and Ukhaneva (2021) find that while women and men are equally likely to change majors in response to poor grades in relevant courses, women are more likely than men to switch out of male-dominated majors in science, technology, engineering, and mathematics. Using Wellesley College data, Butcher, McEwan, and Weerapana (2023) highlight the effect of the all-female liberal arts college environment on women's choice of mathematically-intensive fields. In this journal, Buckles (2019) presents a review of recent efforts to encourage women to join and persist in economics at all levels, from K–12 students to undergraduate students to associate professors.

Increased efforts among control schools, which we applaud, may also help explain the lack of statistically significant effects of the interventions in the analysis of our full sample. It may also help to account for the positive and significant coefficient on *Post* in all columns of Table 1—that is, there seems to be improvement over the years after the start of the *UWE Challenge*.

Progress Reports and Best Practices

All treatment schools submitted reports by spring 2016 describing their progress with interventions, obstacles encountered, and impressions of accomplishments. In 2018, seven treatment schools submitted reports on their judgment of “best practices” for encouraging women to major in economics: Brown University, Southern Methodist University, University of Richmond, University of Wisconsin–Madison, Washington and Lee University, Williams College, and Yale University. Based on this combined feedback, we classified interventions as either “effective”

or “ambiguously effective.” We describe these interventions in this section, with further details provided in the online Appendix.

Interventions classified as “effective” included invited speaker sessions and the formation of student clubs. The speaker and role model interventions included inviting well-known alumni to speak in principles courses (Patnaik et al. 2023; Porter and Serra 2020), increasing the number of female speakers in regularly scheduled seminars, and organizing a trip to a nearby Federal Reserve Bank. Student clubs focused on promoting women in economics or on diversity more broadly and were among the most widely implemented interventions. Faculty advisers remarked that identifying charismatic alumni takes time, as the speakers may need to be vetted in interviews. However, once connections with alumni are established, repeat visits can be relatively low cost. Faculty also gave overwhelmingly positive feedback about the ability of the clubs to foster lasting connections among students.

Interventions aimed at improving curriculum and pedagogy are the most labor intensive. Several schools offered new economics courses that applied economics to topics such as health, crime, marriage, and housing—courses that often offered possibilities for research in the local area. Finally, several schools implemented more targeted first-year/pre-major advising. For example, several departments worked with their registrar’s office or career services office to improve the pre-major advising system and to correct misinformation being shared about the economics discipline with undeclared students.

Not all attempts by our treatment institutions to encourage more female economics majors were successful. “Ambiguously effective” interventions that received mixed feedback from the schools included email nudges targeting either incoming first-years (to encourage them to take an introductory course in economics) or students at the end of their principles of economics course (to encourage them to take more courses/to major in economics). However, most schools that implemented this intervention did report some positive feedback, and two schools that ran their own randomized controlled trial found causal evidence that for some groups of women nudges increase the number of women majoring in economics (Li 2018; Bedard, Dodd, and Lundberg 2021).

In the category of interventions that focused on building community and support networks (included in the “mentoring and role model” group), the success of the initiatives relied on student buy-in. Tutoring services were typically reported as being successful. Online forums that allowed students to ask homework- and lecture-related questions or facilitated coordination of shared tutoring services or textbook costs were widely utilized.

Capacity constraints can pose a serious obstacle to growing the economics major. Economics is already among the largest majors on many campuses, and departments are often wary of increasing demands on faculty or overcrowding gateway courses. Initiatives that created opportunities for students to meet faculty outside of the classroom and additional research opportunities were received enthusiastically by students, but such interventions increased time commitments

for faculty, often more so for economics professors who were female or from under-represented minority groups.

An important conclusion from the “Adams” data was that interventions must occur soon after undergraduates arrive on campus, if not before. One of our treatment schools received permission from the admissions office to include information about the economics major in the welcoming packet sent to the incoming students before their first semester. The department noted a disproportionate increase in principles course enrollment among women that year. A UWE club at another school designed a successful outreach program specifically targeted at high school students in the area. Professional and scholarly associations of economists would do well to consider more systematic interventions at the high school level.

The *Undergraduate Women in Economics Challenge* tested whether a variety of low-cost and light-touch efforts could move the needle on female representation among undergraduate economics majors. There is evidence that it did. Interpreting the details of such experiments is undeniably tricky, given that all the schools in both treatment and control groups volunteered to participate in the challenge and comparable treatments were available to any school wishing to fund them. In fact, the *UWE Challenge* seemed to have sparked many economics departments, including some in our control group, to be less complacent about attracting only a large, if disproportionately male, number of majors, and to focus on attracting a more diverse group. If our efforts have led to a recognition of a range of low-cost ways that curriculum and advising can be altered to attract the group that now makes up the majority of bachelor’s degrees—women—we will have succeeded admirably.

■ *The authors thank the Alfred P. Sloan Foundation for funding the Undergraduate Women in Economics Challenge through grant no. G-2014-14504 and Danny Goroff of the Sloan Foundation for having the foresight to encourage Goldin to undertake the project. We are grateful to the many faculty members at the UWE treatment schools who worked to implement the various treatments, especially to those who ran their own randomized controlled trials at these schools. Thanks are also due to the UWE Board of Experts who helped set up the UWE Challenge. For additional details, see <http://scholar.harvard.edu/goldin/UWE>.*

Appendix 1

Sample Invitation Letter for the Undergraduate Women in Economics Challenge (Sent to Economics Departments at the 344 Institutions that Graduated at Least 15 Econ BAs, on Average, between AY 2010–2011 and AY 2012–2013)



Undergraduate Women in Economics

BOARD OF EXPERTS

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William Nordhaus, *Sterling Professor of Economics, Yale University; AEA President, 2014*
Richard Thaler, *Charles R. Walgreen Distinguished Service Professor of Behavioral Science and Economics, University of Chicago; AEA President, 2015*

January 23, 2015

Dear Professor Claudia Goldin,

We are inviting your economics department at Adams College to participate in an exciting initiative we are calling the *Undergraduate Women in Economics Challenge*.

The aim of the Challenge is to encourage undergraduate women to major in economics. **The Challenge will provide \$12,500 per school** to implement interventions designed to fulfill this aim. Schools will be given guidance, but the precise interventions will be left up to the department’s discretion. This initiative is funded by the Alfred P. Sloan Foundation through the National Bureau of Economic Research and endorsed by the American Economic Association.

We believe that the relative lack of women in economics needs to be addressed. Nationwide there are about three males for every female student majoring in economics and this ratio has not changed for more than 20 years. **At your institution, there were 1.89 male economics graduates for every female economics graduate.**¹ Although we cannot identify just one explanation for why gender differences persist, our Board of Experts from across the country met recently to figure out the common causes of this problem across institutions. You now have the opportunity to make your department part of the solution.

All we ask, at this point, is for you (or another person in your department or undergraduate office) to express an interest in joining the Challenge. We will choose, at random, at least 20 schools for the treatment group from among those that express an interest, with the remaining schools serving as the control group. The awarded funds can be used in a variety of ways to implement interventions targeting areas such as information, role models, and content and style of teaching. Examples of interventions are included on the following page. Participating institutions will submit a brief progress report every three months and provide information on the number and gender of students declaring majors (and eventually graduating from the institution) after the intervention. Upon the completion of the Challenge, data on the numbers of economics majors in the treatment and control groups will be collected and analyzed to assess the program.


If you are interested in participating in the Challenge, **please reply to this e-mail by February 13, 2015**. We will respond to all applications by February 27, 2015.

Regards,

Claudia Goldin
Henry Lee Professor of Economics, Harvard University
AEA President, 2013

Tatyana Avilova
Project Director, Undergraduate Women in Economics, NBER

¹ $\frac{(\text{Male Econ BAs})/(\text{Total Male BAs})}{(\text{Female Econ BAs})/(\text{Total Female BAs})}$ using US Dep. of Educ. data, averaged over 2011 to 2013.

Potential Interventions Devised by the UWE Team and Board of Experts


Potential Interventions		
Better Information	Mentoring and Role Models	Content and Presentation Style
<p>Without accurate information about the broader application of economics (e.g., beyond finance and consulting), women are more likely to major in less rigorous fields, often within the social sciences or humanities.</p>	<p>Women are more sensitive to their grades in introductory courses when choosing their major than are men. The creation of networks among students within the department and showing support for their decision to major in the field has been effective in recruiting underrepresented minorities.</p>	<p>On average, female undergraduates are less confident about their quantitative skills than are men even if they are equally able and prepared. Their lack of confidence may diminish their belief that economics fits their personal strengths and abilities.</p>
<p>Use the <i>UWE-AEA Video</i> (to be produced by the AEA before Fall 2015) during freshman orientation week to highlight key points about the major, including:</p> <ul style="list-style-type: none"> The many applications of economics; The diversity of its practitioners; and The range of potential careers. <p>Also use the video at the start of the introductory course, post it on the course website, and include it on the department's website.</p> <p>Augment the material provided on your department's website or in printed pamphlets to highlight information such as:</p> <ul style="list-style-type: none"> Subfields and upper-level courses; Various career options and course requirements for the different career tracks; and How economics relates to other fields and majors, and the high return to an economics degree. <p>Guest speakers in lecture and other times:</p> <ul style="list-style-type: none"> Invite alumni working in diverse fields to talk about their jobs and interests. Have talks during campus open days, e.g., freshman parents' weekend. Guest speakers in lecture classes should include diverse faculty in terms of gender, race and field. Recruit faculty, from non-business/non-finance fields, who are inspirational and approachable. 	<p>Mentoring:</p> <ul style="list-style-type: none"> Increase the number of female TAs/grad students/older undergrad mentors for students in intro and intermediate courses. Make a video of your alumni talking about their work involving economics, even though "economist" may not be in their job title. Facilitate opportunities for research and collaboration with the faculty. Help students find summer jobs that value economics, are dynamic, and include human contact. <p>Creating student learning communities:</p> <ul style="list-style-type: none"> Encourage coffee/study breaks in the economics department lounge. Organize student groups to work with the department to create talks and conferences on diverse topics. Connect with students through social media. <p>Faculty lunches:</p> <ul style="list-style-type: none"> Have informal lunches with professors and TAs. Pick faculty who specialize in diverse areas of economic research (e.g., health, labor, education, environmental, econ history, behavioral, corporate finance). <p>Student counseling:</p> <ul style="list-style-type: none"> Offer faculty counseling at midterms and other grade times (research papers, presentations, etc.). Convey that making mistakes is often part of learning economics. 	<p>Add modules and case studies to introductory and intermediate courses. Use more evidence-based material in teaching.</p> <ul style="list-style-type: none"> Present information through real-world examples that cover diverse subfields in economics and related disciplines. Include study results and also information on the researchers who did the work and how they became interested in the subject. Invite the researchers to give a lecture. Help faculty communicate more clearly and encourage more evidence-based theory courses. <p>Support independent/group projects in various sub-fields (e.g., health, education, poverty, crime, inequality, sports).</p> <ul style="list-style-type: none"> Have students interview community residents about issues in recent economics news (e.g., pay-day loans; Affordable Care Act; student debt) and how they have been affected. Coordinate community service opportunities that apply economic concepts and tie into course material. <p>Make sections more conducive to learning for students with different skill levels, styles of learning, and interests.</p> <ul style="list-style-type: none"> Separate sections based on students' quantitative experience, not by ability. If sections are heavily skewed by gender, deliberately change the gender mix and collect data on grades and drop-off rates.

Appendix 2: Treatment and Control Schools (= Liberal Arts College; # = Public Institution)*

20 Treatment Schools in Alphabetical Order

Brown University
 #Colorado State University (Fort Collins)
 *Connecticut College
 #Illinois State University
 Princeton University
 Southern Methodist University
 *St. Olaf College
 #University of California, Berkeley
 #University of California, Santa Barbara
 #University of Central Florida
 #University of Colorado Boulder
 #University of Connecticut
 #University of Hawaii, Manoa
 #University of Illinois Urbana-Champaign
 *University of Richmond
 #University of Virginia
 #University of Wisconsin-Madison
 *Washington and Lee University
 *Williams College
 Yale University

68 Control Schools in Alphabetical Order

American University
 *Amherst College
 Boston College
 Boston University
 Brandeis University
 Brigham Young University
 *Bucknell University
 *Carleton College
 Case Western Reserve University
 *Centre College
 *Claremont McKenna College
 #Clemson University
 *Colby College
 *College of the Holy Cross
 *Colorado College
 Cornell University

Dartmouth College
 *Davidson College
 *Dickinson College
 Duke University
 #George Mason University
 George Washington University
 Georgetown University
 *Gettysburg College
 #Indiana University, Bloomington
 *Lafayette College
 Massachusetts Institute of Technology
 #Michigan State University
 *Middlebury College
 Northeastern University
 Northwestern University
 #The Ohio State University
 #Oregon State University
 #Rutgers University-New Brunswick
 #SUNY at Binghamton
 *St. Lawrence University
 Stanford University
 #Stony Brook University
 *Swarthmore College
 #Temple University
 #Texas A&M University
 Texas Christian University
 #Texas Tech University
 Tulane University
 *Union College
 #University of Arizona
 #University of California, Davis
 #University of California, San Diego
 University of Chicago
 #University of Delaware
 #University of Houston
 #University of Kansas
 #University of Kentucky
 #University of Maryland at College Park
 #University of Michigan
 #University of Missouri, Columbia
 #University of North Carolina at Chapel Hill

University of Notre Dame
 #University of Oklahoma
 #University of Pittsburgh
 #University of Tennessee
 #University of Texas at Austin
 #University of Utah

#University of Vermont
 Vanderbilt University
 Wake Forest University
 *Wesleyan University
 *Wheaton College

Method for Selecting the Treatment Group from the Sample of 88 Schools

Rankings of universities and liberal arts colleges are from the 2011 and 2013 *US News & World Report*. The rankings for these two groups of institutions are separate, meaning that there is a #1 . . . #N for each group. We concatenated these lists, so that the top university and the top liberal arts college would both be #1 and so on down the list. This meant, given our criteria concerning the size of the major, that we had far fewer liberal arts colleges than universities but that the liberal arts colleges would be relatively high in our rankings.

We then divided the group of 88, that had responded favorably to our initial note and that had a sufficiently large group of economics majors (graduating 30 BAs or more on average between 2011 and 2013), into four groups of 22, from the highest to the lowest with regard to our rankings. We randomly selected five schools from each group of 22. Each of the groups of 22 is called a “cluster” and we have added a dummy variable for the cluster in the regressions and interacted it with either the “post” period or the year, depending on the specification.

We chose the selection method within these “clusters” to ensure, given our small treatment sample of 20, that we had schools across the distribution of rankings. The method, in addition, guaranteed that we had a substantial number of liberal arts colleges (23 in the sample group of 88 and 5 in the treatment group), many of the largest universities in the US, as well as several state flagship institutions, several Ivies, and a private university. The list of schools in each cluster can be found in Avilova and Goldin (2024).

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