April 12, 2015
first version August 2013

Gender and the Undergraduate Economics Major:

Notes on the Undergraduate Economics Major at a Highly Selective Liberal Arts College

Claudia Goldin [1]
Department of Economics
Harvard University

I have written these notes to explore why women are not majoring in economics to the same degree as are their male BA counterparts across a wide variety of colleges and universities. I focus on a liberal arts college called Adams. Adams is similar in selectivity to institutions such as Amherst, Brown, Chicago, Columbia, Cornell, Dartmouth, Harvard, Pennsylvania, Princeton, Stanford, Swarthmore, Williams and Yale.

Differences in the male and female rates of majoring in economics are large and do not appear to be narrowing. It should be said at the outset that economics continues to be a highly popular major in most universities and colleges. Around 10 to 20 percent of all male undergraduates major in economics among the top-ranked 100 universities and top 100 liberal arts colleges without an undergraduate business major. At Adams almost one in five male students majors in the field. The emphasis in this note is on the *relative* popularity of economics among female undergraduates.

The reason for my interest in female economics majors is because I would like all students to have accurate information regarding the usefulness of a major. Many college seniors, both male and female, realize too late in their studies that knowledge of statistics, econometrics, and economic modeling are helpful tools in a large number of areas. Too often students think that economics is only for those who want to work in the financial and the corporate sectors. Many do not realize that economics is also for those who have broad intellectual interests. And that it is also for those with far-reaching goals that may include reducing crime, obesity, inequality, terrorism, poverty and infectious disease, to mention a few of the areas in which economists have advanced knowledge.

[1] I thank the Institutional Research staff at Adams College. Friederike (Fritzi) Reuter ably helped with the data analysis, Natalia Emanuel and Amira Abulafi made valuable suggestions, and Larry Katz provided important insights and comments. I thank them all.

Economics Majors Nationwide and at Adams

For every female economics major today there are almost 2.9 male majors nationwide, relative to their numbers as BAs. I term that statistic the "conversion rate." (At many institutions where women greatly outnumber men it is important to scale by the number of BAs.) The rate is nearly 2.5 among the 100 top-ranked universities and about 2.6 for the 100 top-ranked liberal arts colleges.[2] The conversion rate varies considerably across schools. It is higher in schools that have a business major, as women tend to exit economics to major in business. In the aggregate the conversion rate has been fairly constant for the past two decades (see Fig. 1).

The record at Adams is similar to that of most of its peer institutions (averaged across 2009 to 2011) using data from the IPEDS. The relative rates at which male versus female BAs become economics majors for that period are as follows: Dartmouth (2.32), Princeton (2.09), Yale (1.94), Columbia (1.86), Chicago (1.85), Harvard (1.83), Stanford (1.78), Cornell (1.74), Pennsylvania (1.69), and Brown (1.64). There are some outliers that have more women: Berkeley (1.47), UCLA (1.18) and MIT (0.74). The explanation for MIT is that engineering schools tend to have a far higher fraction female in non-engineering subjects. The reason that Berkeley and UCLA have relatively more women than the other institutions listed will be discussed at the end.

The fraction female among economics majors at Adams decreased somewhat during the past eight years but rose recently and women were about 0.33 of the 2013 graduating class. The conversion rate (given as the green line in Fig. 2) rose a bit to 2006, then decreased to 2009 and then rose to 2013. Almost all of the movement in the conversion rate at Adams has been due to changes in the rate for males not that for females, which has remained fairly constant at 10 percent for graduating classes from 2005 to 2013 (see red line in Fig. 2). Including applied math majors who do the economics track increases the fraction of majors for both males and females, but the male share does not change by a significant amount.[3]

I turn now to an analysis of Adams College administrative data. Each observation in the data has been arranged by the student's graduating class. To ensure consistency across classes I use only individuals who appear in the data as freshmen or sophomores.

[2] Data are from U.S. Department of Education, IPEDS and are weighted by the number of BAs. Schools are included only if they grant a BA in economics. Top group of 100 is from *US News & World Report*.
[3] The number of applied math majors who do the economics track is estimated by assuming that all applied math majors who take the intermediate sequence do the economics track.

When and Why Do Females, Relative to Males, Fall Out of Economics?

The fraction female among economics majors at Adams is around 34 percent in the graduating classes from 2005 to 2013. About 14.7 percent of all students major in economics (10 percent of female and 19.5 percent of male students). Economics is a popular major at Adams but far less so for females than for males.

Economics is also a popular secondary major.[4] The current fraction of students (2013 graduating class) for whom economics is their secondary field is 14 percent, among those who pick any secondary field. The division between males and females echoes that for majors: 17.6 percent of males who pick a secondary choose economics compared with 10.2 percent of the women.

Given the low fraction of female relative to male economics majors, the question is whether women drop the idea of the major after taking the introductory economics courses or disproportionately do not express interest in the major from the outset. The answer is some combination of the two.

Only about 10 percent of women list economics as their primary major upon acceptance whereas almost 20 percent of men do.[5] It would appear, therefore, that the die is cast even before students enter the campus grounds. But there is considerable flux in this declaration.

For women there are three almost equally sized groups among those who eventually major in economics and/or listed it as their first choice: those who major in economics and had stated they would (0.33), those who major in economics but did not list it as their first choice (0.36), and those who listed it as their first choice but did not major in it (0.31).[6] Because most of the students who listed economics as their first choice but did not major in it took the principles course in the Fall, a large group leaves the major after that point although another equally sized group enters.[7] (I will term taking the principles course in a semester as "Principles-Fall/Spring.") The women who leave are disproportionately those who did not get an A or A-.

Therefore, the drop-off for women relative to men occurs at several points in their progression from new entrant to sophomore. There is a relative drop-off of women from freshman entrant to Principles-Fall and also from Principles to the Intermediate sequence (see

[4] Secondary majors have existed ever since the graduating class of 2007. The requirement for the secondary in economics is both semesters of principles, one semester of the intermediate course and three other upper level economics courses.
[5] By "acceptance" is meant when the student accepts the offer from Adams.
[6] For males the division is: 0.39 major in economics and say they will; 0.31 major in economics but do not say they will; and 0.30 listed economics as their top major but do not eventually pick it.
[7] Principles Fall is "micro" and Principles Spring is "macro." Until 2005 students who took Principles Fall had to take Principles Spring to get credit. But after 2005 the courses were separated.

Fig. 3). A somewhat greater fraction of females relative to males exit after taking Principles-Fall when Principles-Fall could be taken separately from Principles-Spring.

One obvious reason why women disproportionately do not take Principles and eventually do not major in economics is because they enter Adams with less desire to major in economics than do their male counterparts.

Incoming freshmen at Adams are asked to provide each of their three most likely majors. Because high school students have probably not been exposed to many of the 54 subject selections on the form, their answers are expected to have considerable error. Interestingly, the fraction of both males and females who state that economics is their most likely major is approximately equal to the fraction who eventually majors in the subject. But there is considerable flux.

At the time of their acceptance 9.4 percent of females and 19 percent of males in the graduating classes of 2005 to 2013 stated an intention to major in economics. The fractions that actually majored in economics in these classes are 10 and 19.5 percent. But half of the women who initially intended to major in economics eventually did not whereas 44 percent of the men did not (see Table 1).

The intention to major in economics at the time of acceptance is a strong determinant of whether a student takes Principles or places out of one or both semesters upon entry. Almost 80 percent of students (either male or female) who gave economics as their top choice upon acceptance took Principles-Fall and an additional 10 percentage points placed out of it. Among females who did not give economics as their first choice 33 percent took Principles-Fall and among males 43 percent did. The Principles course is clearly very popular but especially so among those who enter Adams College with an interest in economics as a major.

Considering the top three majors each student declared about 24 percent of females listed economics as one of them and a whopping 43 percent of the males did. About 80 percent of the males and 74 percent of the females who eventually majored in economics had given economics as one of their top three choices upon acceptance. The remaining group was drawn from among those who did not list economics as one of their top three choices. They were widely dispersed regarding their initial top choices although the most numerous were government (for males and females), engineering (for males) and psychology (for females).

Taking and Placing Out of Principles of Economics: The Portals to Economics

As just noted, Principles is highly popular at Adams and 44 percent of Adams College students take at least the first semester (50 percent of males and 37 percent of females in the graduating classes considered here). Until 2005 students had to take both semesters of Principles to get a grade but after 2005 students could take Principles-Fall without taking Principles-Spring.

Because the student data are grouped here by graduating class and because most students take these courses in their freshman or sophomore years, the class of 2007 was the first affected by the change. As can be seen in Fig. 4, the fraction of both males and females taking Principles-Fall (but not Spring) greatly increased with the ability to split the semesters but differences in enrollment by semester then narrowed.

In the most recent graduating class about 32 percent of female and 47 percent of male undergraduates took both semesters of Principles (or placed out of the Fall semester and took Principles in the Spring). The fraction female among Principles students in 2013 was around 40 percent and reached a local peak of 44 percent with the graduating class of 2009 (see Fig. 5).

Males receive considerably higher grades in Principles-Fall than do females (Fig. 6, panel A). They garner more A's and A-'s (44 percent) than do females (38 percent). Grades in Principles are extremely important in determining whether females major in economics. But that is far less the case for males.

The probability of majoring in economics by the grade in Principles is given in Fig. 6, panel B and demonstrates that males major in economics almost without regard to their grade in the elementary course.[8] Women, on the other hand, major in economics primarily if they did well in Principles. Whereas 42 percent of the females with A's in Principles major in economics and 40 percent of the males with A's do so, just 27 percent of the females with a B+ major in economics but 41 percent of the males do. That is, a nearly identical fraction of males with an A major in economics as with a B+, but for females those with a B+ are two-thirds as likely to major in the field as are those with an A.

The relative fall off of women from Principles to intermediate microeconomics (Ec200 and Ec300) is primarily due to the fact that females do not continue with economics unless they do fairly well in Principles.[9] Although they receive a lower fraction of the A's and A-'s, that factor is a minor part of the difference. Far more important is the gradient of their continuing in economics with regard to their grade in Principles. Note that continuation to intermediate microeconomics from Principles is almost equivalent to who majors in economics or has a secondary in the subject.

One possibility is that males with low grades in economics major in the field because they also have low grades in other subjects as well but females have higher grades in other subjects and gravitate to them. The data currently made available do not allow a complete understanding of that possibility but one can look at the entire GPA.

[8] The conclusions from this analysis would not change if Principles-Fall were used instead.
[9] Note that the difference in the gradient with regard to the grade in Principles for males versus females exists within groups. For example, it exists for certain groups like Asian-Americans and international students who have relatively high rates of majoring in economics and it also exists for those who intended to major in economics and for those who did not intend to do so.

Female economics majors have higher GPAs than male majors (see Fig. 7). In addition, they have even higher GPAs relative to non-economics majors whereas males economics majors have lower GPAs than other majors. Even among students with an A or A- in Principles-Fall, females have higher GPAs than do males. That is, female economics majors are positively selected on their GPA whereas male economics majors are negatively selected on their GPA. One disconcerting factor is that non-economics majors who receive an A or A- in Principles-Fall have higher overall GPAs than do economics majors and this holds for males and females.[10]

Intermediate Theory: The Entry Points for Majors

Economics majors at Adams are required to take the Micro and Macro Intermediate sequence. These courses are called Ec201, Ec301 for Micro and Ec202, Ec302 for Macro. The higher number means that the level of mathematical proficiency needed is greater. Ec201, Ec202 use less math and Ec301, Ec302 use more. In addition, one or both of the semesters are taken by other majors. It, too, is a popular (although demanding) course at Adams.

Among all Adams students 26.7 percent take Ec201 or 301, Micro-Intermediate (18 percent of female and 36 percent of male students).[11] Thus about 34 percent of the students in Micro-Intermediate are female and that is also the case for the entire intermediate sequence. The full year of intermediate theory attracts 20.4 percent of all Adams College students (13.7 percent of female and 27.2 percent of all male students). Fewer take the Spring (Ec202 or Ec302 Macro-Intermediate) course than the Fall (Micro-Intermediate) but an equal fraction of males and females exit. The fraction female in intermediate theory increased somewhat after the 2007 graduating class but it has recently decreased to 32 percent (Fig. 8).

As just noted, the intermediate sequence has two tracks. One (Ec200) is the less mathematical and another (Ec300) is more mathematical. More than 70 percent of Adams students who enroll in the Intermediate course take the Ec200 track, but most who continue with economics in graduate school have taken the Ec300 sequence. The fraction female is around 7 percentage points less in Ec200 than in Ec300.

The aggregate falloff from Micro-Intermediate to the major is about 70 percent and does not differ by sex (as was apparent from Fig. 3). In addition, females who took the Micro-Intermediate course are somewhat more likely than are males to pick economics as a secondary major beginning with the class of 2007 (10 versus 14 percent).

Women do better than men in Ec200 (less mathematical version) but worse in Ec300 (more mathematical). The mean grade for women in Ec201 is 3.33 but is 3.24 for men. The tables are turned in Ec202 where men have a mean of 3.40 and women 3.30. Interestingly, the

[10] This finding is unaffected by excluding majors in the humanities.
[11] The Intermediate sequence data includes students who placed out of both semesters of Principles.

means for Ec301 are about the same by sex (3.30) although men do better in Ec302 than do women (3.42 vs. 3.35). The full distributions for the four courses by sex are given in Fig. 9.

Students who take Micro-Intermediate but who do not major in economics tend to major in applied math, social issues, and government (for males). The data in Fig. 10 are expressed as an odds ratio where a value exceeding one means that the major is greater than average for those who took Micro-Intermediate and a value under one means that the major is less than average for those who took Micro-Intermediate.

Race, Ethnicity and Gender

I have, thus far, not discussed demographic differences across students other than gender. Yet these distinctions have important implications for gender differences. I had earlier noted that the conversion rate in economics at Berkeley was 1.47 for 2009 to 2011 and was 1.18 at UCLA. The reason, it appears, is in part that Asian-American students have a higher fraction of females majoring in economics than do other ethnic and racial groups, in particular than do U.S. born whites. In fact, about the same fraction of Asian-American women at Adams major in economics as do U.S.-born white men.

Among Asian-American students at Adams the conversion rate is 1.22 but among U.S. whites it is 2.83 (see Fig. 11). International students also have relatively more female economics majors and a conversion rate of 1.39. Asian-Americans are 16 percent of Adams College students, international students are 11 percent, and U.S.-born whites are 46 percent (although there is a substantial group with no listed race/ethnicity).

Summary of the Findings

There are about two males for every one female majoring in economics in the graduating classes at Adams from 2005 to 2013. Women disproportionately do not major in economics at Adams. But Adams is not alone in this circumstance. The same is true of Adams's peer institutions.

Males come to Adams with a far greater intention to study economics than do females. At the time of acceptance two males for every one female state that economics is their number one major choice, the same ratio for actual majors. Males whose top choice is economics are less dissuaded than are females from majoring in economics when they do poorly in the introductory principles course. But, for the most part, much regarding the economics major decision is determined before any course is taken. More than 50 percent of those who gave economics as their top choice eventually majored in the field. And 80 percent of male majors

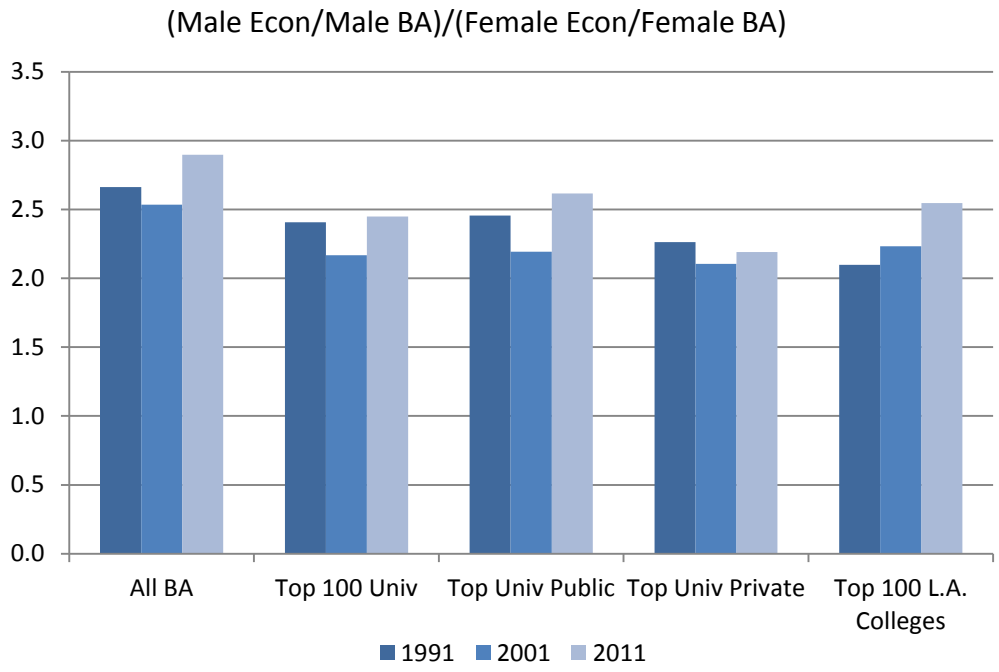
and 74 percent of female majors had listed economics as one of their three top choices at the time of acceptance.

Does math-ability have much to do with these differences? The raw difference between males and females in declaring economics as one of the three top choices upon acceptance is 0.187. Including the pre-admission scores on the SAT math and the Adams math placement test reduces the difference by just 1 percentage points to 0.177. Math-ability does not have much to do with the initial decision to major in economics and with the eventual major.

What about taking economics prior to admission? Males disproportionately take AP economics, but that does not explain the large differences in major choice discussed here. Among male undergraduates 15.8 percent take the macro AP and 11.4 percent of females do; 12 percent of males but 9.2 percent of females take the micro AP. Differences with regard to the major are much larger. Including whether or not a student took the economics AP decreases the difference between males and females in the declaration of economics as the intended major by less than 1 percentage point. Similar results hold for the eventual major.

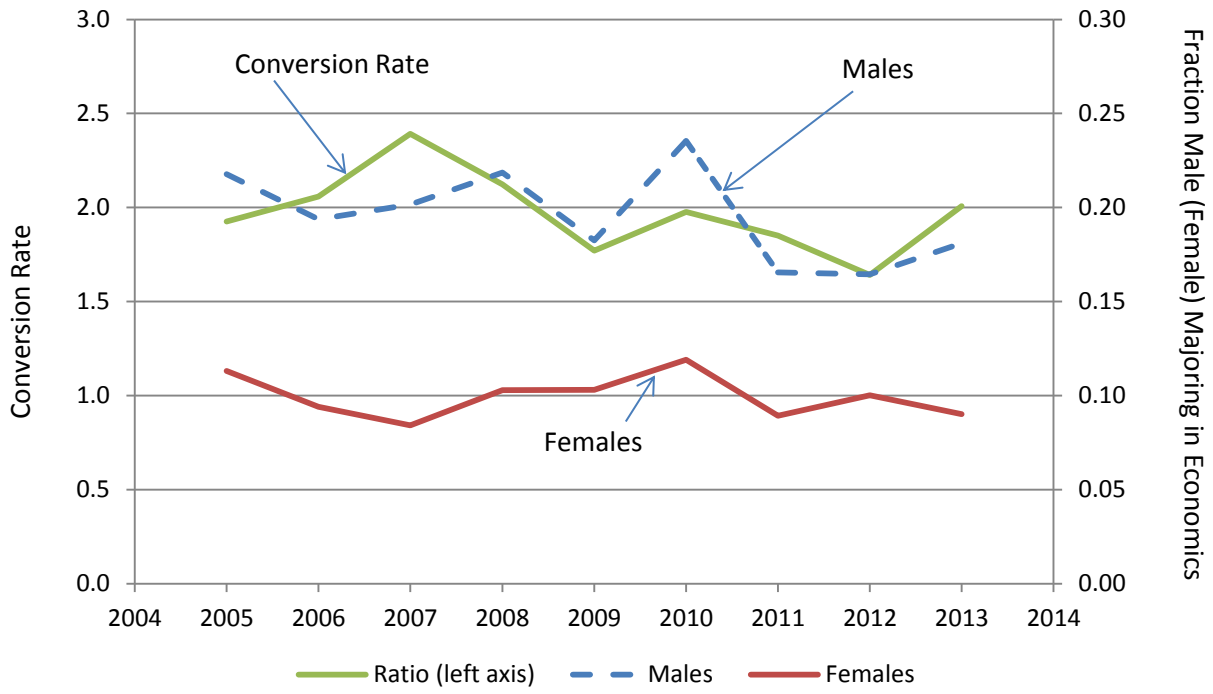
Exactly why males decide to major in economics far more so than females, even prior to beginning their freshmen year, remains somewhat of a mystery. It is likely that males have a stronger desire to work in the financial and corporate sectors and see economics as their ticket to success in those realms. It is important to impress upon the recent entrants that economics can be a ticket to success in a large number of realms, not just in the financial and corporate sectors.

Figure 1: Economics Majors as a Fraction of BAs by Sex and Institution Type: 1991, 2001, 2011



Source: IPEDS data on-line.

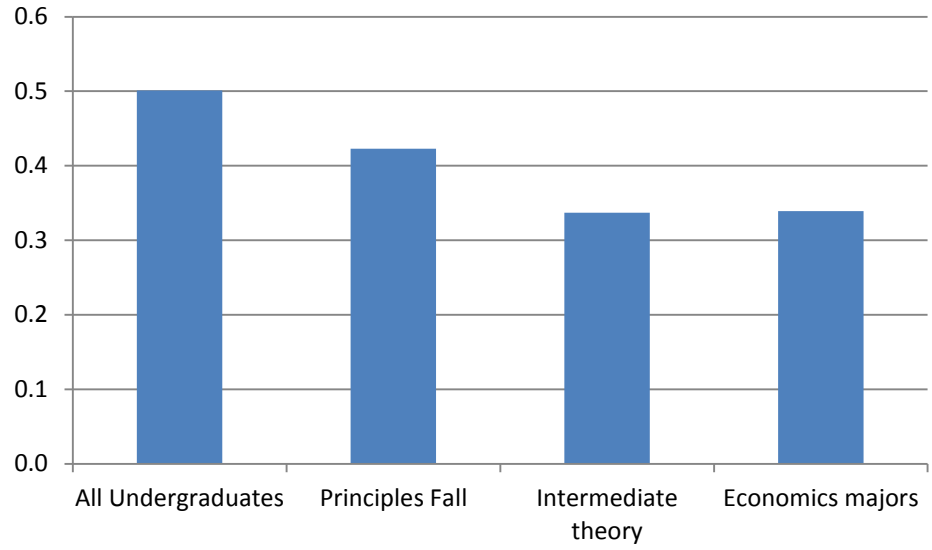
Figure 2: Male versus Female Economics Majors as a Fraction of BAs and the Conversion Rate: Adams, 2005 to 2013 Graduating Classes



Source: Adams College administrative data.

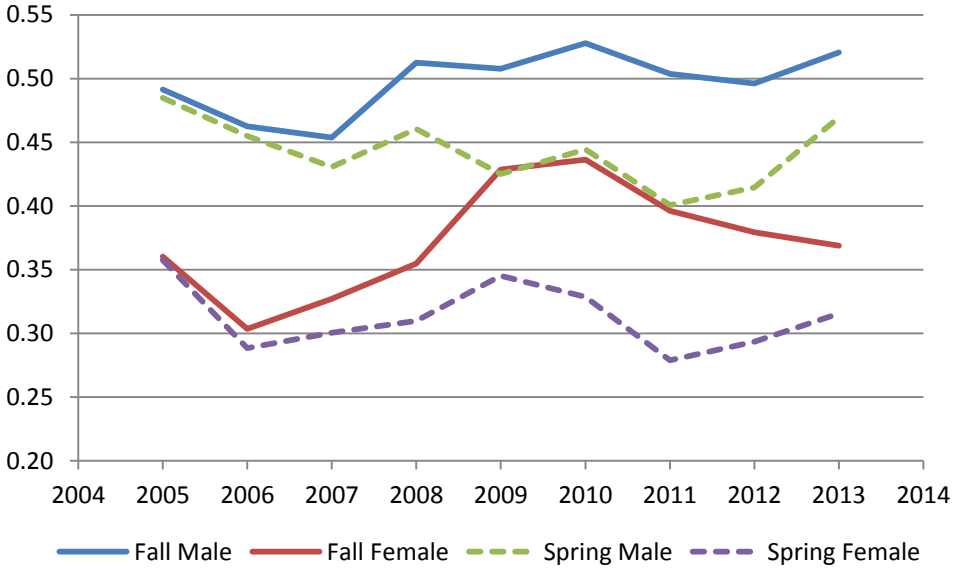
Notes: Conversion rate is graphed onto the left axis and Male and Female fractions are graphed onto the right axis. The conversation rate is (male economics majors/male BAs)/(female economics majors/female BAs) = (Fraction Males Majoring in Economics)/(Fraction Female Majoring in Economics).

Figure 3: Fraction Female by Stages to Economics Major: 2005 to 2013 Graduating Classes



Source: Adams College administrative data.

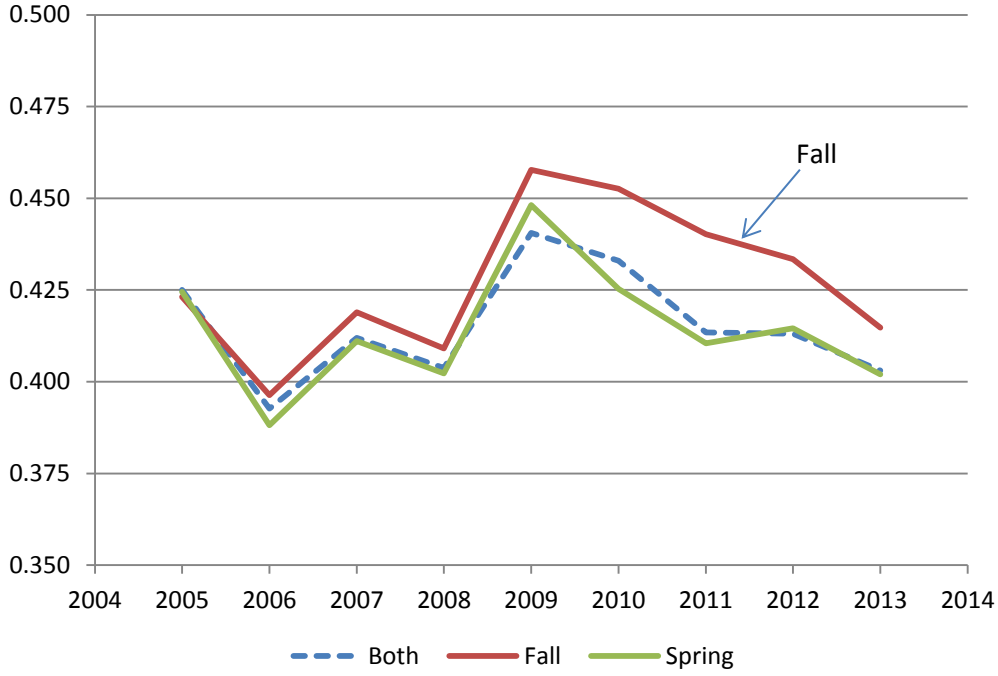
Figure 4: Principles Students as a Fraction of 2005 to 2013 Graduating Classes by Sex



Source: Adams College administrative data.

Notes: Male Fall, Female Fall: took Principles-Fall, does not include those who placed out of micro-economics. Male Spring, Female Spring: took Principles-Spring, does not include those who placed out of macro-economics. Principles could have been taken in any year and is not restricted to freshman and sophomore years. Students who place out of any semester are included only if they actually took the course in that semester.

Figure 5: Fraction Female among Principles Students: 2005 to 2013 Graduating Classes

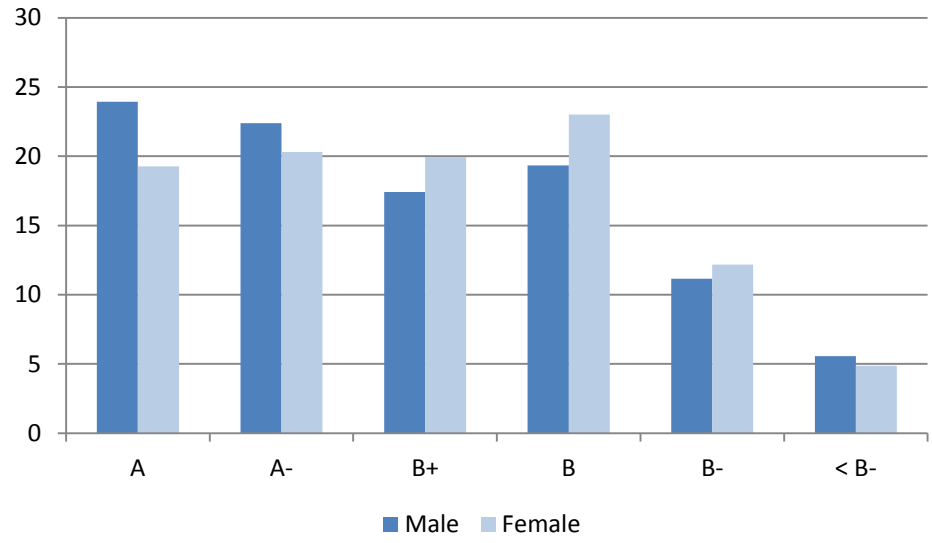


Source: Adams College administrative data.

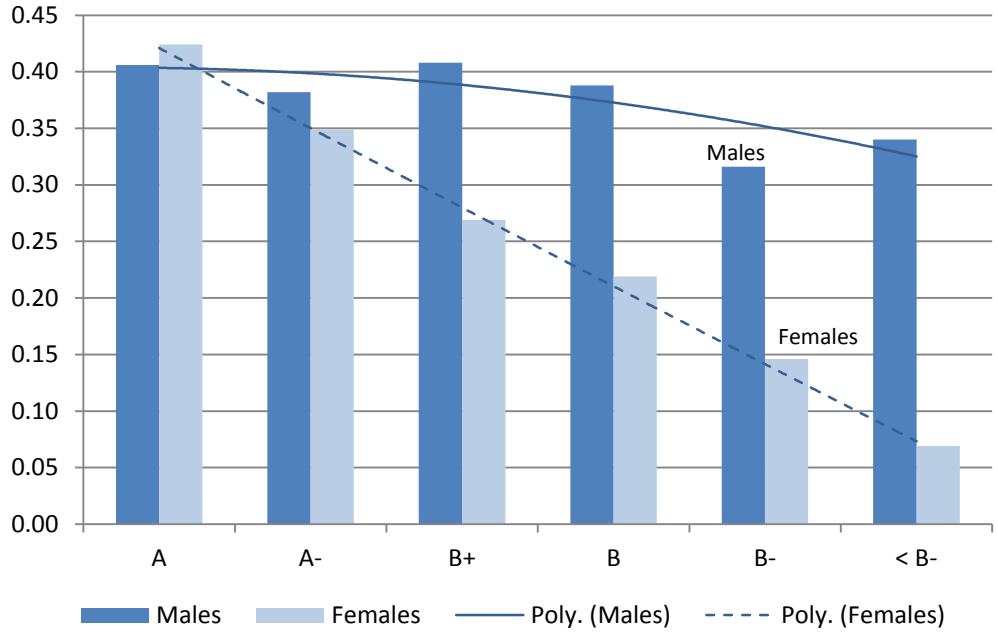
Notes: Both Semesters: took both Fall and Spring of Principles or placed out of one or the other semester. Fall, Spring: took Principles in that semester. Fraction female is expressed as a "conversion rate," meaning that it is scaled by the number of BAs of each sex.

Figure 6: Grade Distribution in Principles and the Fraction Majoring in Economics by Grade in Principles by Sex: 2005 to 2013 Graduating Classes

A. Distribution of Grades in Principles-Spring (or Fall if placed out)



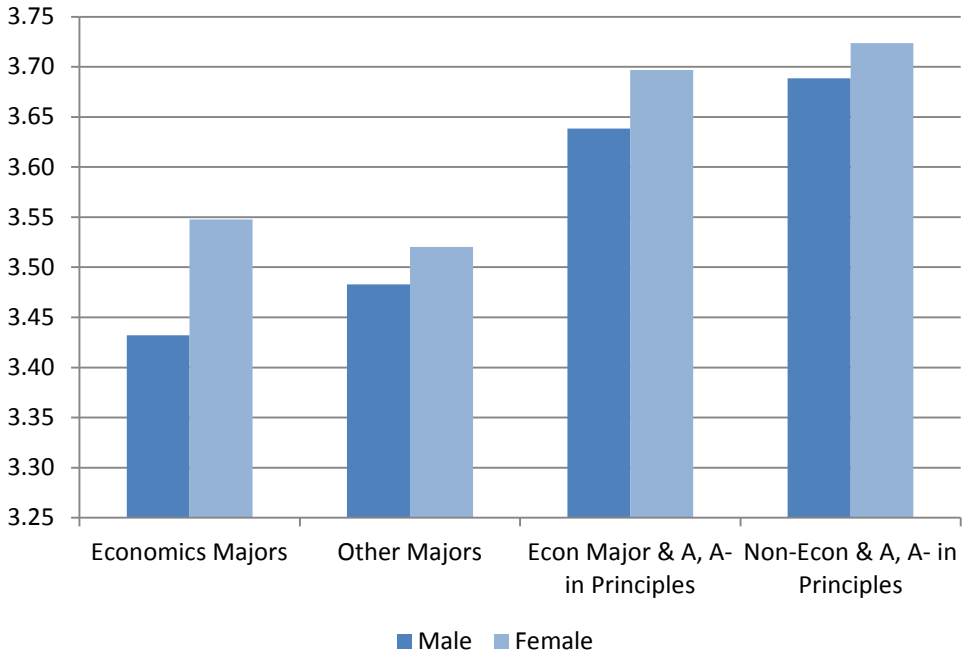
B. Fraction Majoring in Economics by Grade in Principles-Spring (or Fall if placed out)



Source: Adams College administrative data.

Notes: Grade is for Principles-Spring or -Fall if student placed out of Principles-Spring. Results do not change if Principles-Fall is used. Trendlines are second degree polynomials.

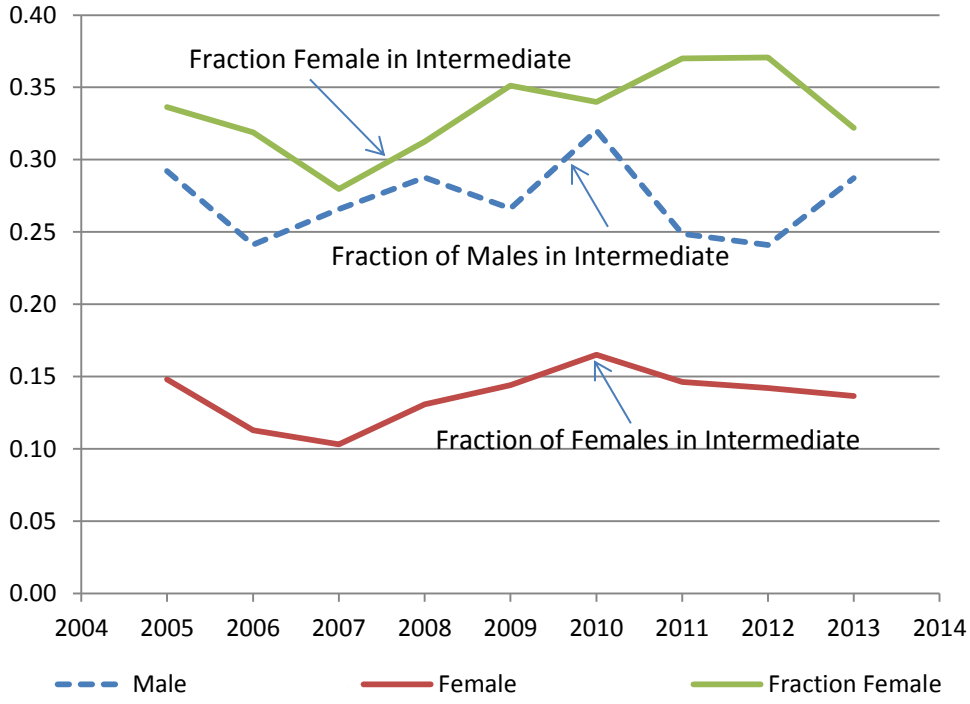
Figure 7: GPA at Graduation by Major and Grade in Principles



Source: Adams College administrative data.

Notes: Grade is for Principles-Fall but results do not change if Principles-Spring is used.

Figure 8: Fraction Female and Male Undergraduates Taking Intermediate Theory and Fraction Female among Intermediate Students: 2005 to 2013 Graduating Classes

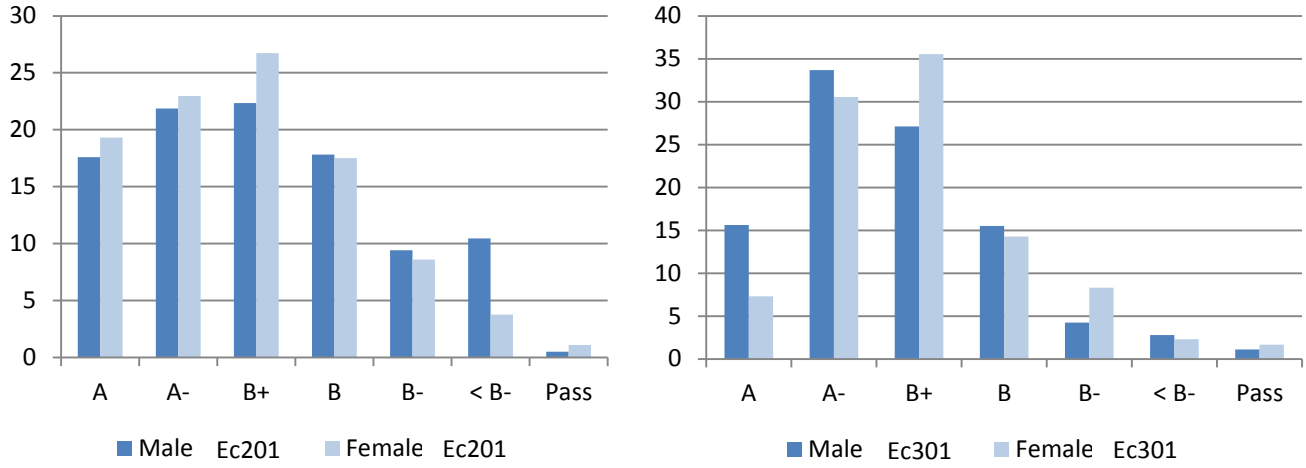


Source: Adams University administrative data.

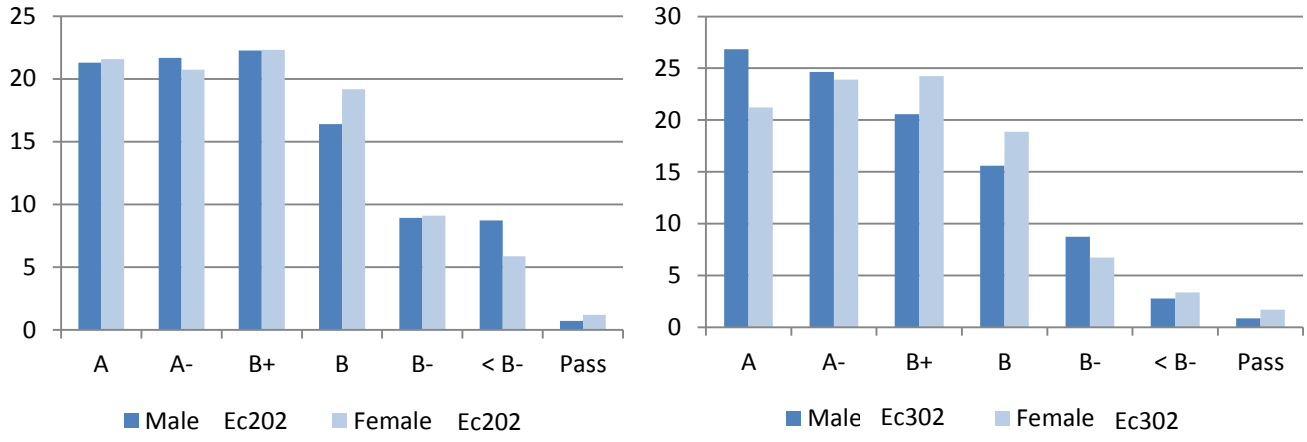
Notes: Gives students who took both Micro and Macro semesters of intermediate economics at either the Ec200 or Ec300 level. Fraction female is expressed as a "conversion" rate, meaning that it is scaled by the number of BAs of each sex.

Fig. 9: Grade Distributions in Micro and Macro Intermediate: 2005 to 2013 Graduating Classes

A. Micro Intermediate Theory (Ec201, 301)



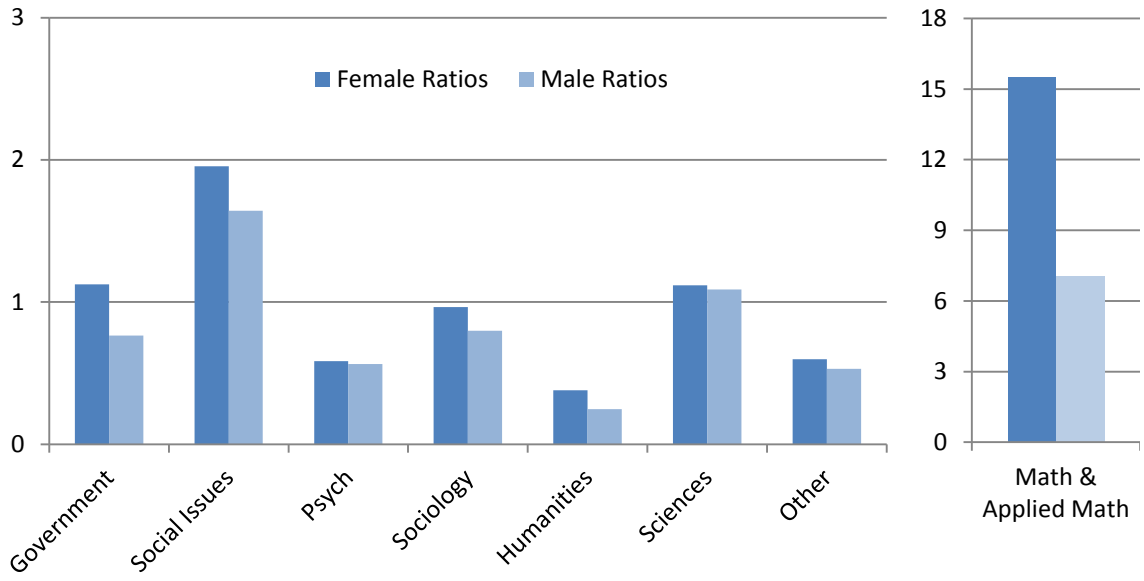
B. Macro Intermediate Theory (Ec202, 302)



Source: Adams College administrative data.

Notes: Ec201 is Micro-Intermediate Theory, less mathematical; Ec202 is Micro-Intermediate Theory, more mathematical. Ec301 is Macro-Intermediate Theory, less mathematical; Ec302 is Macro-Intermediate Theory, more mathematical.

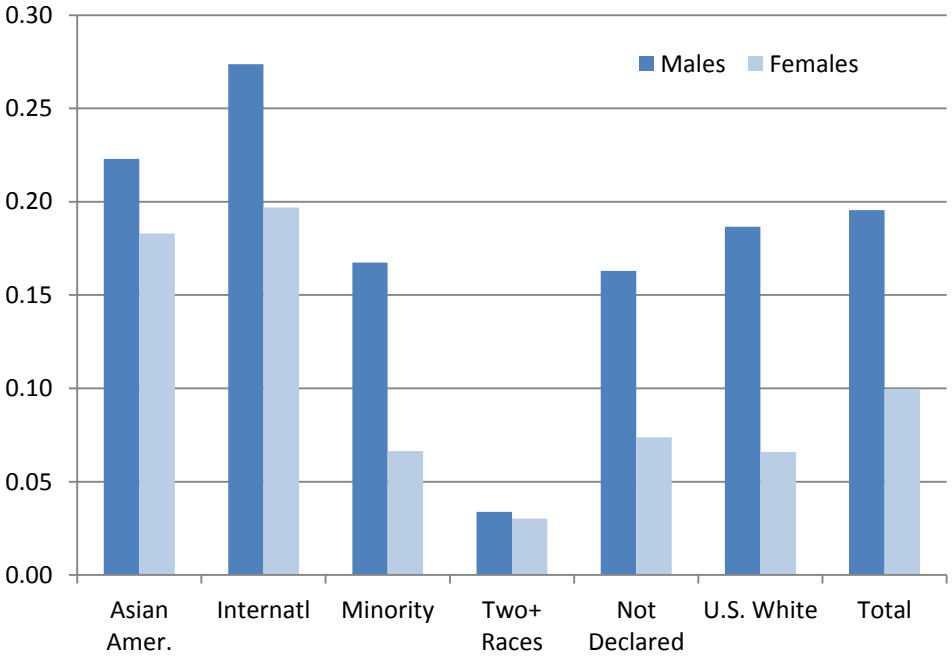
Figure 10: Majors (Other than Economics) of Students Taking Micro Intermediate Relative to All Other Adams Undergraduates



Source: Adams College administrative data.

Notes: Intermediate Theory includes both Fall semester (Micro) courses, Ec201 and Ec301. The data are the ratio of the fraction majoring in the subject conditional on taking the Ec201/Ec301 course to the fraction majoring in the subject who did not take the Ec201/Ec301 course. The Math and Applied Math group is given separately because it is considerably larger than the others.

Figure 11: Fraction Economics Majors by Race, Ethnicity, and Nativity



Source: Adams College administrative data.

Note: "Minority" is the term used by the Adams College administration and includes any underrepresented minority group. International means that the student is not a resident of the United States at the time of admission.

Table 1: Economics is Top Choice at Time of Acceptance to Adams College: 2005 to 2013 Graduating Classes

	Males	Females
(1) Total giving economics as top choice upon acceptance	1,413	686
(2) Placed out of Principles-Fall & did not take, given (1)	169	82
Placed out of Principles-Spring & did not take, given (1)	182	93
(3) Took Principles-Fall, given (1)	1,115	539
(4) Took Principles-Spring, given (1)	1,068	509
(5) Economics major, given (1)	795	348
(6) Applied math/economics track major, given (1)[a]	72	19

[a] Applied math/economics track is estimated as all applied math majors who have taken both semesters of Ec200 or Ec300.