Home Economics and Women's Gateway to Science*

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Abstract

We propose that collegiate home economics programs in the early 20th century introduced a generation of women to chemical and biological sciences. Using college-level data from the 1910 Commissioner of Education report and a collection of historical college yearbooks spanning 1900-1940, we document that a 10 percentage points increase in the share of women in home economics led to a roughly 3 percentage points increase in the share of women majoring in science. We also show that colleges with historical home economics programs have higher shares of women studying biology in years since 1965.

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1 Introduction

What explains differences in gender representation across science, technology, engineering, and math (STEM) fields? Over the past century, women have come to hold a growing share of STEM majors and jobs, although they are still underrepresented as a share of total STEM and there is substantial heterogeneity across STEM fields in terms of the speed of convergence and the size of the current gender gap (Barone, 2011; Goldin, 2014, 2021; Goldin et al., 2006; Kahn and Ginther, 2017). In particular, the share of women in life sciences, chemistry, and related fields (e.g., epidemiology, public health, and veterinary medicine) is much higher than in other physical sciences and engineering, a pattern that has been well documented over many samples and periods (Lubinski and Benbow, 1992; Xie and Shauman, 2003). This difference is perhaps surprising, since biology/chemistry on one hand and physical sciences/engineering on the other are similar along many dimensions. The two sets of STEM fields require similar training and credentials and have similar demands on individuals' time, factors which explain a large share of the gender gap across careers (Goldin, 2014, 2021). Several scholars have pointed to differences in math demands between biology/chemistry and physical sciences/engineering; see Kahn and Ginther (2017) for a thorough survey. While the degree of math may differ between biology and physics, this does not explain gender differences between all STEM fields, for instance between geology (40% female) and epidemiology (55% female).[1] Others argue that gender differences in subjective beliefs, such as interests in STEM occupations (Ceci et al., 2014), expectation to enjoy coursework (Wiswall and Zafar, 2015), expectations about family life (Wiswall and Zafar, 2021), alignment with cultural norms (Nollenberger et al., 2016; Zhao, 2020), etc., play for a large role in college major choices. But where do these gender differences in beliefs come from, and how are they subject to intervention? What is needed is an explanation that can produce substantial variation in gender preferences across seemingly very similar scientific disciplines and generate long-lasting differences.

This paper provides a historical explanation for this puzzle: collegiate home economics programs during the early 20th century introduced a generation of women to some scientific

[1] Data on gender ratios in these fields is from (National Center for Education Statistics, 2017).

fields, but not others. As a professional college major tailored to women, home economics was uniquely positioned to shape gender norms across academic fields during a time when women were first attending college in large numbers (Goldin et al., 2006). Today home economics is typically associated with a high school curriculum in domesticity—and indeed, one purpose of college home economics was to prepare women to become homemakers. But the early collegiate home economics curriculum heavily featured science content, especially biology and chemistry. Using data from historical college course catalogs, we document that from 1900 through 1930, biology and chemistry courses accounted for about a third of the required credits in a home economics degree, and in some years more than half of required credits were from biology and chemistry.After 1930, home economics reduced its scientific focus, and certain fields like physics and engineering were generally never featured prominently in the home economics curriculum.

Why would the home economics curriculum in the first two decades of the 20th century affect gender ratios in science today? Boyd and Richerson (1985), Alesina et al. (2013), Xue (2020), and Giuliano (2020) show that gendered attitudes are often transmitted across generations, and Eccles and Jacobs (1986) argue that this can be true in particular for academic stereotypes. Moreover, several studies find evidence that female role models can influence decisions of future cohorts of women (Beaman et al., 2009, 2012; Bleemer, 2016; Bostwick and Weinberg, 2022; Calkins et al., 2023; Dennehy and Dasgupta, 2017; Porter and Serra, 2020), and interventions that take place when cultural attitudes are in flux can substantially alter gender norms (Okuyama, 2021).If home economics led to a perception that biology and chemistry were appropriate fields for women to enter at a time when beliefs about women's place in higher education were new and unsettled, it is plausible that these perceptions would perpetuate to the present.

We modify a model by Altonji (1993); Altonji et al. (2012) to clarify the channels through which collegiate home economics could have led women to major in science. We identify three channels. First, there is an exposure effect: home economics incentivizes women who would otherwise become homemakers to go to college and major in home economics. While studying home economics and its corresponding heavy scientific content, enrollees can update their preferences early in their college careers and switch to a science major at little cost should they find they like it. Second, there is an option value: for women who would otherwise be indifferent between science and other majors, home economics increases their ex-ante return to attempt science by providing a backup option. Finally, there is a channel of intergenerational transmission: as the previous channels push more women into science, they generate an intertemporal spillover in which future cohorts observe their predecessors' success in science fields, increasing their beliefs they are more likely to be "science types." In the remainder of the paper, we draw on several data sources to test for each channel.

We test for exposure and option value effects using two datasets. First, we conduct cross sectional analysis using the 1910 Commissioner of Education Report, which is the only historical Commissioner of Education report to record enrollment by major and gender for a full set of college majors. Consistent with the presence of exposure effects, colleges whose share of women majoring in home economics is 10 percentage points larger have about 3.6 percentage points more women majoring in science. In placebo tests, we find that no other major similarly predicts the share of women in science. If the option value channel is strong, then the presence of a home economics program should predict women in science majors, regardless of the size of home economics enrollment; we find only weak evidence that this is the case. We explore heterogeneity of the exposure effect across types of colleges and find substantially larger correlations at public universities and land grant colleges.

The strong effect found in land grant colleges is not surprising. Home economics was closely tied to agriculture studies at land grant colleges, ensuring that its program was well funded in research and teaching and therefore upheld the highest scientific standard. More specifically, home economics programs could "piggyback" off funding from the 1887 Hatch Act and the 1914 Smith-Lever Act; both were federal funding to support the expansion of agricultural departments. We exploit this relationship to argue that the effect of home economics on science majors is likely causal, using the size of the agriculture program as an instrument for the share of women in home economics. Our IV results are similar to our baseline cross-sectional results. To ensure that our instrument is not working through other channels, such as the sharing of scientific equipment between agricultural and home economics departments, we take advantage of the fact that the 1910 Commissioner Report includes a wealth of information on colleges' endowments, the value of their scientific apparatuses, teaching disbursements by subject, etc. Controlling for all of these measures of resources does not affect our results. We also show that the size of the agricultural program does not predict female enrollment in any other majors that could not take advantage of the land grant funding.

While the Commissioner of Education report contains data on home economics and science majors for all colleges in operation in 1910, we have this information for only a single year. We therefore utilize a second source of data consisting of a panel of yearbooks collected from 21 colleges by Andrews (2023). While roughly the same number of men majored in science in colleges with and without home economics programs, virtually no women majored in science in colleges without home economics. We show that when a college increases the share of women majoring in home economics by 10 percentage points, the share of women majoring in science increases by about 2.7 percentage points; the correlation is largest for the decades 1900-1920, when the home economics curriculum was most science-intensive, and then declines in 1930 and 1940. While double majors are exceedingly rare in our data, women in home economics majors were more likely to double major in science than women in other majors. By restricting the sample to in-state students, we argue that this effect is unlikely to be driven by women selecting into colleges that are strong in both home economics and science. We also match students in the yearbooks to their families in previous decennial censuses, and show that home economics attracted women to attend college who would otherwise have been more likely to forego college and work fulltime in the home, namely women whose mothers were not in the labor force and whose fathers earned lower incomes. Furthermore, when the share of women majoring in home economics in a college increases, science majors increasingly come from families with these same backgrounds, suggesting that many of the flows into science caused by home economics were coming from women who would otherwise not have attended college, rather than drawing from other college majors.

Finally, we show that colleges with more women in home economics in 1910 also have more women in science in the years since 1965, consistent with the intertemporal spillover predictions of our model. One benefit of recent educational outcome data available from the National Center for Education Statistics (2017) is that we have information on detailed major choices; in the yearbooks and Commissioner report, in contrast, we can see when a student majors in science but not which scientific field they studied. We find that historical home economics predicts that a higher share of biology majors are female today, but a smaller share of engineering majors are female, consistent with the contents of the historical home economics curricula.

We draw a number of lessons from this study. First, we contribute to a nascent literature showing that the contents of educational curricula have long-lasting effects on students' cultural beliefs and labor market decisions. Cantoni et al. (2017) and Dhar et al. (2022) use survey evidence to assess the impact of a textbook reform and new classroom program, respectively, while Adukia et al. (2022, 2021) measure portrayals of race and gender in children's literature and find that messages in purchased books are correlated with children's later-life beliefs. More closely related, Arold (2022) documents that exposure to evolution theory in high school, as opposed to no exposure, caused more students to work in life sciences, and Martínez-Marquina (2022) finds that a women's educational program that focused on homemaking skills but did not contain scientific content decreased female labor force participation.[2] Together with our results, these studies suggest that it was the scientific content of the home economics curricula that led women into scientific fields, rather than the existence of the program per se. Second, we document the long-lasting effects of education policy decisions, showing that today's gender differences across academic fields have roots in curricular choices made in the first decades of the 20th century. Perhaps more worrisome for those interested in eliminating gender gaps across educational fields, it was precisely the aspects of early home economics that were most "rigorous" and "progressive" that led to women choosing biology and chemistry over other fields like engineering, leading to smaller gender gaps in some fields but larger gender gaps in others. On a more optimistic note, our findings give a dramatic example of what Goldin (2001) refers to as the "virtue" of "general education": by introducing women to subjects from many fields in the early years of their program, home economics opened doors to science that otherwise would have remained closed. A curriculum focused exclusively on practical homemaking skills

[2] Also of interest, Biasi and Ma (2022) show that students are less likely to pursue advanced degrees when their college courses have more outdated curricula. Arteaga (2018) show that reducing the amount of coursework required to obtain a degree (and hence less knowledge content in the college curricula) caused lower wages for college graduates.

without also teaching the underlying science would have been unlikely to reshape perceptions about women in science.[3]

This paper is organized as follows. Section 2 provides a brief history of home economics and describes the data. Section 3 presents a simple model illustrating the channels through which home economics pushed women into science and persistently shaped gender attitudes towards specific science fields. The remaining sections test for evidence of the channels highlighted in the model. Section 4 presents evidence for exposure and option value effects using cross-sectional data from the 1910 Commissioner of Education Report. Section 5 presents evidence for exposure and option value effects using the panel of college yearbooks. Section 6 presents evidence of intergenerational transmission of beliefs about gender in college majors. Section 7 concludes.

2 Historical Background and Data

We begin by briefly sketching the history of home economics in U.S. higher education, emphasizing how science-intensive its early curriculum was at a time that female college attendance was increasing dramatically.[4] In the process, we also describe the datasets we use in this paper.

2.1 Why Did Home Economics Emerge in the Late-19th/Early-20th Century?

The beginnings of home economics as an academic discipline is typically dated to September, 1899, when a conference at Lake Placid, New York, brought together several early luminaries to coin a name for the movement and set an agenda for future years (Dreilinger, 2021; Weigley, 1974). In reality, the formation of home economics was far less centralized, and important

[3] Goldin (2001) refers to "virtues" in the context of the American high school movement, but the principle—that openness and a general education allows students to experience more fields and find the best match for their individual skills—applies to first and second year college courses as well.

[4] Two full-length histories of the home economics movement in the U.S., Elias (2008) and Dreilinger (2021), also emphasize its early science focus. We draw on both of those histories throughout.

precursors took place decades before the Lake Placid Conference. We identify three important factors that led to home economics emerging when and how it did.

First, home economics got a jump start from the promotion of agricultural education in the late 19th century. Public support for agricultural training, best exemplified by the Morrill Land Grant Acts of 1862 and 1890 and the Hatch Act of 1887, represented a sharp break in the history of American higher education and contrasted sharply with the classical liberal arts curriculum practiced at most private colleges. Public land grant institutions were required to provide training in agricultural, mechanical arts, and military training, but these programs almost entirely served men. Creating a new field for women—home economics—provided a way for land grant colleges to further their democratic mission by increasing women's enrollment. Home economics also served a practical purpose, as increasingly sophisticated farmers required increasingly sophisticated wives. As the trustees at Iowa State College put it in 1869, "if young men are to be educated to fit them for successful, intelligent and practical farmers and mechanics, is it not as essential that young women should be educated in a manner that will qualify them to properly understand and discharge their duties as wives of farmers and mechanics?" (Eppright and Ferguson, 1971)

The early leaders of home economics embraced this connection with agricultural training, as it allowed them to benefit from the available public resources. By classifying home economics as a subject under the broad umbrella of agriculture, early home economists were able to unlock funding from the 1887 Hatch Act and 1914 Smith-Lever Acts.[5] In addition to providing direct funding, the US Department of Agriculture (USDA) provided employment opportunities for home economics graduates. The USDA Office of Home Economics opened in 1915, hiring home economists to work alongside agricultural experts (Elias, 2008).

Second, home economics benefited from the pace and direction of technological advances during the Second Industrial Revolution. During the early 20th century, high school attendance increased dramatically, preparing a generation of boys and girls for advanced education (Goldin and Katz, 1999a). Electrification brought labor-saving technologies into the home (Cowan,

[5]See Kantor and Whalley (2019) and Andrews (2021) for recent research evaluating the effectiveness of these laws at producing agricultural research through the land grant colleges and disseminating it to local communities. Neither study focuses on home economics.

1976, 1985) and skill-biased job opportunities in the service sector (Goldin, 2006; Gray, 2013; Vidart, 2020). Many of the scientific discoveries from the late nineteenth and early twentieth century were directly relevant to homemaking (Mokyr, 2000). The first home economics subject in 1900 was Hygiene and Sanitation (Elias, 2008), certainly not a coincidence given recent breakthroughs in bacteriology. As scientists better understood the germ theory of disease, they also came to realize that many diseases were preventable through better hygiene and sanitation; actually achieving better hygiene and sanitation, however, would require changing behavior inside the home, which required educating the homemakers (Stage and Vincenti, 1997).

Third, home economics was seen as a vehicle to provide both theoretical and vocational instruction to women at the higher education level. The participants at the Lake Placid Conference saw themselves as revolutionaries opening up new horizons for women.[6] They were emboldened to construct a curriculum that would be both practical but also abstract and scientific, but they were not above advertising the program as training for housewives if it would lead to greater resources and enrollment.

2.2 How Scientific Was the Field of Home Economics?

Home economics was thus widely seen as preparation for a purely domestic life, yet the programs had substantial scientific resources available and many early founders were determined to provide a rigorous education. So how scientific was the field of home economics in actuality?

Anecdotally, students who were interested in homemaking complained that the home economics curriculum was too theoretical and not practical enough, but the founders saw rigorous theoretical training as vital for women to access new career paths, since "they cannot all become teachers".[7] While histories of home economics often stress that the field was science-heavy in its early years (especially Dreilinger (2021)), to the best of our knowledge our study is the first attempt to quantify the changing nature of science in home economics.

We collect course catalogs from 15 colleges covering the years 1890 to 1953. We selected colleges to correspond to those for which we have data from college yearbooks, described below;

[6] This is the factor Dreilinger (2021) emphasizes most.
[7] Quoted by Ellen Richards in (McCollough, 1912).

for some colleges we were unable to locate historical course catalogs. From the catalogs, we manually transcribed course requirements for the home economics curricula. A sample from an Iowa State course catalog in presented in Figure 1.

From the Iowa State example, the influence of agriculture in the home economics curriculum is apparent. In fact, when Iowa State inaugurated its home economics program, the freshmen year courses for home economics were identical to those for the agriculture major. The sophomore year courses continued to include courses in chemistry and botany (Eppright and Ferguson, 1971). Since agriculture is a multidisciplinary field of biology, students who enrolled in home economics programs were fully exposed to the foundation of biological sciences. Before taking specialized home economics courses, students had to complete courses in chemistry, physiology, and bacteriology. This is typical across programs and is not unique to Iowa State. For example, the 1919 Cornell Catalog shows that women who wished to specialize in home economics must complete the same core courses as men in agriculture, covering biology, chemistry, physics, physiology, and bacteriology. Similarly, at Utah State University in 1911, students in domestic science had to complete courses in general chemistry and plant physiology in their freshman year, as well as courses in bacteriology, advanced physiology, and chemistry in their sophomore year.

Figure 2 shows the share of total required credit hours for the home economics degree over all course catalogs broken out by different subjects. Panel(a) plots eight different fields: chemistry, biology, health, math, engineering, physics, psychology, and finance. For readability, in Panel (b) we plot two larger groups, the first of which consists of biology and chemistry and the second of which consists of math, physics, and engineering. The overall pattern is clear: home economics majors had a surprisingly large share of credit hours in these technical fields, with the share peaking early in home economics' life around 1900, remaining high through 1920, and eventually declining.

A closer examination reveals how the focus of fields has changed over time. As mentioned above, the earliest home economics subjects were related to biology: health and hygiene applied

Figure 1: The Iowa State Home Economics Curricula

UNIFORM FRESHMAN YEAR

Fall Quarter	Credits[2]	Winter Quarter	Credits	Spring Quarter	Credits
Elementary Design A.A. 104[1]	2	Elementary Design A.A. 105	3	Household Equipment H Eq. 154	3
General Chemistry Chem. 105	4	General Chemistry Chem. 106	4	†General Physics Phys 106	4
Composition Engl. 101	3	Composition Engl. 102	3	‡Composition Engl. 103	3
Health Education Hyg. 104	3	Textiles T.&C. 104	3	Biology Zool. 104	3
Introd. to Social Sciences Hist. 211	3	Introd. to Social Sciences Hist. 212	3	Introd. to Social Sciences Hist. 213	3
Physical Education Phys.Ed. 121	R[3]	Physical Education Phys.Ed. 122	R	Physcial Education Phys.Ed. 123	1*
	15		16		17

In addition to the courses listed above, each student will be required to include in his schedule: H.Ec. 101, 102, 103. Psych. 110 and Library 106B make up the requirement of H.Ec. 101 in the Fall quarter.

SOPHOMORE YEAR

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Food Preparation F.&N. 204	4	Food Preparation *F.&N. 205	4	Human Physiology Zool. 255	5
Applied Organic Chem. 264	5	Food Chemistry Chem. 265	5	Physiol. & Nutr. Chem. Chem. 275	5
Principles of Economics Ec. 211	3	Principles of Economics Ec. 212	3	Ec. of Consumption Ec. 213	3
Costume Design T.&C. 144	3	House Planning A.A. 260	2	Interior House Design A.A. 264	3
		Early 19th Century Engl. 254 or Technical Journalism T.Jl. 225B	3		
Physical Education Phys.Ed.221	R	Physical Education Phys.Ed. 222	R	Physical Education Phys.Ed. 223	1**
	15		17		17

*Home Experience, F.&N. 207, required upon completion of F.&N. 205. See page 202.
**One credit is given upon the completion of three quarters' work.

JUNIOR YEAR

Large Quantity Cookery I.Mgt. 380	4	Meal Planning F.&N. 303	4	Nutrition and Dietetics F.&N. 305	4
Household Bacteriology Bact. 304B	5	Applied Sociology Ec. 384	3	Mid-19th Century Engl. 255 or **Electives in English	3
American Government Govt. 315	3	General Psychology Psych. 204	3	Extempore Speaking P.S. 311	3
Electives	3	Clothing T.&C. 224	3	Child. & Adolescence Psych. 415	3
		Electives	3	Electives	3

recent knowledge of bacteriology, while food and nutrition built on recent discoveries of vitamins and advanced the frontier of food science. In 1900, more than one out of every three required home economics credit hours was devoted to biology, and more than half were devoted to either biology or chemistry. This share declined to just over 20% by 1950 as the main topics of focus shifted.[8] In the 1930s, home economics training added developmental psychology, possibly in response to the cultural shift in the belief that children deserved protection, nurture, and education. The 1920s, and especially the Great Depression decade of the 1930s, saw the addition of courses on personal finance. While worthy subjects, the shift towards psychology and personal finance reduced home economics' traditional emphasis on biology and chemistry; in later decades, the field would double down on its domestic focus, with science almost entirely disappearing from its curriculum (Dreilinger, 2021). Physics and engineering, while always present, accounted for only a small share of credit hours in all years. From these figures, it is therefore not surprising that women who studied home economics, especially before the mid-1920s, would have been very familiar with ideas in biology and chemistry.

In Appendix C, we also collect data on the content of academic journal articles published in the Journal of Home Economics beginning in 1909. These journal articles paint a similar picture: the field of home economics was very science-focused, especially in biology, chemistry, and related fields, in its earliest decades and peaking around 1920. In subsequent decades, the field had less scientific and less concentrated on biology and chemistry.

2.3 How Large Was Home Economics within Higher Education?

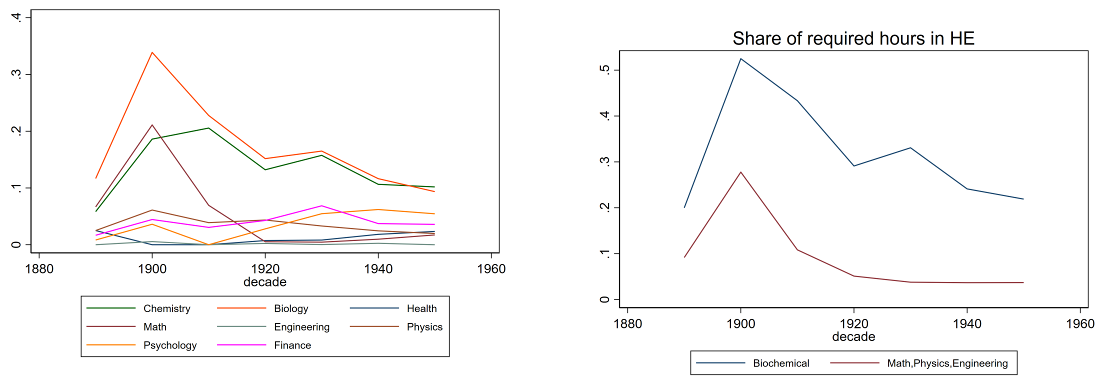
Was home economics large enough to expose a large number of college-going women to science? We draw on two data sources to quantify the size of home economics over time: reports from the U.S. Commissioner of Education and college yearbooks.

[8]Although life sciences dominated early home economics science requirements, as farming continued to mechanize and electrified household appliances were continuously invented, home economics also began adding courses in household equipment and courses in physics and electric circuits were sometimes required (Bix, 2002). Our data show that home economics curricula always required more biology- and chemistry-related courses than those related to physics or any engineering field, including electrical and mechanical.

Figure 2: Share of Required Credits in Home Economics belonging to Different Subjects

(a) All Subjects

(b) Bio-Chem vs. Math, Physics, and Engineering



Notes: Share of required home economics credit hours belonging to different subjects. Data source: Course catalogs.

2.3.1 Commissioner of Education Reports

The U.S. Commissioner of Education published annual reports until 1915, and biennially thereafter until 1957. These reports list self-reported information from each U.S. institution of higher education, including data on enrollment for professional majors. Commissioner of Education reports have been transcribed and used by several previous researchers, including Goldin and Katz (1999b) and Xiong and Zhao (2019).

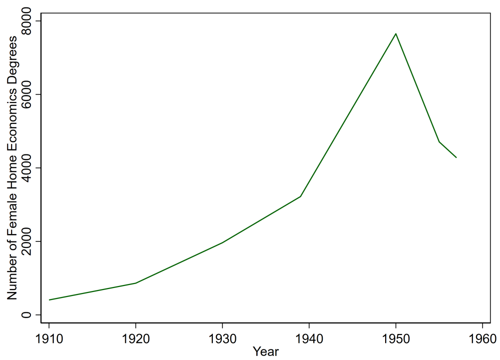
Figure 3 Panel (a) plots the total number of home economics degrees conferred in several different waves of the Commissioner Reports.[9] Home economics started out small in the early 20th century but grew rapidly, with enrollment peaking at almost 8,000 students in 1950 before declining thereafter. Panel (b) plots the share of female home economics degrees conferred out of all degrees conferred to women. The share is also the highest in 1950 at almost 8% of all degrees women earned, although the share also reached about 6% in 1920 before declining slightly in the 1930s and 1940s and increasing again after World War II. In 1910, when the field

[9]While the Commissioner Reports record degrees conferred, the number of students enrolled in a home economics major may be a more relevant statistic, especially if women switch from studying home economics to a science major. The 1910 Commissioner Report includes both degrees conferred and enrollment by major. According to the 1910 Report, the ratio of degrees to enrollment for women is approximately 1:10.

of home economics was new and many colleges had not yet established programs, less than 1% of female degrees were in home economics, making the leap to 6% in 1920 even more impressive.

Figure 3: Female Home Economics Degrees Conferred by Year

(a) Total Number of Degrees (b) Share of All Female Degrees



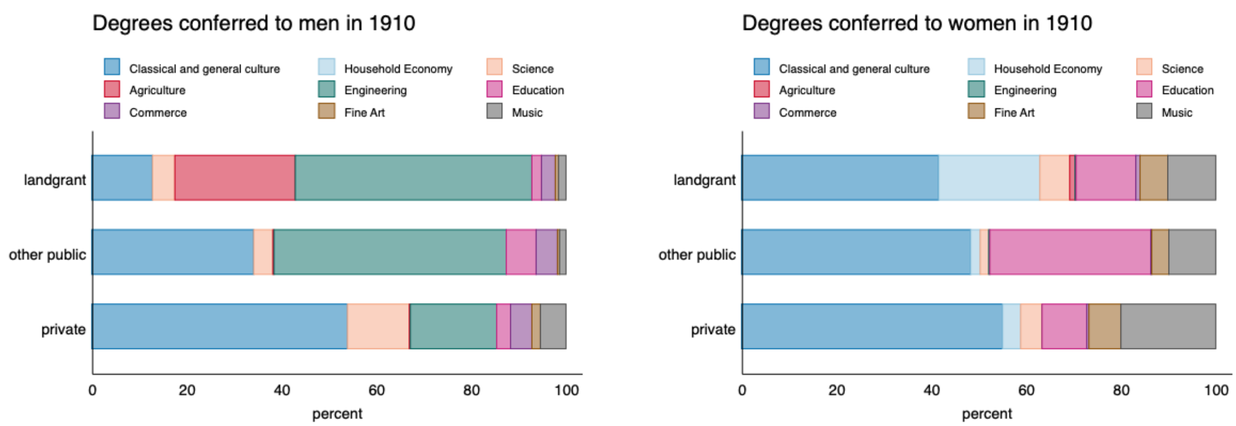
Notes: Number of degrees in home economics conferred to women (Panel (a)), and the number degrees in home economics conferred to women divided by the total number of degrees conferred to women (Panel (b)). Data source: Annual Report of the Commissioner of Education 1910; Biennial Survey of Education 1920, 1930, 1939, 1950, 1955, 1957.

Unfortunately, for most years the Commissioner Reports provide counts for "arts & sciences" majors, but do not provide separate numbers for science. Moreover, most years do not separately list enrollment or degrees granted by gender and major. The 1910 Commissioner Report, however, does include enrollment counts of all majors by gender, including science majors by gender. We therefore rely on the 1910 report for many detailed results that show the relationship between home economics and science. The 1910 report contains a total of 583 institutions and provides detailed information on nine majors: classical & general culture, general science, agriculture, household economy (home economics), engineering, education, commerce, music, and fine art.

Figure 4 shows the distribution of majors separately for men and women at different types of institutions in 1910. The relationship between agriculture and home economics is once again on display: at land-grant universities, roughly 20% of men enrolled in agriculture, and 20% of women enrolled in home economics. While agriculture was supposedly a men's field and home economics a women's field, there were a few exceptions. Women constituted 1.7% of agricultural students in 1910, and although home economics was exclusively female in 1910, some men studied home economics in later years.[10] General Science was not a popular major for either gender. However, the share of women in general science (women in general science/total female students) was larger at land-grant colleges (5.4%) than at state colleges (1.5%) or private colleges (3.8%). Men were more likely to major in science in private college (11.4% of men) compare to state (3.5%) or land-grant (4.3%) colleges. Classical education dominated the higher education landscape at private colleges for both men and women.

In addition to data on enrollment, the Commissioner Report of 1910 also includes information on many college characteristics, including location, the number of faculty, founding date, funding sources, values of various assets, library volumes, tuition costs. For land-grant universities, in particular, teaching expenses on different subjects were reported. We utilize several of these data below.

Figure 4: Distribution of Majors by Institution Type



Notes: Data source: Annual Report of the Commissioner of Education 1910.

[10]Elias (2008) suggested that when men enrolled in home economics courses, these were most often institutional management classes, a group of topics that later became the core of hotel management and similar programs. Using Cornell University's yearbooks from 1919 to 1936, we estimate that 95 percent of male students in home economics were indeed majoring in Hotel Management. (See below for information on college yearbooks.) However, data from the 1958 *Biennial Survey of Education* provides information on men in home economics programs and does not show a concentration in institution management. Among the 36 bachelor's degrees in home economics conferred to men, there were 2 in general curriculums, 2 in child development and family relations, 3 in clothing and textile, 11 in foods and nutrition, 6 in institution management, and 12 in other unspecified home economics fields.

2.3.2 College Yearbooks

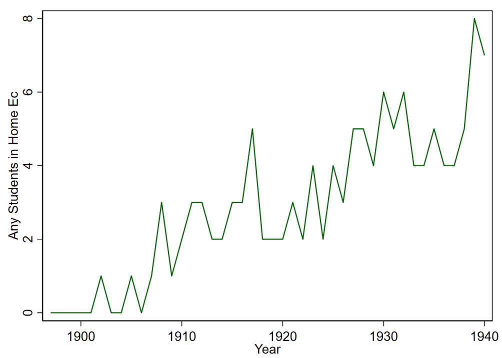
Because detailed information on college majors and gender from the Commissioner of Education reports is only available for 1910, we turn to another source to create panel data on women's major choices. We collect college yearbooks for 21 colleges from `ancestry.com`; this same set of yearbooks is used in Andrews (2023). The yearbooks include the names, hometowns, and majors for all students, along with other information such as sports and club participation. Our data cover 305 individual yearbooks from 1879 to 1940 and include records for 83,448 undergraduate seniors. Summary statistics of all colleges appearing in the sample are provided in Appendix Table A1. In our sample, 7 colleges had no home economics enrollments in any year, 5 colleges had positive home economics enrollment for all transcribed years, 9 colleges went from having no enrollment to positive enrollment in home economics. When reporting enrollment by subjects, we exclude majors in "Arts & Sciences" (or similar variations) since we cannot identify whether these are science majors or not.

Figure 5 Panel (a) show the increase in the number of colleges for which we have yearbooks in each year along with the number of those colleges with a home economics program. Panel (b) shows the share of yearbook colleges with a home economics program. Panel (c) plots the total number of female home economics enrollment over all yearbooks over time. Finally, Panel (d) plots the share of female students enrolled in home economics over time. Because we do not have yearbooks for every college in every year, the number of colleges changes from year to year; our panel is unbalanced. In general, coverage becomes more complete in later years, especially around 1940.

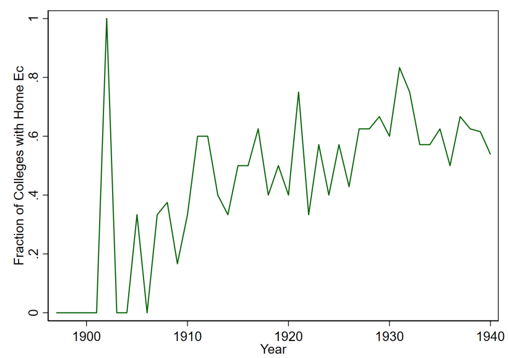
While it may be plausible to assume that almost all home economics students are women, this is almost certainly not the case for science majors, and hence we need some way to determine a student's gender. To infer gender, we use first names from the US decennial censuses. More specifically, for each state and each census plotted in Panels (c) and (d), we calculate the probability of being male for each first name in the yearbooks, and then impute the inferred gender of the student. A similar technique has been used in, for instance, (Andrews, 2023) to infer gender and race of patentees, (Cook et al., 2014) to infer race, and (Jones, 2009) to infer age. Using the inferred gender, we can calculate several statistics about women's participation in science.

Figure 5: Home Economics Trends from the Yearbooks Sample

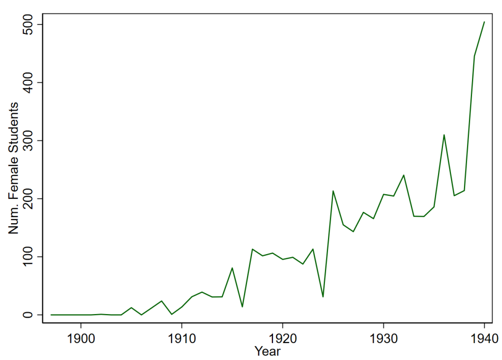
(a) The number of colleges offering Home Ec



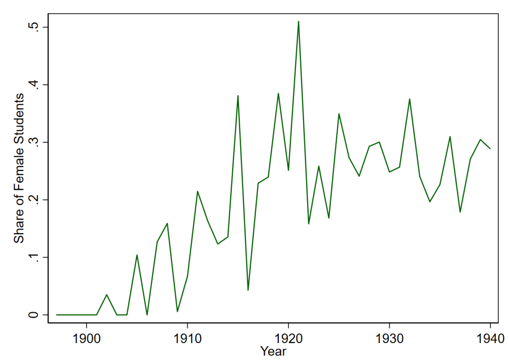
(b) Share of colleges offering Home Ec



(c) Number of declared female majors in Home Ec



(d) Share of declared female majors in Home Ec



Notes: Majors are based on major data reported in college yearbooks. A student is counted as women if the first name has a probability of male less than 50% based on data from the U.S. census. Data source: College Yearbooks.

2.4 A Gateway to Science?

We next present the first suggestive evidence that home economics played a role in bringing women into science fields.

In Figure 6 Panel (a), we plot the share of all female students who major in science (that is, number of women in science/ total women) for the yearbook sample. We separately plot the colleges that had at least one female home economics student and the colleges that had no home economics students in each year.[11] With the exception of a few years early in our sample when there are few yearbooks available, the share of women majoring in science is consistently higher in colleges that have home economics students. In Panel (b), we plot the fraction of science majors that are female and again find that women account for a larger fraction of science majors in colleges with home economics.

Figure 7 collapses our yearbook data over all years and presents aggregate counts of men and women in science for colleges with home economics and those without. The results highlight the fact that colleges with home economics were not "more science-heavy" per se; the number of men in science is virtually identical in colleges with and without home economics. Instead, home economics is highly predictive only of females majoring in science.

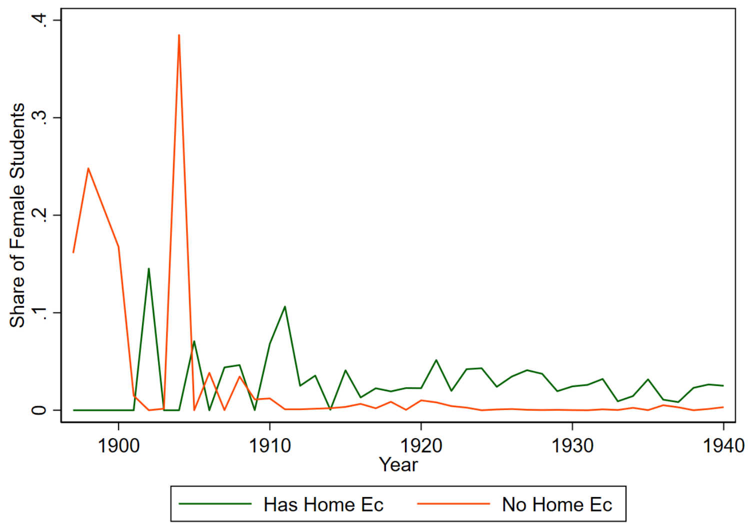
Why is home economics positively associated with women's enrollment in science? The scientific content in early home economics curricula provides an obvious clue. For women with little scientific training in primary school and few female scientist role models, their first extended exposure to science may have occurred during home economics programs, with many discovering an interest or aptitude for science. Because a home economics student would take many courses required for majors in chemistry or biology, if she learned that she hated home economics subjects, it would be less costly for her to switch to a science major than to other majors that did not cross-list as many courses.[12] Moreover, home economics prepared women with the necessary skills to go on to medical school or graduate school in science. On the extensive margin, more women who were planning on becoming housewives may have gone to college if home economics was available; once at college they could have been exposed to scientific ideas. Home economics may have encouraged more women to study science even if they never planned on majoring in home economics. Women could attempt a science major and, if they struggled in their introductory courses, switch to major in home economics with a few required classes

[11] Note that the colleges that belong to each group changes as schools add home economics programs. Results are similar when keeping consistent groupings of colleges, for instance plotting those that always had home economics against those that never had home economics; colleges that added home economics during our sample period initially appear similar to colleges with no home economics but become more similar to the colleges that always had home economics over time.

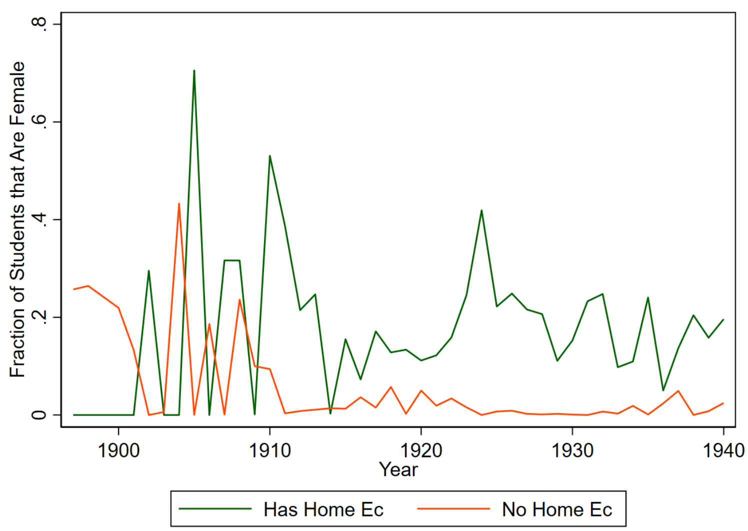
[12] As long as the switching rate from home economics to science is less than 100%, the existence of this channel will produce a positive correlation between the number of women in home economics and the number of women in science.

Figure 6: Women in Science for Colleges with and without Home Economics from the Yearbook Sample

(a) Share of women who major in science

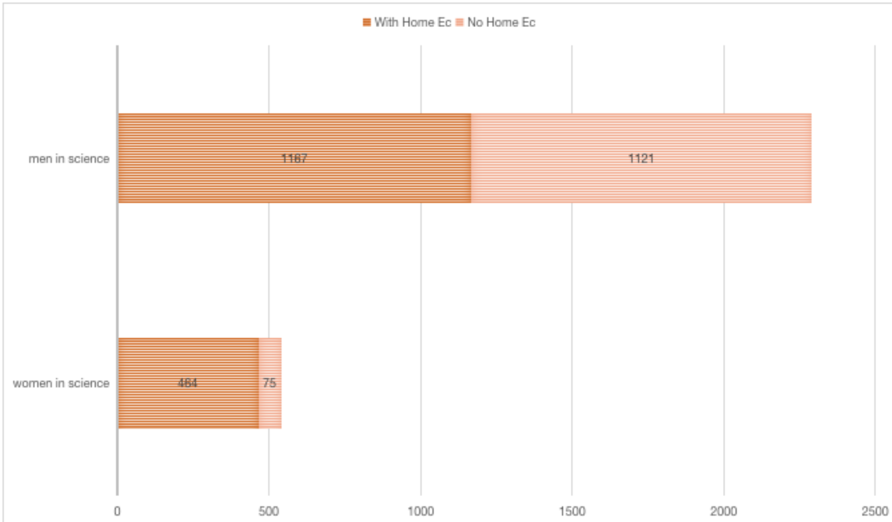


(b) Fraction of science majors that are female



Notes: Unconditional mean share of women in science majors (women in science majors/total women) (Panel (a)) and gender ratio in science (men in science majors/ total science majors) (Panel (b)) for colleges with home economics and colleges without home economics in each year. A student is counted as women if the first name has a probability of male less than 50% based on data from the U.S. census. Data source:the student yearbooks sample.

Figure 7: Number of Science Majors by College Home Economics Status from the Yearbook Sample



Notes: Number of science majors by gender and whether or not a college has home economics, for all yearbooks.

already completed; the option to switch to home economics could have encouraged women to try science in the first place. Finally, as home economics grew, science-related career opportunities for women increased as well, with home economics graduates working in hospitals, food and consumer goods industries, and the public sector in food testing and regulation positions (Nyhart, 1997); the availability of these positions may have encouraged women to study more science.

Numerous anecdotes to provide evidence for each of these channels. For example, Cassandra Wanzo went to Northwestern University in 1969 and majored in nutrition, a degree offered through the Department of Home Economics. She met all the requirements for a pre-med track and went on to medical school at the University of Wisconsin and became a psychiatrist in Atlanta (Blackwell, 2017). In another case, Reatha Clark King initially chose home economics as a major when she attended Clark College in Atlanta, planning on becoming a high school home economics teacher (possibly until exiting the labor market after marriage, as many women born prior to the 1950s did (Goldin, 2006, 2021)). During her home economics major, Reatha fell in love with science and switched her major to chemistry. She continued her education at the University of Chicago and completed her Ph.D. in thermochemistry, working as a chemist at the National Bureau of Standards and eventually General Mills, where she rose to become vice president (Spangenburg and Moser, 2003).

We formalize these channels in Section 3 below.

3 Theoretical Framework

Our model takes the framework from (Altonji, 1993; Altonji et al., 2012), where we treat choosing a college major as a sequential choice under uncertainty. The model has three periods $t = 0, 1, 2$, refers to the period before starting college, the first period of college and the second (final) period of college, respectively. In period 0, a woman decides whether to get married directly or begin college in either science (s) or letters (l). Later we will introduce a college major choice, home economics (h). While we examine the choice of science and letters, the model could be equivalently thought of as a choice between biology/chemistry and physical science/engineering majors; alternatively, we could have women choose between more than two majors, although this makes the model more cumbersome without changing the intuition.

A woman chooses whether or not to attend college and her major conditional on attending in order to maximize her ex-ante utility, which is composed of monetary return and taste. However, she does not know her ability and taste for certain. In order to graduate with a college degree, she would have to accumulate sufficient knowledge in either s or l. Knowledge accumulation in s and l increases with aptitude in either field, knowledge endowment before starting college, and of course, the years spent on a field chosen at college. At the end of the first period, taste is revealed and an informative signal on their field-specific ability is given. Based on the updated information, a woman may change her field of study or drop out of college. If she drops out of college, she goes to work at semi-skilled jobs or becomes a homemaker. If she attends college for the second period, she finds out whether she completed the degree requirements at the end of the period. She then goes to work at the appropriate wage. If she receives the college degree, she goes to work at skilled jobs and earns the college premium; if she does not receive the degree, then she goes to work at semi-skilled jobs.

Ability: Women differ in two dimensions of cognitive ability. Let $A = A_s, A_l$, where A_s is science ability and A_l is verbal ability. A_s and A_l are important for the production of K_s and K_l respectively, and unknown to the student when $t = 0$.

The stock of knowledge: Let knowledge at the end of college period t be denoted by $K_t = \{K_{st}, K_{lt}\}$, where K_{st} is the science knowledge, K_{lt} is the letters knowledge at the end of t. Before attending college, a woman with characteristics X may have knowledge endowments in either field, with $K_{l0} > 0$ or $K_{s0} > 0$.

Degree requirement and graduation probability: A college degree in field l or s requires that a field-specific stock of knowledge K_{2l}, K_{2s} exceed a threshold degree requirement by the end of second period. The probability g_{2c} that a person who is studying in field c in the second period will complete the degree requirement is an increasing function of K_{1l}, K_{1s} , A_l, A_s. The relative effect of these variables on g_{2c} depends on c. Graduating with a degree in c increases with the field-specific knowledge accumulation, and relevant ability. The programs and the requirement for field l and field s are sufficiently different that students who choose to study in field l in the second period have a small chance of completing the degree requirement in s, and vice versa.

Earnings: The discount rate is R. The wage premium for having some college is r, for having a college degree in s is $r_2 s$, and for a college degree in l is $r_2 l$. The discounted present value of earning is Y_0 for persons who enter the labor market without any college, $Y_1 = Y_0(1+r)/(1+R)$ for individuals who leave school after 1 year of college, $Y_1/(1+R)$ for women who attend college a second year but fail to get a degree, $Y_{2l} = Y_0(1 + r_{2l})/(1 + R)^2$ for persons with a l degree, $Y_{2s} = Y_0(1 + r_{2s})/(1 + R)^2$ for persons with a s degree. We assume

$$Y_{2l}, Y_{2s} > Y_1, Y_0 \tag{1}$$

Preferences: Utility is the sum of the present value of income and a term that depends on a taste parameter j summarizing nonpecuniary preferences for marriage, career and types of career. Type 0 woman dislike school and career sufficiently relative to the difference between Y_{2s}, Y_{2l}, and Y_1 such that they do not receive an increase in utility from completing a degree in science and letters even though they would earn higher wages. Type 1 women prefer a career in science to a career in letters. Type 2 women prefer a career in letters to one in science. Type 3 women prefer college to no college, career to homemaking, but is indifferent between a career in science and a career in letters.

Before attending college, a woman with characteristics X believes that the probability that she is type j is $\theta_j(X)$, where $j = 0, 1, 2$, or 3. A woman learns her preference type after the first year of college. Similarly, a woman with characteristics X believes that the probability that her ability type is type k is $\gamma_k(X)$, where $k = HH, HL, LH$, or LL. E.g., $k = HH$ indicates high ability in both letters and science. A woman learns her ability type after the first year of college.

The value of attending the first year of college in the field l or in the field s is

$$V_1(A, \theta, l_1) = \sum_0^3 \theta_j \sum^k \gamma_k E\{V_2(g_2, j, k)|l_1\} \tag{2}$$

or

$$V_1(A, \theta, s_1) = \sum_0^3 \theta_j \sum^k \gamma_k E\{V_2(g_2, j, k)|s_1\} \tag{3}$$

where the expectation is taken over the distribution of g_2 conditional on the choice of field c in the first period.

Given the assumption about preferences, it is optimal for type 0 women to drop out school and become homemakers. She may have high ability but her preferences for homemaking are sufficiently strong that her academic ability does not matter. Because of the college experience, her home productivity increases from Y_0 to equivalently semi-skilled wage Y_1, but her delayed family life means that her taste is discounted by 1 period, so

$$V_2(g_2, 0) = Y_1 + t_0/(1 + R) \tag{4}$$

For type 1 individual (who likes a career in science), the value function is the maximum of the return to staying in college in field s and leaving school and receiving Y_1.

$$V_2(g_2, 1) = max\{[g_{2s}Y_{2s} + (1 - g_{2s})Y_1/(1 + R))], Y_1\} \tag{5}$$

For type 2 individual (who likes a career in letters), the value function is the maximum of the return to staying in college in field l and leaving school and receiving Y_1.

$$V_2(g_2, 2) = max\{[g_{2l}Y_{2l} + (1 - g_{2l})Y_1/(1 + R))], Y_1\} \tag{6}$$

Type 3 individual either stays in college and major in l, stays in college and major in s, or drop out and receive Y_1, so

$$V_2(g_2, 3) = max\{[g_{2l}Y_{2l} + (1 - g_{2l})Y_1/(1 + R)), [g_{2s}Y_{2s} + (1 - g_{2s})Y_1/(1 + R))], Y_1\} \tag{7}$$

In the absence of home economics, a woman starts college if

$$max\{V_1(A, \theta, l_1), V_1(A, \theta, s_1)\} > Y_0 + \theta_0 t_0 \tag{8}$$

She starts college in the field l if the condition in Equation (8) holds and

$$V_1(A, \theta, l_1) > V_1(A, \theta, s_1) \tag{9}$$

Now we introduce the home economics major (h). Recall from our discussion in Section 2 that the first years of a home economics program tended to be extremely science-heavy; we will utilize this fact below. Earnings for a woman who graduates with a degree in h earns $Y_{2h} = Y_0(1 + r_{2h})/(1 + R)^{-2}$ and we assume that

$$Y_{2l}, Y_{2h}, Y_{2s} > Y_1, Y_0. \tag{10}$$

When home economics is introduced to college, the number of women who study s increases through two channels.

Channel 1: Previously, women who are type 0 with large probability may not have gone to college. Because home economics provides homemaking knowledge, these women may choose to go to college and study home economics (h) to increase home production. She will stay in college even if she is revealed to be type 0. Assume there is no trade-off between studying home economics and family life. Equation (4) becomes

$$V_2(g_2, 0) = max\{g_{2h}Y_{2h} + (1 - g_{2h})Y_1/(1 + R)) + t_0, Y_1 + t_0\} \tag{11}$$

Y_{2h} could be thought of as value of home production should a type 0 woman get married with a degree in home economics, or the market value of a home economist. Home economics therefore increases total female enrollment. For some of the women who started college with home economics, their true type might be revealed to be 1 or 3. If home economics covers enough science courses, knowledge accumulation in science K_{1s} will be comparable to that a woman would have obtained if she studied science in the first period, and g_{2s} would be as high as if she started off in science. In other words, she could switch to science at a low cost.

Channel 2: For women who are career type with large probability, the availability of home economics reduces their cost to starting college in s. Especially for those who are pretty indifferent to start college in either s or l, home economics as a back-up option can push the ex-ante utility to start college with science to be greater than that with letters. For instance, in the case that their true types are not science but 0, they can still switch to home economics and graduate with reasonable probability: g_{2h} conditional on starting with science is higher than starting with letters.

$$V_1(A, \theta, s_1) > V_1(A, \theta, l_1) \tag{12}$$

Intertemporal Spillover: Where does the belief θ_j come from? Boyd and Richerson (1985) show that in situations such as ours where it is costly for individuals to acquire information about their type, it can be optimal to rely on heuristics and rules of thumb. One plausible heuristic is to use the previous cohort's distribution for college attendance and major choice to form ex ante beliefs. In fact, data suggests this is plausible; for example, Goldin (2021, pg. 124-125) cites survey results from the National Longitudinal Survey of Young Women and National Longitudinal Survey of Youth and finds that the share of young women who believed they would be in the labor force at age 35 is almost identical to the share of women whose mothers were in the labor force at the time of the survey.

We can formalize this logic by specifying that a woman forms beliefs about her type through the composition of N role models she grows up with. The role models could be mothers, neighbors and friends, and their types are randomly drawn from the social distribution of types at the time. Let X be the number of role models in each type: $X = \{x_0, x_1, x_2, x_3\}$ and $\sum x_j = N$, and the expected probability that she is type j could simply be the share of role models in type j: $\theta_j(X) = \frac{x_j}{N}$. The role models not only pass down preferences, but also knowledge endowments in specific fields. $K_{s0}(X)$ is an increasing function of $\frac{x_1}{N}$ and $K_{l0}(X)$ is an increasing function of $\frac{x_2}{N}$. If a woman grows up with more role models in science/letters, she is more likely to have knowledge in science/letters before entering college.

In the absence of home economics, the social distribution consists of a large share of homemakers s_0, zero scientists s_1, a decent share of female graduates in letters s_2, and a decent share of other working women s_3. Then for a typical woman, her role model and knowledge endowments in science are zero $\theta_1 = 0$, $K_{s0} = 0$, whereas those in letters are positive $\theta_2 > 0$, $K_{l0} > 0$. Conditional on college attendance, she always prefers letters. Therefore in this situation, women are stuck in a perpetual loop where a small share of women go to college and those who do enroll in letters.

When home economics becomes available for the first generation, even a woman who is the homemaker type with a large probability will go to college. As long as she has a reasonable ability to graduate, she can major in home ec, which aligns with type 0's taste. After spending a year in college, types are revealed. Although most women who major in Home Ec will realize as type 0 and type 2, and none will realize as type 1, the game changers are women who realize as type 3. Type 3 is career-oriented, and we assume she will switch from Home Ec to either science or letters. Without home economics, the positive knowledge endowment in letters makes the letters major more appealing. However, a year in Home Ec major boosts her knowledge accumulation in science to outweigh her knowledge in letters, making science the better choice.

Thanks to Home Ec, the next generation will have role models and knowledge endowment in science. A woman indifferent between science and letters now has Home Ec as the tie-breaker. For example, suppose a woman has a set of role models $\{1, 1, 1, 2\}$. She should start college in science because if she turns out to be a type 0, she could transfer to Home Ec with lower costs.

The science graduates in the second period come from two channels: women with science role models and women who study Home Ec, revealed to be type 3 and switch to science like in the previous generation. Over time, as the share of type 0 becomes smaller, the role model channel becomes the main channel.

According to historical evidence, women with Home Ec degrees find meaningful employment as home economists, nutritionists, teachers, etc. We can model this fraction of women as type 3 role models for the next generation. Depending on how quickly Home Ec converts women from homemakers to working women, whether through degrees in letters, science, or Home Ec, Home Ec as a college major would lose students as fast. The implication might explain the short life span of the Home Economics major in U.S. history.

We calibrate our model and simulate the changing choices in college majors overtime in the Appendix.

4 Cross Sectional Analysis with 1910 Commissioner of Education Report

In this section, we test for a relationship between the relative size of women in home economics and women in science using the cross section of colleges in the 1910 Commissioner of Education report. We estimate

$$WomenInScience_c = \beta WomenInHomeEconomics_c + X_{ct}\alpha + \epsilon_c. \tag{13}$$

In all specifications, X_{ct} consists of the total number of students at each college and the total number of female students at each college, as well as a state fixed effect. We cluster standard errors by state.

We present results using all 1910 colleges in Table 1. We use several alternative definitions of $WomenInScience$ and $WomenInHomeEconomics$. In our baseline specifications in Panel (a) Column 1, we use as our main explanatory the share of women majoring in home economics and as our dependent variable the share of women majoring in science. More specifically, we define:

$$ShareWomenInHomeEc = \frac{Num.WomenHomeEcMajors}{Num.TotalFemaleStudents - Num.WomenScienceMajors}. \tag{14}$$

We subtract the number of female science majors from the denominator because otherwise the share of women majoring in home economics and science would be mechanically related (since the shares must sum to one). Likewise, we define:

$$ShareWomenInScience = \frac{Num.WomenScienceMajors}{Num.TotalFemaleStudents - Num.WomenHomeEcMajors}. \tag{15}$$

Column 1 shows that a 10 percentage point increase in the share of women majoring in home economics is associated with a 3.6 percentage point larger share of women majoring in science.

The model in Section 3 shows that home economics may affect women's major choice even for women who do not choose to major in home economics. For that reason, in Column 2 we estimate an extensive margin regression to test whether the share of women majoring in science increases when a college establishes a home economics program, regardless of the size of that program.[13] The main dependent variable, $AnyWomenHomeEcMajors$, is an indicator equal to one if college c has at least one home economics student in the 1910 Commissioner Report. We find that having any women majoring in home economics predicts a larger share of women majoring in science at the 10% level of statistical significance. In Column 3, we include both the share of women majoring in home economics and the indicator for any women in home economics; the share of women majoring in home economics remains statistically significant and increases in magnitude, while the extensive margin indicator is negative and significant. We once again view this as suggestive evidence that the second channel, in which home economics provides an insurance major to women who study science, is not driving most of the observed correlation.

[13]This is a crude test of this channel, since a small home economics program may be highly selective or not very attractive and, in either case, not be a good outside option for women who attempt a science major.

In Columns 4-6, we use the fraction of science majors that are female as the dependent variable. These specifications tell a similar story: a larger share of women majoring in home economics and the presence of any female home economics majors both predict that women will make up a larger fraction of science majors. When horse racing both measures of home economics in Column 6, we find that the intensive margin variable is larger in magnitude, although neither is individually statistically significant.

Both of our main dependent variables, the share of women majoring in science and the fraction of science majors that are female, are bounded below by zero and above by one. For this reason, in Panel (b) of Table 1 we repeat the analysis in Panel (a) but estimate fractional response probit models as proposed by Papke and Woolridge (1996). Marginal effects are reported. The results in Panel (b) are broadly similar to those in Panel (a) in both magnitude and statistical significance.

In Appendix Table A2, we show that results are robust to several additional transformations of the dependent and independent variables. In Appendix D.3 we present suggestive evidence that the correlation between home economics and science is not merely contemporaneous, but also affects women's labor market decisions, and especially the probability of working in a biology or chemistry-related occupation.

4.1 Placebo Tests and Robustness Checks

We show that this relationship between home economics and science is, indeed, unique to home economics. We re-estimate the cross sectional correlations but use the share of women in the most common non-home economics majors for women: education, music, fine art, and commerce. Results are presented in Table 2. In no cases do these other majors significantly predict more women in science, although a larger share of women majoring in fine arts does statistically significantly predict a lower share of women majoring in science.[14]

[14] For each major m, we define

$$ShareWomen_m = \frac{Num.Women_m}{TotalWomen - Num.Women_{Science}}$$

Table 1: Home Economics and Science Majors from the 1910 Commissioner Report: All Colleges

(a) OLS

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of women in home ec	0.362***		0.505***	0.311**		0.239
	(0.114)		(0.147)	(0.141)		(0.272)
Any women home ec majors		0.0729**	-0.0904***		0.165**	0.0569
		(0.0327)	(0.0333)		(0.0704)	(0.142)
Observations	378	380	378	113	163	113
Adj. r^2	0.118	0.0152	0.134	0.239	0.272	0.232
Mean Dep. Var.	.072	.077	.072	.385	.283	.385

(b) Fractional Response

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of women in home ec	0.194***		0.274***	0.374**		0.363
	(0.0452)		(0.0610)	(0.168)		(0.313)
Any women home ec majors		0.0578**	-0.0579**		0.125***	0.00715
		(0.0232)	(0.0263)		(0.0483)	(0.134)
Observations	384	387	384	129	179	129
Pseudo-r^2	0.139	0.132	0.144	0.176	0.249	0.176
Mean Dep. Var.	.072	.08	.072	.379	.277	.379

Notes: In both panels, the unit of observation is a college in 1910. Panel A reports OLS estimates. Panel B reports estimates of a fractional response probit model. For both panels, the dependent variable for columns 1-3 is the share of non-home economics female students who major in science. The dependent variable for columns 4-6 is the number of female science majors divided by the number of all science majors. All specifications include state fixed effects and controls for the total size of the student population and the size of the female student population. Standard errors are clustered by state and reported in parentheses. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

In Column 5 of Table 2, we also show that a larger share of women majoring in home economics does not significantly predict a larger share of men majoring in science. The number of colleges in Column 5 is smaller because all female-only colleges are omitted. This null result ensures that our observed correlation between women in home economics and women in science is not simply due to a relationship between larger home economics programs and larger overall science programs.

In Appendix Table A4 we control for many additional college-level covariates provided in the Commissioner reports: the total number of books in the college library, total college endowment, total college faculty, the number of majors offered, the share of men majoring in science, the number of science instructors, the value of college-owned scientific instruments, the amount of public funding, and the amount of private funding. In all cases, our conclusions about the relationship between women in home economics and women in science are unchanged.

The large number of colleges reported in the 1910 Commissioner report allows us to examine heterogeneity across different types of colleges. In Appendix Table A6, we repeat our analysis in Column 1 of Table 1, but in each column we restrict attention to a different type of college. For all college types except for historically black colleges and universities, we find that the share of women majoring in home economics statistically significantly predict the share of women majoring in science, and the correlation is especially large for public colleges and land grant colleges. We also find consistent results for female-only colleges, although the correlation is smaller than our baseline estimate but still positive and statistically significant. This finding is important, because it rules out the possibility that home economics programs served as a gateway into science by providing a place for women to learn technical skills without the presence of men (Calkins et al., 2023); because men were not present in any major in the women's college, this strongly suggests that the skills taught in home economics was what

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and we redefine

$$ShareWomen_{Science} = \frac{Num.Women_{Science}}{TotalWomen - Num.Women_m}$$

to ensure that our explanatory and dependent variables are not mechanically correlated.

mattered to get women into science, rather than or in addition to the gender composition of the subject.

Table 2: Placebo Majors and Science from the 1910 Commissioner Report

	Share of Women Who Major in Science				Share of Men Who Major in Science
	(1)	(2)	(3)	(4)	(5)
Share of women in education	0.134*				
	(0.0723)				
Share of women in music		0.119			
		(0.0787)			
Share of women in fineart			-0.117***		
			(0.0429)		
Share of women in commerce				-0.00416	
				(0.142)	
Share of women in home ec					0.0291
					(0.0557)
Observations	376	362	378	380	287
Adj. r^2	0.0191	0.0250	-0.00104	-0.0112	-0.0268
Mean Dep. Var. Rate	.067	.076	.062	.061	.118

Notes: The table reports OLS estimates. An observation is a college in 1910. The dependent variable for columns 1-4 is the share of non-major m female students who major in science, where m is classics, education, music, fine arts, and commerce, respectively. The dependent variable for columns 5 is the share of non-home economics men who major in science. All specifications include state fixed effects. Standard errors are clustered by state and reported in parentheses. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

4.2 Agriculture Instrument

The large correlation between the share of women majoring in home economics and women majoring in science observed in public colleges, many of which are land grants, points to the relationship between home economics and public agricultural education highlighted in Section 2. The USDA contributed to the development of home economics by including it as an agricultural subject for the purposes of federal funding. Thus, in-state demand for agricultural education likely correlated with resources available for home economics. Specifically, a higher in-state demand for agricultural education led to a larger agriculture program; since home economics shared the same funding sources with agriculture, a larger agriculture program meant a lower marginal cost to invest in a home economics program. Home economics programs were often part of schools of agriculture, home economics research was conducted at Agricultural Experiment Stations, and collaborations between home economics faculty and agriculture faculty were common (Smith, 1933). Building off these observation, we use the share of men who major agriculture as an instrument for the share of women who major in home economics. Agricultural education was almost exclusively male, with 98.3% of male agricultural degrees awarded to men in 1910. The identifying assumption is that agricultural funding affects women in science only through its affect on the share of women in home economics. This in turn requires that agricultural funding is allocated to support agricultural program research and is independent of colleges' home economics programs, as well as requiring that agricultural funding has no other channels through which it can increase the share of women in science.

Before turning to the IV results, we examine the first stage relationship in Column 1 of Table 3. The share of men in agriculture strongly predicts the share of women in home economics, with a first stage F-statistic of 11.21. In Column 2, we show reduced form results. A 10 percentage point increase in the share of men majoring in agriculture predicts a 4.9 percentage point increase in the share of women majoring in science. Finally, in Column 3 we present the IV results. After instrumenting the share of women majoring in home economics using the share of men majoring in agriculture, we find that a ten percentage point increase in the share of women majoring in home economics is associated with 5.4 percentage point increase in the share of women majoring in science.

The discrepancy between IV and OLS estimates point to the fact that home economics program sizes could be correlated with omitted variables that are negatively associated with women's enrollment in general science, resulting in a downward bias in the OLS estimates. This suggests that if anything there is a negative bias in the selection of home economics programs with respect to women's scientific pursuit. This accords with the narrative evidence which indicates that the design for home economics was motivated by ideas about traditional gender roles and targeted women from rural areas (Schwieder, 1986). The bias could occur, for instance, if prior to the college entrance, a woman (or her parents) who chose the home economics major had a lower level of interest in science than another woman who chose the major in music or classics (the type 0 women from our model in Section 3).

Because our instrument relies on a mechanical relationship between agricultural programs and home economics caused by federal funding programs, it may make sense to restrict attention

Table 3: Men in Agriculture and Women in Science: First Stage, Reduced Form, and IV Results

	First Stage	Reduced Form	IV
	(1)	(2)	(3)
Share of men in ag	0.926***	0.486**	
	(0.218)	(0.227)	
Share of women in home ec			0.539***
			(0.176)
Observations	287	287	285
Adj. r^2	0.448	0.0884	0.127
F-stat	11.21	3.278	3.951
Mean Dep. Var.	.063	.089	.083

Notes: The table reports estimates of first stage (Column 1), reduced form (Column 2), and IV (Column 3). An observation is a college in 1910. The dependent variables in column 1 is the share of non-science women majoring in home economics. The dependent variable in Columns 2-3 is the share of non-home economics women majoring in science. All specifications include state fixed effects. Standard errors are clustered by state and reported in parentheses. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

to the land grant colleges. There was substantial variation across land grant colleges in the extent to which colleges took advantage of federal funding and emphasized their agricultural message. Coefficients are similar in magnitude and statistical significance to those using all colleges; in our IV estimate, a ten percentage point increase in the instrumented share of women majoring in home economics is associated with a 5.6 percentage point increase in the share of women majoring in science. We present these results in Appendix Table A7.

The credibility of our research design hinges on the assumption that male agricultural education did not affect women in science for reasons other than providing resources for home economics programs. In Appendix Table A8, we directly rule out some potential channels through which male agricultural education could plausibly affect women in science. For example, it may be the case that agricultural education, perhaps by introducing students to scientific equipment in their agriculture courses, increases the total demand for science education. We regress the share of men majoring in agriculture on the share of men majoring in science, the logged number of science instructors, and the logged value of the college's scientific instruments. In all cases, the share of men in agriculture does not significantly predict these various outcomes and all three are small in magnitude. These results provide evidence for the plausibility of the exclusion restriction, and hence we tentatively conclude that the relationship between home economics and women in science is causal.

5 Panel Analysis with Yearbook Data

In this section, we analyze whether a larger share of women in home economics majors in our yearbook sample predict more female science majors. In contrast to our estimates in Section 4, here we exploit changes in the relative sizes of home economics programs within a college at different points in time. However, we have yearbook data from a much smaller sample of colleges. We estimate the following:

$$WomenInScience_{ct} = \beta WomenInHomeEconomics_{ct} + X_{ct}\alpha + College_c + Decade_t + \epsilon_{ct} \tag{16}$$

where $WomenInScience$ is some measure of the relative number of female science majors, $WomenInHomeEconomics$ is a measure of the relative number of female home economics majors, X_{ct} is a vector of college-year-specific control variables, $College_c$ is a college fixed effects, and $Decade_t$ is a decade fixed effect. We use a decade fixed effect rather than a year fixed effect because our panel is unbalanced and in many cases only a small number of colleges may have a yearbook in a given year. The college-year-specific controls in all specifications are the total number of students and total number of female students at college c in year t. We cluster standard errors by college.

In Table 4, we repeat the analysis conducted in Table 1 with the cross sectional sample from the 1910 Commissioner Report but use the yearbook panel. Column 1 of Panel (a) shows that increasing the share of women majoring in home economics within a college by 10 percentage points is associated with 2.7 percentage points more women majoring in science. Column 2 shows that when a college adds a home economics program on the extensive margin, this is associated with a statistically insignificant 2.9 percentage points more women majoring in science. When combining the share of women majoring in science and the extensive margin indicator, only the former is positive and statistically significant at the 10% level.[15] Columns 4-6 similarly show that colleges that increase the share of women majoring in home economics also see a greater fraction of science majors that are women, although all are imprecisely estimated.

In Panel (b), we again account for the fact that our dependent variables are bounded between zero and one. We estimate fractional response probit models that allow for unobservable county-specific heterogeneity (Papke and Woolridge, 2008); additionally, since the yearbook data make up an unbalanced panel, we estimate the correlated random effects fractional probit model as suggested by Wooldridge (2010).[16] We present coefficients as marginal effects. We again find that a larger share of women majoring in home economics within a college predicts a larger share of women majoring in science. The share of women majoring in home economics has an imprecisely estimated relationship with the fraction of science majors who are female, although in columns 5 and 6 we find that the extensive margin measure is positive and statistically significant at the 5% level.

In Appendix Table A10 we again show that results are robust to several alternative transformations of the dependent and independent variables.

In nearly every case, our estimates are larger in the 1910 cross sectional regressions in Table 1 than they are in the panel results in Table 4. In Figure 8 we show that this is because our panel data includes yearbooks from the 1930s and 1940s, as home economics was becoming much less scientific. We re-estimate Equation 16 but interact our measures of $WomenInHomeEconomics$ with an indicator for each decade. Figure 8 reproduces these coefficients from Column 1 of Table 4. From 1900 to 1920 (the same years in which home economics was most scientific as documented in Figure 2), the correlation between the share of women in home economics and

[15] As in Table 1, we once again define

$$ShareWomenInScience = \frac{Num.WomenScienceMajors}{Num.TotalFemaleStudents - Num.WomenHomeEcMajors},$$

and likewise for $ShareWomenInHomeEc$.

[16] Adding unbalanced-time averages of covariates to the correlated random effects model reproduces the fixed effects estimator (Wooldridge, 2010). This approach requires the assumption that the availability of yearbook data is uncorrelated with the share of women majoring in home economics, which seems natural in this context. We estimate these models in Stata using the fhetprob package (Bluhm, 2013). See Ramalho et al. (2011) for a survey of fractional response models.

Table 4: Home Economics and Science Majors from the Yearbook Sample

(a) OLS

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of women in home ec	0.266**		0.313**	0.0950		0.134
	(0.119)		(0.111)	(0.156)		(0.147)
Any women home ec majors		0.0287	-0.0356		-0.00658	-0.0369
		(0.0377)	(0.0302)		(0.0486)	(0.0389)
Observations	246	246	246	174	174	174
Adj. r^2	0.534	0.503	0.534	0.645	0.642	0.643
Mean Dep. Var.	.11	.11	.11	.22	.22	.22

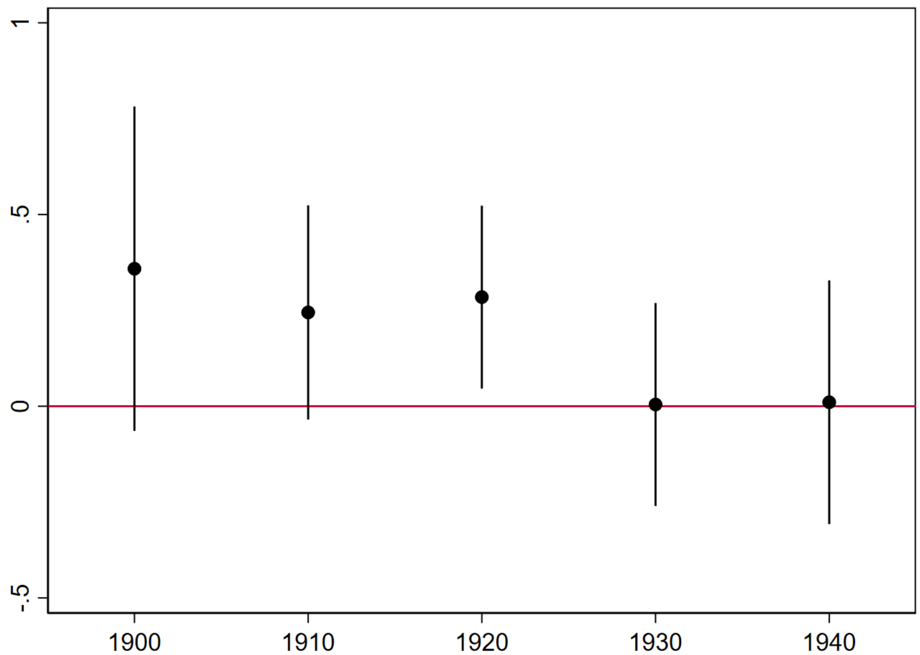
(b) Fractional Response

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of women in home ec	0.169***		0.166***	0.123		0.0834
	(0.0529)		(0.0513)	(0.0985)		(0.0906)
Any women home ec majors		0.0283	0.00477		0.121***	0.115***
		(0.0314)	(0.0336)		(0.0406)	(0.0394)
Observations	249	249	249	179	179	179
Pseudo-r^2	.	.	.	.	.	.
Mean Dep. Var.	.11	.11	.11	.22	.22	.22

Notes: In both panels, the unit of observation is a college in a particular year. Panel A reports panel OLS estimates with college and year fixed effects. Panel B reports estimates of a correlated random effects fractional response probit model that allows for unobservable county-specific heterogeneity. For both panels, the dependent variable for columns 1-3 is the share of non-home economics female students who major in science. The dependent variable for columns 4-6 is the number of female science majors divided by the number of all science majors. All specifications include controls for the total size of the student population and the size of the female student population. Standard errors are clustered by college and reported in parentheses. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

the share of women in science is very similar to that from the 1910 cross section in Column 1 of Table 1; in 1930 and 1940, the coefficient is close to zero in magnitude.

Figure 8: Correlation between Share of Women in Home Economics and Share of Women in Science Over Time



Notes: Coefficients and 95% confidence intervals of the regressions of the share of non-home economics women majoring in science on the share of non-science women majoring in home economics interacted with an indicator for each decade. Data source: college yearbooks.

5.1 Double Majors

In the previous section, we show that when a college gets more women in home economics majors, it also gets more women in science majors. We interpret this as evidence that exposure to science in home economics programs changes women's preferences and induces them to switch to a science major. Instead of switching to science majors, women in home economics programs may simply add a science major to their home economics degree, especially if many science classes fulfill requirements for both majors. Unfortunately, double majoring is exceedingly rare in the yearbook data, and so we cannot conduct a statistical test to see if home economics majors are more likely to double major in science than are students with other majors, but the raw data is consistent with this view.

While we observe a total of 56,314 undergraduates' declaration of majors, only 648 (1.15%) undergraduates enrolled in more than one major. The percentage (2.7%) is higher for students in Home Ec: out of 5,179 students in Home Ec, 140 had a second major. Among the double-majors, 45 (32%) paired with sciences, while the next highest double major was 29 (20%) pairing with education.[17] In comparison, 171 out of 5,633 (3%) students who majored in education had a second major. Only 6 students (3.5%) had a double-major in science. [18]

5.2 Self-Selection of Women into Colleges

It is plausible that our results are driven by self-selection of women into colleges that are strong in both home economics and science. Such an outcome would be possible if, for instance, home economics and science departments can share resources (e.g., laboratory equipment). If instead colleges with strong home economics programs gain reputations for being poor in science, then women with an interest in science may self-select away from colleges with large home economics programs, and hence our results may be understating the causal effect of exposure to science ideas through home economics on women's decisions to major in science.

To address self-selection concerns, we repeat the results in Panel (a) of Table 4 but focus on a set of women that is unlikely to have selectively chosen their colleges. One unique feature of the college yearbook data is that they often report students' hometowns. Numerous studies have argued that transportation costs to a college are a significant barrier to attendance, and hence students are much more likely to attend local colleges; frequently proximity to a college is used as an instrument for attendance (Card, 1995, 2001; Russell et al., 2021). We therefore estimate the effect of the share of women in home economics on the share of women in science when restricting attention to students who are from the same state as the college (Panel (a)), same

[17]With this small number of science double majors, we can examine the exact name for the paired major. 35 home economics majors doubled in general science, 3 in industrial science, 1 in science, 5 in chemistry, and 1 in zoology.

[18]1 double majored in botany, 2 in chemistry, 1 in medicine, 1 in physiology, and 1 in pharmacy.

county as the college (Panel (b)), and same town as the college (Panel (c)).[19] In Appendix A6, we plot the share of all students from the same state, county, and town as the college over all years for which yearbooks are available; to the best of our knowledge, these results are also novel to the literature on the history of education.

In all panels and columns, results are qualitatively similar to those in Table 4, although sample sizes are smaller since we do not have hometown information in all yearbooks. Additionally, we have less effective variation within each college-year since we omit individuals who live in locations different from the university. Consequently, some results are no long statistically significant at conventional levels, especially in the last two panels when effective sample sizes become quite small. Overall, however, we view these results as broadly consistent with a negligible role for self selection of students to colleges.

5.3 Student Backgrounds

The fact that the yearbooks report students' hometowns also allows us to match students' names and towns of former residences to U.S. decennial census records to determine if home economics induces women from different backgrounds to enter college and major in science. We link first names, last names, hometowns, and home counties, blocking on state, to the last U.S. decennial census that was completed before an individual would have entered college, and keep any successful matches for individuals who would have been 22 years old or younger at the time of their inclusion in a yearbook.[20] In Appendix D.5, we present match statistics and show that we are able to match male and female students, and home economics, science, and other majors, at comparable rates.

As shown in the model in Section 3, one channel through which home economics brings more women into science is by inducing women to enter college and pursue a home economics degree who would have otherwise chosen to forego a college education and become homemakers

[19] Results replicating Panel (b) of Table 4 using women from the same location as the college are available upon request.

[20] So, for instance, we would match an individual in a yearbook published from 1935-1944, inclusive, to the 1930 census because we can be certain that the census was taken more than four years before the individual appeared in the yearbook record. We keep an individual if $YearbookYear - CensusYear + CensusAge <= 22$. We use the reclink2 command in Stata to conduct the matching; see Wasi and Flaaen (2015).

Table 5: Home Economics and Science Majors from the Yearbook Sample: Women with Hometowns Close to their College

(a) Same State

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of women in home ec	0.294***		0.346***	0.237***		0.257***
	(0.0876)		(0.0849)	(0.0534)		(0.0634)
Any women home ec majors		0.0192	-0.0426		0.0321	-0.0190
		(0.0300)	(0.0263)		(0.0397)	(0.0414)
Observations	231	231	231	162	162	162
Adj. r^2	0.603	0.568	0.605	0.668	0.656	0.666
Mean Dep. Var.	.105	.105	.105	.209	.209	.209

(b) Same County

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of women in home ec	0.173		0.262	0.0799		0.138
	(0.244)		(0.261)	(0.255)		(0.222)
Any women home ec majors		-0.0385	-0.0863**		-0.0195	-0.0633
		(0.0682)	(0.0375)		(0.117)	(0.0571)
Observations	222	225	222	126	129	126
Adj. r^2	0.542	0.531	0.548	0.532	0.496	0.529
Mean Dep. Var.	.126	.138	.126	.289	.288	.289

(c) Same Town

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of women in home ec	0.251		0.348	0.242		0.388
	(0.206)		(0.223)	(0.337)		(0.349)
Any women home ec majors		-0.00479	-0.102**		-0.00949	-0.161*
		(0.0931)	(0.0388)		(0.162)	(0.0832)
Observations	205	208	205	100	103	100
Adj. r^2	0.525	0.468	0.531	0.537	0.514	0.541
Mean Dep. Var.	.122	.135	.122	.274	.279	.274

Notes: In all panels, the unit of observation is a college in a particular year. Panel (a) includes only students in yearbooks that are born in the same state as the college. Panel (b) includes only students in yearbooks that are born in the same county as the college. Panel (c) includes only students in yearbooks that are born in the same town as the college. In all panelts, the dependent variable for columns 1-3 is the share of non-home economics female students who major in science. The dependent variable for columns 4-6 is the number of female science majors divided by the number of all science majors. The dependent variable in columns 7-9 is the number of female science majors. Standard errors are clustered by college and reported in parentheses. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

or unskilled workers; some of these would-be non-college women would have then learned that they liked science through exposure in the home economics curricula. To see if this is the case, we use several variables proxying for students' family backgrounds and see whether those proxies differ on average for home economics majors and for science majors in colleges and years with larger home economics programs.

We first compare female home economics majors to all non-science female students, estimating

$$FamilyBackground_{ict} = \beta_1 HomeEcMajor_{ict} + \beta_2 X_{ct}\alpha + Decade_t + \epsilon_{ct}, \tag{17}$$

for student i attending college c in year t. We again control for the size of the college and the number of female students and cluster standard errors by college. In Column 1 of Table 6, we show that home economics majors are about two percentage points less likely (about 30%) to have a mother in the labor force than other non-science female students. Much of this difference comes from differences across schools in the relative size of their home economics programs; in Column 2 we include a college fixed effect and, while the estimated sign is still negative, it is about one-third as large in magnitude and no longer statistically significant at conventional levels. In Columns 3 and 4, we repeat the exercise in Columns 1 and 2 but use logged fathers' income as the proxy for family background.[21] Home economics majors come from families with fathers earn about 11% less than the fathers of non-home economics majors, although again this difference is not statistically significant after including state fixed effects.

In Columns 3 and 4, we test whether female science majors are likewise more likely to come from households with mothers who are not in the labor force and fathers earning lower incomes than are female non-science majors in the same college when the home economics program is

[21] We calculate fathers' incomes using occupational income scores.

larger, providing additional suggestive evidence for the exposure effect. We estimate

$$\begin{aligned} FamilyBackground_{ict} = & \beta_1 WomenInHomeEconomics_{ict} + \beta_2 ScienceMajors_{ict} \\ & + \beta_3 WomenInHomeEconomics_{ct} \times ScienceMajors_{ict} \\ & + \beta_4 X_{ct}\alpha + College_c + Decade_t + \epsilon_{ct}, \end{aligned} \tag{18}$$

using the same set of controls as before and excluding home economics majors from these regressions. For $WomenInHomeEconomics_{ct}$, we again use the share of non-science female science majors that major in home economics. In Column 5, we show that science majors are less likely to have a mother in the labor force in colleges with a larger share of women majoring in home economics. In Column 6, we show that science majors likewise have fathers earning a lower income in colleges with larger home economics programs. If women whose mothers are not in the labor force or whose fathers earn lower incomes are less likely to be pursue high-income, technical careers themselves, then these results are consistent with home economics drawing more of these women into science.

Table 6: Family Backgrounds of College Students

	Mother In Labor Force		Father Income		Mother In Labor Force		Father Income	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Home ec major	-0.0205**	-0.00672	-0.114**	-0.107				
	(0.00769)	(0.00770)	(0.0461)	(0.0636)				
Share of women in home ec					0.0572	-0.00419	0.0677	0.125
					(0.0397)	(0.124)	(0.0408)	(0.164)
Science major=1							0.0553*	0.243***
							(0.0271)	(0.0761)
Science major=1 × Share of women in home ec							-0.0909**	-0.726***
							(0.0342)	(0.0836)
Number of students	0.0000110	0.00000375	-0.0000126	0.000254	0.0000335	0.000183	0.0000345	0.000203
	(0.0000211)	(0.0000356)	(0.000118)	(0.000207)	(0.0000399)	(0.000211)	(0.0000396)	(0.000211)
Number of female students	-0.0000847	-0.0000149	0.000418	-0.000539	-0.0000793	-0.000277	-0.0000790	-0.000301
	(0.0000667)	(0.0000917)	(0.000332)	(0.000566)	(0.000102)	(0.000528)	(0.000101)	(0.000523)
Observations	5676	5676	5676	5676	4398	4398	4398	4398
College Fixed Effect	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Adj. r^2	0.00367	0.0105	0.0111	0.0114	0.0133	0.0142	0.0136	0.0151
Mean Dep. Var.	.069	.069	22.433	22.433	.075	22.935	.075	2.693

Notes: The table reports OLS estimates. An observation is a female student from the yearbook sample. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

6 Historical Home Economics and Recent Educational Outcomes

Our model in Section 3 suggests a channel through which more women studying college home economics in the past could lead to ossified beliefs about the fields in which women are most likely to succeed. In this section, we present evidence for this persistent effect of historical home economics.

We test whether having a larger share of women in home economics in 1910 Commissioner Report predicts the share of women studying science-related fields in years from 1965 to the present. We estimate

$$FractionMajorFemale_{c,t} = \beta ShareWomenHomeEconomics_{c,1910} + Year_t + \epsilon_{c,t}, \tag{19}$$

for several majors, where $FractionMajorFemale_{c,t}$ is the fraction of each major that is female and t indexes all years in the National Center for Education Statistics (2017) from 1965 to 2016.[22] Because we have multiple recent observations for each college listed in the 1910 Commissioner report, we include year fixed effects and cluster standard errors by college. Linking colleges across time is not a trivial exercise, as colleges frequently change names, exit, merge, or move locations. To merge our historical data to modern data on college majors, we manually assign modern IPEDS codes to the set of colleges appearing in the 1910 Commissioner of Education Report.

The idea behind this test is that beliefs about the fields women will be most successful in have a locational component. For instance, women who attend a college that has historically produced a large number of female biology majors will be more likely to view biology as a good

[22]We prefer to us the fraction of majors that are female for the specifications in this section (instead of the share of women who choose a particular major, as in many of the baseline results in Sections 4 and 5) because the more narrowly-defined majors in the NCES data mean that women spread themselves out more thinly over many closely-related majors that may be classified in different ways. More concretely, even if home economics has the effects we conjecture in this paper, historical home economics may be negatively correlated with the share of women majoring in biology today since home economics also opened doors for women to study related majors such as public health, epidemiology, veterinary medicine, psychology, etc. Because the fraction of majors who are female is trivially 1 for female-only schools and trivially 0 for male-only schools, in this section we restrict attention to coeducational institutions.

major for them than women who attend a college that does not have such a history. We stress that this is a demanding test. After 45 years, women's beliefs about fields are likely to have spread and become partially geographically harmonized. Historical home economics exposure may be as likely to be reflected in nationwide beliefs as in college major shares at a specific college.

We present results in Table 7. We begin by estimating the correlation between historical home economics and female biology majors, a major that was heavily taught in home economics through the 1920s and continued to appear for decades. A ten percentage point increase in the share of women majoring in home economics in 1910 is associated with a statistically significant 5.3 percentage point increase in the fraction of biology majors that are women since 1965. In Column 2, we instead use the share of women majoring in home economics *in the same year* as the explanatory variable. We find that contemporaneous home economics has a statistically insignificant correlation with the fraction of women majoring in science, although the correlation is economically large at 7.5 percentage points. In Column 3 we include both 1910 home economics and contemporaneous home economics, since our measure of contemporaneous home economics may be picking up persistence in the size of home economics programs over decades. In this specification, we find that historical home economics continues to significantly predict the fraction of science majors that are female, and if anything the magnitude is slightly larger, but contemporaneous home economics has a negative and still statistically insignificant correlation. This latter result should not be surprising, given the the de-emphasis of science in post-World War II home economics curricula. Taken together, these results are consistent with historical home economics at a particular college changing women's beliefs about the suitability of biology as a major at that college, but as the field of home economics became more domestic-focused in recent decades, a larger home economics program today does not lead women into the field of biology.

In Columns 4-6, we use the fraction of engineering majors that are female since 1965 as the dependent variable. Since engineering was never emphasized in home economics, we should expect home economics to have a negative or null effect on engineering majors. Indeed, we find that a larger share of women in home economics in 1910 is associated with a 3.5 percentage point decline in the fraction of engineering majors that are women. A larger contemporaneous share of women majoring in home economics is likewise correlated with a smaller fraction of engineering majors that are women, with a large decline of 18 percentage points. When including both historical and contemporaneous home economics in the specification, we again find that contemporaneous home economics is associated with a large decline in the fraction of engineering majors that are female; the coefficient on historical home economics is still negative, but is smaller in magnitude and no longer statistically different from zero. In Appendix D.6 we conduct similar exercises using several other groups of majors from the NCES data.

Table 7: Home Economics and Science from 1965-2016, All Colleges in the 1910 Commissioner Report

	Biology			Engineering		
	(1)	(2)	(3)	(4)	(5)	(6)
Share women in he in 1910	0.0527***		0.0569***	-0.0351***		-0.0192
	(0.0152)		(0.0174)	(0.0118)		(0.0137)
Share of women in home ec 1965-2016		0.0749	-0.0344		-0.184***	-0.136*
		(0.0580)	(0.0652)		(0.0553)	(0.0691)
Observations	8601	8738	8600	3761	3853	3761
Adj. r^2	0.440	0.440	0.440	0.345	0.354	0.346
Mean Dep. Var.	.495	.496	.496	.15	.15	.15

Notes: The table reports OLS estimates. An observation is a college in a year 1965-2016. The dependent variable is the fraction of biology majors that are female (Columns 1-3), and the fraction of engineering majors that are female (Columns 4-6). Standard errors are clustered by college and reported in parentheses. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

7 Conclusion

In this paper, we study how the collegiate home economics curriculum in the early 20th century could have affected women's entry into scientific majors and fields up to the present. While home economics is largely associated with homemaking skills today—cooking, sewing, etc.—we show, using novel data from historical course catalogs, that in the early 1900s the typical college home economics curriculum required multiple courses in biology, chemistry, and related subjects. We then document a contemporaneous link between women studying home economics and women studying science using two data sources: the 1910 Commissioner of Education report and a panel of college yearbooks. Using the unique relationship between home economics programs and male agricultural education to instrument for the size of historical home economics programs, we argue that this relationship is likely causal. Moreover, home economics programs led women who would otherwise have been less likely to attend to college to enter into home economics programs and, eventually, into science. Finally, we show that the relative size of home economics programs in the past still predicts women's choice of college majors in recent years. The modern data also allows us to more finely observe major choice. We document that historical home economics predicts a larger share of women majoring in biology, but a null or negative effect on physical sciences or engineering.

Given its domestic focus today, home economics is at best an afterthought to those studying STEM majors today; at worst it is seen as retrogressive. One goal of this paper is to highlight the surprisingly progressive legacy of home economics. At a time when women had few opportunities to study science at the collegiate level, home economics successfully served as a gateway, at least for a few fields of science. These findings also demonstrate that historical social movements and educational policy choices can have long-lasting, and perhaps unintentional, effects on gender differences today.

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