

**Fixing the Leaky Pipeline:
Strategies for Making Economics Work for Women at Every Stage**

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Abstract

While women comprise over half of all undergraduate students in the United States, they account for less than one-third of economics majors. From there, the proportion of women at each stage of the academic tenure track continues to decrease, creating a “leaky pipeline.” In this paper, I provide a toolkit of interventions that could be implemented by individuals, organizations, or academic units who are working to attract and retain women students and faculty at each stage of this pipeline. I focus on smaller-scale, targeted interventions that have been evaluated in a way that allows for the credible estimation of causal effects.

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It is often said that the first step to solving a problem is to admit that you have one, and with regard to the representation of women in the economics profession, many economists now seem to have taken this step. Awareness of the gender gap in economics and interest in addressing it have been building slowly over recent years, but the issue was moved to the forefront by Alice Wu's (2018) study describing biased language on a widely-read web forum for economists. Since its release as a working paper in the summer of 2017, numerous media features have described the discipline's "problem with women" (Coyle 2017; see also Gittleson 2017; Wolfers 2017, 2018; "Inefficient Equilibrium: Women in Economics" 2017). Against this backdrop, the American Economic Association (AEA) has hosted a high-profile session on Women in Economics at its annual meetings, formed a standing Committee on Equity, Diversity, and Professional Conduct, and adopted a Code of Professional Conduct (available at <https://www.aeaweb.org/about-aea/code-of-conduct>).

While the AEA's actions are welcome, lasting change will require effort at all levels of the profession. But what, exactly, can be done? We are fortunate in that, over the last decade, researchers have begun to evaluate strategies for attracting and retaining women in economics and other disciplines in which they are historically under-represented. Some of this research has used the tools of rigorous policy evaluation, including randomized controlled trials, to evaluate interventions. Thus, we now have high-quality evidence that can help identify approaches that are likely to be effective. In this paper, I will draw on this evidence to provide a toolkit for those who want to increase the representation of women in economics. I focus on smaller-scale, targeted interventions that might be implemented by individuals or small groups who want to try to "move the needle" in their spheres of influence—a professor teaching an undergraduate class, a mentor to graduate students, an active member of a professional organization, or a department chair looking to retain women on the faculty.

The experience of women economists in higher education has been characterized as a "leaky pipeline," because the fraction of women in the discipline decreases at each stage along the path from graduate school to the full professor rank (CSWEP *News* 2018). Ph.D. The pipeline metaphor has been fairly criticized as being overly simplistic and linear (Branch 2016), but it remains useful for thinking about the issues women face and the possible solutions at different stages of academic life. Thus, in the sections that follow, I identify strategies for attracting and retaining undergraduate women, and for supporting the careers of graduate students and assistant and associate professors. Near the end of the paper, I turn my attention to the pipeline's "source": the K-12 experience. Finally, I consider ways that promising interventions could be adapted for women economists in non-academic career paths, discuss broader policy changes that might also help close the gender gap in economics, and offer some guidance for future work.

Undergraduate Students

In recent years, women have comprised about 56 percent of undergraduate students in the United States, but less than one-third of economics majors. Moreover, the proportion of women majoring

in economics has been flat for nearly thirty years, despite the rising share of women among undergraduates (Avilova and Goldin 2018).¹ Women are better represented in many similarly quantitative fields like math or the physical sciences.

Recognizing this issue, Tatyana Avilova and Claudia Goldin initiated the Undergraduate Women in Economics Challenge in 2015. Funded by a grant from the Alfred P. Sloan Foundation, the challenge aims to identify interventions that work to increase the numbers of women graduating with a degree in economics. The Challenge was implemented as a randomized controlled trial—specifically, 20 treatment schools were randomly chosen from a pool of 88 interested departments that had at least 30 economics graduates per year, and were in the top 100 universities or colleges according to *U.S. News and World Report*. The treatment group received \$12,500 to spend on initiatives designed to increase the number of women in their major, targeting the incoming class of freshmen in the fall of 2015. Freshmen classes were targeted because “the prime moments where female students relative to male students decide to major in economics are at the very start of their undergraduate life and just after taking Principles” (Avilova and Goldin, p. 4). Each department was allowed to design its own intervention as long as it did at least one of the following: 1) delivered better information to students, 2) provided mentoring or role models, or 3) altered instructional content and presentation style. These three objectives were chosen because they have been identified as particular challenges at the undergraduate level.

It is too soon to know the results of the Undergraduate Women in Economics Challenge. Students enrolling in fall 2015 are only now in their senior year, so the key outcome (economics graduates) is not yet observable. However, several treatment schools designed their own interventions as randomized controlled trials, creating “experiments within the experiment.”

For example, Colorado State chose an intervention in which sections of Principles courses were assigned to one of three groups (Li 2018). Students in sections in the first group received information about career prospects, average earnings, and grade distributions, and women whose grades were above the median at the midterm received an email encouraging them to major in economics.² Sections in the second group received this treatment and all women were also invited to a series of mentoring activities. Sections in the third group (the control group) received no treatment. Women with midterm grades above the median who received either the full or partial treatment were about six percentage points more likely to major in economics, off of a base of about 13 percent. These students were also more likely to say that they expected to enjoy studying and

¹ In recent years, the percent women is slightly higher for senior economics majors than it is for freshmen declaring economics as a major, suggesting that the profession is having modest success in winning college women over to the discipline (CSWEP *News* 2018). I return to the issue of women’s choice of major as incoming college students in the section on K-12 students.

² Rask and Tiefenthaler (2008) find that women are less likely than men to continue in economics after receiving lower (but still good) grades in their Principles courses.

working in economics in a follow-up survey, and that they believed they could succeed in economics. There was no statistically significant difference in the effect of full or partial treatment, perhaps because take-up of the mentoring activities was very low.³ The intervention decreased men’s likelihood of majoring in economics—an effect driven by men with midterm grades below the median. Li shows that men overestimated the grade they would get in the class by more than one grade point on average (based on a pre-treatment survey at the beginning of the semester), and hypothesizes that the information about the true grade distribution and their position in it may have discouraged some of these below-median men.

As another example, Southern Methodist University (SMU), implemented a randomized controlled trial in which female graduates who majored in economics spoke to students in Principles classes about their careers (Porter and Serra 2018). The intervention was inspired by research showing that female role models—and in particular, female instructors—can influence women’s career choices. As Porter and Serra discuss in their careful review of this literature, most studies rely on correlations in the data, but a few have taken advantage of random assignment. Two of the most relevant studies exploit the random assignment of cadets at the US Air Force academy to introductory courses in science, technology, engineering, and mathematics fields. The results show that high-ability cadets who are assigned to a female instructor are more likely to major in, work in, and pursue advanced degrees in these fields (Carrell, Page, and West 2010; Mansour et al. 2018).

While the evidence on the effects of professor gender on female enrollment is compelling, in practice it may be difficult for departments to manipulate instructor gender. Many economics departments do not have enough female professors to ensure that all students experience a class with one of them (a “chicken and egg” problem). Placing a disproportionate share of women professors in classes that students take early in their studies, such as Principles classes, poses problems of its own.

The surprising and promising finding of the SMU study is that exposure to female role models *other than the instructor* can have a noticeable effect. In the study, sections of Principles classes were randomly chosen to be visited by two career women who had majored in economics at SMU. Untreated sections serve as the control group, and the authors also collected data on the (untreated) classes from the previous year, to add a differences-in-differences element to the study design. The intervention increased women’s enrollment in intermediate economics classes by 13 percentage points, and increased the probability that women expressed an intention to major in economics by 7.9 percentage points—roughly doubling both measures. The added students appear to have been

³ While mentoring did not have an effect in the Colorado State program, the AEA’s Committee on the Status of Minority Groups in the Economics Profession conducts summer programs in which minority undergraduate students spend several weeks receiving both skills training and mentoring. Compared to students who applied to the program but did not attend, participants were more likely to enroll in and complete PhD programs in economics (Becker, Rouse, and Chen 2016). Among black economists working at academic institutions, those who participated in the program had better success with publications and grants (Price 2005).

drawn from those who otherwise would have majored in languages or the humanities, suggesting that this program's success in attracting women to economics did not exacerbate problems in other fields in which women are under-represented. Like the Colorado State study, the effects were largest for women with high grade point averages. The intervention had no effect on men's outcomes.

Porter and Serra (2018, p. 24) acknowledge that the mechanisms for this large effect are unclear—did the intervention work through *information*, or through *inspiration*? If it is mostly information, then the information could possibly be provided in even more low-cost ways. The effect sizes in the SMU study are larger than those in the Colorado State study, which effectively provided only information and a nudge. As more results from the Undergraduate Women in Economics Challenge study become available, we may gain additional insight that will help identify the essential components of this effective treatment.⁴

The Colorado State and SMU interventions focused on the first two areas targeted by the Undergraduate Women in Economics Challenge study—information and mentoring/role models. The third area is pedagogical innovation. The website “Div.E.Q.” (Diversifying Economic Quality at <https://diversifyingecon.org>), created by Amanda Bayer and sponsored by the Committee on the Status of Minority Groups in the Economics Profession, identifies several proven strategies that can be implemented in economics classrooms. For example, interactive learning techniques and values affirmation practices have been shown to eliminate gender gaps in introductory physics courses (Lorenzo, Crouch, and Mazur 2006; Miyake et al. 2010), with the latter having its largest effects on women who agreed with traditional stereotypes about gender and science. Courses that assess students using only high-pressure, timed exams are also more likely to result in anomalously low grades for women in introductory courses in science, technology, engineering, and mathematics classes (relative to their grade point average in other courses), suggesting that more diversified grading structures could help women succeed in those classes (Koester, Grom, and McKay 2016).

Graduate Students

The percent of students who are women in undergraduate and graduate programs in departments with doctoral programs has been nearly identical for the last several years, at around 30 percent; in departments without doctoral programs, the percent of undergraduates who are women is around 35 percent. (CSWEP *News* 2018). Women matriculate from Ph.D. programs at roughly the same rate at which they enter. The first significant leak in the academic pipeline occurs in the *transition* from graduate programs to assistant professorships. Of course, some of these women are moving into public or private sector jobs in economics. But given the research on the impact of female

⁴ An alternative way to expose undergraduate women to female role models is to select a textbook that includes more women. Stevenson and Zlotnick (2018) surveyed eight commonly used Principles texts and found that the share of people referenced who are women ranged from 10 to 34 percent.

professors and role models cited in the previous section, it is important to ensure that women have a fair shot at making it through graduate school, and making the transition into an academic job if they wish to do so. In this section, I will discuss interventions that can improve the experience of women Ph.D. students and help to ensure an even playing field for women on the academic job market for economists.

First, as with undergraduates, nudges that inform or encourage women have the potential to increase women's attachment to their graduate program or their chances for success. As an example, Unkovic, Sen, and Quinn (2016) conducted a randomized controlled trial investigating the impact of personalized emails encouraging graduate students to submit papers to an applied statistics conference in the social sciences. Of the nearly 4,000 students in the experiment, half received the treatment and the other half received no emails. The intervention increased submissions to the conference by 2.7 percentage points, and the strongest effects were for women from top programs (4.3 percentage points). However, women in the treatment group were less likely to have their papers accepted than those in the control. This might seem to suggest that the compliers were negatively selected, but in fact, treatment women who submitted to the conference were less likely to be in quantitative fields, and also were less likely to have a recommendation letter as part of the application. The authors suggest that female students lack networks and mentors that could help them navigate professional situations.⁵

When it comes to the job market, women can face biases that affect their probability of being hired. For example, a growing body of evidence suggests that students evaluate female instructors more harshly. MacNell, Driscoll, and Hunt (2015) found that students in an on-line only course rated a course more highly when they were told that the instructor was male, regardless of the instructor's actual gender (see also Mengel, Sauermann, and Zolitz forthcoming). Women are also given less credit for co-authored papers (Sarsons 2017), and recommendation letters for women are less likely to refer to their ability or agency (Schmader, Whitehead, and Wysocki 2007; Madera, Hebl, and Martin 2009). While an audit study by Williams and Ceci (2015) showed that academics generally show a preference for hiring a woman over an identical male candidate, male economists were an exception in their hiring decisions. Furthermore, academics are *not* more likely to hire a woman over a slightly more qualified male (Ceci and Williams 2015). So, if biases in teaching evaluations or recommendation letters make an equally qualified woman appear slightly less qualified, women will be disadvantaged even when facing an unbiased hiring committee.

Some recent programs designed to reduce gender bias or to increase the number of women hires are promising. In a randomized controlled trial at the University of Wisconsin-Madison involving 92 academic departments in fields involving science, technology, engineering, and mathematics, half of

⁵ The #EJMinfo twitter campaign began in 2017 as a way to make information about the job market and graduate school available to a wide audience, outside of traditional networks. In 2018, the American Economic Association introduced EconSpark, an online discussion forum with a similar aim (<https://www.aeaweb.org/economics-discussion-forum>).

the study's departments were randomly chosen to participate in a series of workshops on gender bias, while the other half served as a control group. The treatment group not only saw an increase in faculty members' awareness of gender bias issues and "self-efficacy to engage in gender-equity promoting behaviors" in the short term (Carnes et al. 2015), but also increased the proportion of women hired after the intervention by 18 percentage points (Devine et al. 2017). In departments where women were underrepresented, there was an increase in the probability of making a job offer to a woman (Fine et al. 2014). At Montana State University, search committees in science, technology, engineering, and math departments in a randomly-selected treatment group received training and some resources to support the hiring of women, and "searches in the intervention were 6.3 times more likely to make an offer to a woman candidate, and women who were made an offer were 5.8 times more likely to accept" (Smith et al. 2015). At the University of Michigan, a faculty committee focused on increasing the hiring of women met with departments and search committees; while the analysis is limited to a comparison of pre- and post-intervention outcomes, hires of women in science and engineering more than doubled (Stewart, La Vaque-Manty, and Malley 2004).⁶ Soll, Milkman, and Payne (2015) discuss more strategies for reducing bias in evaluations.

I would be remiss if I did not raise an issue that can adversely affect women's experience in graduate school—sexual harassment. While harassment can occur at any stage of the pipeline, graduate students are especially vulnerable, as their career success is highly dependent on their relationships with advisors, mentors, and other students. In a 2015 survey of 27 institutions of higher learning, 44 percent of graduate and professional women students and 30 percent of men reported experiencing sexual harassment; of those, 16 percent of women and 11 percent of men say that the perpetrator was a teacher or advisor (Cantor et al. 2017).

Many universities have mandated sexual harassment training for faculty and staff, but these programs have not been rigorously evaluated. One exception is a study by Bingham and Scherer (2001), which randomized sexual harassment training at a large university at the department level. The treatment that the researchers are able to observe is whether the individual viewed the training videos. The findings indicate that effective sexual harassment training is difficult to implement and there is a potential for unintended consequences. In this case, faculty members who viewed the videos had a better understanding of policy issues surrounding sexual harassment. But perversely,

⁶ In addition to these interventions specifically targeted at hiring women, more general efforts to make hiring more transparent or to standardize the evaluation of candidates can benefit traditionally under-represented groups (Bragger et al., 2002; Uhlmann and Cohen, 2005; Levashina et al., 2014). Efforts along these lines are currently underway at the Federal Reserve under the guidance of David Wilcox (CSWEP 2017).

men who viewed the videos expressed a lower willingness to report sexual harassment and were more likely to engage in victim blaming.

Many other approaches for decreasing sexual harassment have been offered—see the excellent CSWEP newsletter (2018) on the topic for examples. One specific proposal, which is also mentioned in the AEA’s Ad Hoc Committee on the Professional Climate in Economics (2017), suggests an “information escrow” system (Ayers and Unkovic 2012). In this approach, an online platform such as Callisto (<https://www.projectcallisto.org/>) is set up which allows victims of sexual misconduct to file a time-stamped report. If anyone else identifies the same offender, the victims will be contacted by a counselor who will discuss options for pursuing justice. This approach can encourage victims to come forward, knowing that they may be helping other victims or that their report may prevent future incidents. The report of the American Philosophical Association’s Sexual Harassment Ad Hoc Committee (2013) contains further recommendations for curtailing sexual misconduct. But as sociologist Frank Dobbin stated in reference to the American Sociological Association’s working group on harassment, "The research doesn’t show a very clear solution here . . . so we’re at a point where we need organizations to try more things. And we need more research" (Parry 2018).

Finally, a recent study by Bostwick and Weinberg (2018) uses quasi-random variation in cohort composition to show that women are more likely to persist in doctoral programs in science, technology, engineering, and mathematics fields when there are more women in their cohort. The effect is largest in male-dominated fields. If this result holds for economics, it implies that policies that increase the number of women in graduate programs could have a multiplier effect. That is, the marginal woman is not only more likely to earn a degree herself, but other women in her cohort are as well.

Assistant Professors

Once hired into the rank of assistant professor, women continue to face some of the same issues they faced as graduate students. But for many women, this stage also brings the additional pressures of the tenure or promotion process, increased family commitments, and the loss of formal mentoring structures. In this section, I will discuss strategies aimed at helping women succeed at this level so that their chances of being promoted to associate professor and receiving tenure are increased.

Given the importance of a strong publication record at this career stage, one strategy has been to reduce gender biases that could affect women’s probabilities of getting a grant or having a paper accepted for publication. For example, a policy of “blind refereeing,” which removes identifying information so that the reviewers of a paper or grant application do not know the identity or gender of the author, will also remove the opportunity to act on any biases such reviewers may hold. While laboratory-based studies have offered support for this idea (Knobloch-Westerwick, Glynn, and Huges 2013; Krawczyk and Smyk 2016), when this strategy has been evaluated in practice using natural experiments or audit studies, the results are mixed. In the late 1980s, the *American Economic*

Review conducted a randomized controlled trial in which submitted papers were randomly assigned to either double- or single-blind review (Blank 1991). Both men and women fared worse under double-blinded review; the effect was slightly stronger for men (suggesting that men benefit more from having their identities known), but the difference was not statistically significant. This finding is typical in this literature—double-blind journal review does seem to benefit women relative to men, but the effect size is small and not statistically significant in most studies (Tomkins, Zhang, and Heavlin 2017). Furthermore, there is not strong evidence of gender bias in reviewing in economics in the first place (Abrevaya and Hamermesh 2012; Bagues, Sylos-Labini, and Zinovyeva 2017), and in the internet era, it is increasingly difficult to conceal authors' identities. When combined, these facts suggest that blind refereeing is unlikely to have a dramatic impact.

Another intervention that has been proposed to help women at this stage is targeted mentoring (for a survey, see Meschitti and Lawton-Smith 2017). Mentoring can reduce information asymmetries, provide a support system, and connect women with role models (Croson and McGoldrick 2007). However, rigorous evidence on the effects of mentoring has been hard to come by—people often self-select into mentoring relationships and programs, outcomes can be difficult to measure, and mentoring itself is difficult to define.

Within economics, we have evidence from a randomized controlled trial that addresses these challenges. The intervention is a two-day mentoring workshop sponsored by the AEA's Committee on the Status of Women in the Economics Profession and now held annually after the association's annual meetings. Begun in 2004, participants in the program (known as CeMENT) are organized into small groups by research field, with each group including both senior mentors and junior mentees. The groups offer feedback on one another's work. Participants also attend panel discussions on issues such as publishing, promotion, and work-life balance. Many groups continue to operate as support networks long after the workshop.

Initially, the workshops were supported in part by an ADVANCE grant from the National Science Foundation, and the grant included funds for a randomized controlled trial. A study evaluating intermediate outcomes for the first two cohorts of participants shows promising results (Blau et al. 2010). Three years after the program, participants in the treatment group had 1.622 more publications and 0.09 more top-tier publications than the control sample on average. For the first cohort, outcomes were also observable five years after treatment, and the effect on total and top-tier publications was 2.677 and 0.200, respectively. The results are also supportive of a positive effect of the workshop on grant receipt. A follow-up study that will expand the sample to later cohorts and examine the program's impact on promotion and retention rates is currently underway.⁷

⁷ While not implemented as a randomized controlled trial, the NSF ADVANCE program also funded a mentoring program at Hunter College (Rabinowitz and Valian 2007). Assistant and associate professors that participated submitted more papers and grants in the two years after the program than they did in the year before.

Given this success, the CeMENT program has expanded over the years. Initially a biannual event, it is now held annually, with separate workshops for faculty from institutions with and without doctoral programs. Yet combined, the workshops still serve fewer than 100 women each year. How can the mentoring model be expanded or adapted so that more women can benefit? First, to increase scale, the intervention could be replicated at regional or field-specific conferences, or by a group of departments working collaboratively. Other disciplines have similar programs that could be used as models (Croson and McGoldrick 2007). Second, one of the aims of the workshop is to increase assistant professors' access to information about the profession; all of the handouts that CeMENT participants receive are now available online and can be shared. Third, department chairs or administrators can help junior women find mentors. A program at the University of Michigan (modeled on a similar program at Case Western University) provided new hires in science, technology, engineering, and mathematics fields with a "Launch Committee" of mentors. Participants had higher satisfaction with their service loads and with their work environment than similar non-participants (ADVANCE Program at the University of Michigan 2015). Fourth, many institutions already have mentoring programs in place but do not provide much guidance to mentors; a randomized trial involving mentors of clinical and translational research scholars showed that an eight-hour mentor training program could improve mentees' perceptions of their mentor's skills and behaviors (Pfund et al. 2014).

Finally, recent research has highlighted a policy that actually works against women on the tenure track—"gender-neutral" clock stopping policies that allow both men and women to add time to the tenure clock with the birth of a child. While the policies are often adopted in the interest of fairness, they can disadvantage women if men are able to be more productive during their extended time due to differences in child-care responsibilities or the impact of the birth itself. Using data on hires into the top 50 economics departments between 1980 and 2005 and a model with gender-specific university fixed effects, Antecol, Bedard, and Stearns (2018) show that this is in fact the case: "men are 17 percentage points more likely to get tenure in their first job once there is an established gender-neutral clock stopping policy in place, while women are 19 percentage points less likely" (p. 2422). This seems to be due to the fact that men at institutions with gender-neutral clock stopping policies have more top five publications, perhaps because they take more risks with the additional time or have more time to develop papers. Chairs and departments could share this evidence with administrators and encourage them to think carefully about adopting these policies.

Associate Professors

The biggest "leak" in the career pipeline occurs as women move from the ranks of associate professor of economics to full or endowed professor. In 2017, about 23 percent of associate professors in departments with doctoral programs were women, compared to only 14 percent of full professors (CSWEP *News* 2018). This gap has actually widened since 1993, as the increase in the share of women among associate professors has outpaced that for full professors. Despite this, there are very few programs targeted at helping women associate professors succeed, and those that do exist have not been carefully evaluated.

Nevertheless, some related research can guide the design of interventions at this stage. First, it seems likely that strategies that have been shown to help women at earlier stages in the pipeline could benefit tenured women as well—especially mentoring. Many women associate professors report a loss of mentoring and networks after tenure, perhaps because of “an assumption that tenured faculty have ‘made it’ and therefore can figure out the next steps with ease” (McQuillan et al. 2016, p. 71). But post-tenure challenges may be different, as Claire Potter (2013) describes in her article on the “associate professor blues,” as family responsibilities change and expectations for service mount. As both of these issues have been shown to disproportionately affect women, mentoring that includes strategies for navigating them could help move more women into the full professor ranks. A handful of universities including UNC-Charlotte, Brandeis University, Lehigh University, and Northeastern University (as discussed in Rochester Institute of Technology 2018) have developed mid-career mentoring programs. Also, CSWEP now hosts a mentoring breakfast for mid-career women at the annual AEA meetings in addition to its breakfast for junior women.

Second, women in academia do more service, and the service they do is more likely to be internal (and therefore less likely to be rewarded) (Guarino and Borden 2017). Babcock et al. (2017) conducted a clever laboratory experiment on “low promotability” tasks, in which groups were asked to push a button. All group members received a reward if someone pushed the button, but the person who volunteered to push it received a lower reward. In mixed-gender groups, women were 50 percent more likely to push the button. When one group member was tasked with asking someone to volunteer, they were more likely to ask a woman. This reveals a dangerous cycle—women are more likely to be asked to volunteer, and are more likely to say yes, which reinforces incentives to ask them.

To address this service gap, department chairs and university administrators could develop clear service expectations, and systems for quantifying and weighting service contributions, so that it is easier to see when service work is not being equally shared. Such a system will also guide faculty as they prepare for promotion, and should be used by promotion committees in their deliberations. Chairs could also develop service plans for all faculty members, to ensure that these responsibilities are being distributed evenly. A service plan also makes it easier for a faculty member to say “no” when appropriate, since she will have a directive from her chair.

Third, at most institutions, the criteria for promotion to full professor include some degree of visibility within the profession at large. This can be measured by invitations to participate in panels, to give a keynote address, or to serve on editorial boards. When these invitations are issued through existing networks, they can inadvertently exclude qualified women (resulting in the dreaded “manel”). Departments and professional organizations could have policies on representation, and could recommend best practices. In political science, the University of Arizona School of Government and Policy has sponsored an online, searchable database named “Women Also Know Stuff” (at <https://womenalsoknowstuff.com/>) on which women can register and identify their areas of expertise. The site is for academics and journalists to use “when writing syllabi; when planning conferences, panels, and speaker series; when citing research; when inviting essays and op-eds; and

when identifying experts for articles.” This model has recently been adopted in history, philosophy, and other science, technology, engineering, and mathematics fields. A similar database in economics could be developed by a professional organization or department.

K-12 Students

The career pipeline as I have described it thus far begins at the undergraduate level, as this is the point at which most academics first encounter potential economists. However, a serious discussion of strategies for closing the gender gap in economics must also include a look at the pipeline’s source—the K-12 level. Large gender gaps in college major intentions among incoming students suggest that many women are being discouraged from studying economics before they ever enter a Principles classroom (Goldin 2015). Avilova and Goldin (2018) offer an explanation: “Students often think that economics is only for those who want to work in the financial and corporate sectors and do not realize that economics is also for those with intellectual, policy and career interests in a wide range of fields” (p. 1). If women are less interested in finance and business (putting aside how those preferences are formed), then we could be losing many potential economists right out of the gate as a result of this misperception.⁸

One possible area for improvement is the design of Advanced Placement (AP) exams and courses, which are developed by the College Board in collaboration with academic economists. As most AP exam takers are college-bound, this is an ideal population to target for an intervention. Economists could work with the College Board to ensure that the AP courses present a more complete picture of what economists do. For example, the current AP Microeconomics course focuses on product markets, factor markets, and market failures and the role of government (College Board AP 2012). While these topics should remain central, the course could shift its content to include discussions of how economists apply these concepts to topics like health, education, family, crime, or development. These fields are relatively popular among women academics (Chari and Goldsmith-Pinkham 2017); it would not be surprising if they were also more appealing to women in high school.

A change to the AP economics curriculum has the potential to affect many students. In 2017, 141,649 students sat for the Macroeconomics exam, and 87,858 sat for the Microeconomics exam; 44 percent of the exams were taken by women.⁹ Moreover, if these changes were to spill over into the broader high school economics curriculum the impact could be even larger—22 states currently

⁸ When my daughter was in second grade, her teacher began a unit on economics by asking if anyone knew what economists study. My daughter, having heard me talk about my research, raised her hand and answered “families.” Her teacher kindly told her that she was incorrect, and that economists study money.

⁹ As reported at College Board, “Student Score Distributions, AP Exams—May 2017,” <https://secure-media.collegeboard.org/digitalServices/pdf/research/2017/Student-Score-Distributions-2017.pdf>.

require an economics course for graduation, and sixteen require standardized testing of economic concepts (Council for Economic Education 2018).

Fricke, Grogger, and Steinmayr (2018) provide evidence suggesting that this approach could increase women's likelihood of choosing to study economics. The authors exploit a natural experiment in which first-year college students are required to write a paper on a topic that is assigned quasi-randomly. Students assigned to write in economics were more likely to choose it as a major, and the effect was largest when students were assigned a paper in an area "*less typical of the public's perception of the field of economics*" (p. 199, emphasis added). Wang and Degol (2017) suggest that teaching adolescent girls about the ways that innovations in science and engineering improve people's quality of life could help close stubborn gender gaps across the science, technology, engineering, and mathematics fields. Indeed, some universities that have developed minors or programs that emphasize the social impact of the work of engineers have managed to eliminate or even reverse those gaps (Nilsson 2015).

Efforts to broaden students' understanding of economics fall outside the range of small, carefully evaluated interventions that I have highlighted for the other stages of the pipeline. I include this discussion because it is unlikely that economists will make substantial and lasting progress toward gender balance if we ignore the K-12 experience. More innovation and research is needed on this front; see the National Research Council's book "To Recruit and Advance" for strategies that academics can use to reach K-12 students (2006).

Discussion

The set of potential strategies for closing the gender gap in economics is large. In this paper, I have limited the set in three ways. First, I have framed the discussion of strategies for retaining women in post-graduate careers around the academic tenure track. However, nearly all of these interventions could also be adapted for women in the public or private sectors, or in non-tenure track academic positions. For example, most jobs have a "service" component that may disproportionately fall on women and especially women of color (Cross, Rebele, and Grant 2016; Williams and Multhaupt 2018), so many women could benefit from systems that measure and reward this work. Mentoring programs like the CeMENT workshops described earlier could be adapted for women in other career paths and implemented by professional organizations, or by firms and government agencies that employ women economists. Likewise, many of these strategies could be adapted to help increase the numbers of economists from other under-represented groups; see the wiki on "Div.E.Q." for examples of research in this area (at <http://diversifyingecon.org>).

Second, I have focused on smaller-scale, targeted interventions that could be implemented by individuals, organizations, or academic units who are working to attract and retain women students and faculty. Of course, some public policies could also help to accomplish this goal by making it easier for all women to manage professional and family responsibilities. For example, maternity and family leave policies have been shown to improve job continuity and to have long-lasting positive effects on employment, though leaves longer than a year may negatively impact women's careers

(Hegewisch and Gornick 2011; Rossin-Slater 2018). Better access to child care can help women maintain employment and work more hours in demanding careers (Furtado and Hock 2010; Cortes and Tessada 2011; Hegewisch and Gornick 2011), while flexible work arrangements are associated with reduced work-family conflict and increased job attachment (Gajendran and Harrison 2007). Though such policies are beyond the scope of this paper, they will likely be important for sustained progress toward narrowing the gender gap in economics.

Third, to the extent possible I have discussed interventions that have been evaluated in a way that allows for credible estimation of a causal effect. However, those willing to work toward greater diversity and inclusion in economics should not ignore the wealth of resources that describe thoughtful and inventive strategies that do not (yet) meet this standard (for examples, see National Research Council 2006; Stewart, Malley, and LaVaque-Manty 2007; CSWEP *News* 2017; Stewart and Valian 2018). Research in this area faces several challenges to causal identification—it can be difficult to find reasonable comparison samples, treatments are often bundled, and outcomes can be difficult to measure or take years to be realized. Even in cases where a “gold standard” randomized trial was used to evaluate an intervention, questions about external validity and replicability remain. As a result, we will likely have to try some things without knowing for certain that they will work. This is especially true at the associate professor and K-12 levels, where rigorous evidence on effective strategies is virtually non-existent. But this challenge also presents an opportunity for the profession to put its policy evaluation toolkit to work to advance knowledge, by building evaluation into implementation of policies or by finding creative ways to evaluate interventions after they have occurred. To aid this effort, the AEA could create a registry for randomized controlled trials aimed at attracting or retaining women and other under-represented groups to economics.¹⁰

Finally, while many of the interventions discussed here have been shown to yield important benefits, they also have costs. The CeMENT mentoring program requires a significant time investment from its mentors and even more from its organizers; anti-bias training can be expensive and requires faculty time; developing service plans and transparent systems for rewarding service can be complex and (again) time-consuming. Even lower-cost interventions like having successful alumni speak to Principles classes require time to coordinate and manage. As Bayer and Rouse (2016) argued in this journal, the entire profession is likely to benefit from a more diverse membership, as the range of views that are represented expands and group dynamics and decision-making improve. The costs of working toward that goal should not fall on the shoulders of women and underrepresented groups alone.

¹⁰ Wang and Degol (2017) identify several questions for future research on strategies for closing gender gaps in STEM fields.

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