Pedagogy, Student Gender, and Interest in Economics

Elizabeth J. Jensen
ejensen@hamilton.edu

Ann L. Owen*
aowen@hamilton.edu

Hamilton College
198 College Hill Road
Clinton, NY 13323

Abstract

Using a large multi-school sample, we examine how the characteristics and attitudes of students interact with the pedagogy of the instructor to influence students' decisions to study economics beyond the first semester. Students who have a predisposition to majoring in economics, who find economics relevant, who are confident of their ability to understand economics, and who expect higher grades in economics relative to their other classes are more likely to continue. Although teachers of economics cannot directly influence a student's predisposition to major in economics, we find evidence that all three remaining factors can be affected by teaching techniques and evaluation methods in direct control of the instructor. Some, but not all, of these techniques are particularly successful in influencing the decisions of female students.

JEL Codes: A22, J24, J16

---

*Corresponding author. Phone: 315-859-4419, Fax: 315-859-4477. Jessica Manieri, Elena Savostianova, and David Trzepacz provided excellent research assistance. We are grateful to Jeffrey Pliskin and Robert Turner for helpful comments and to all the instructors who participated in our survey.

1 Introduction

Female undergraduates are less likely to take an introductory economics class, less likely to continue in economics after completing the first introductory course, and less likely to major in economics than are male undergraduates. Although these gender differences are well documented, the reasons why women are such reluctant economists are less well understood. Some have suggested that the mainstream economics curriculum excludes topics and methodology of interest to women (e.g., Ferber 1995 and Feiner and Roberts 1995), while others have focused on a classroom environment that is unfriendly to women (e.g., Hall and Sandler 1982). Other suspected reasons for the gender gap in economics classes are poorer math preparation of female students, poorer relative performance in economics classes, and less overall interest in the topic due to different career aspirations. Finally, the pedagogy and types of evaluative instruments traditionally used in economics classes may favor male learning styles, contributing to the large percentage of discouraged women.[1]

Using a large multi-school sample, we investigate how students' characteristics and attitudes interact with the instructor's pedagogy and certain departmental and college level characteristics to influence students' decisions about pursuing economics. While previous studies have focused on the decision to become an economics major, we also examine the decision to continue in economics beyond the first course. In addition, we ask what factors encourage students who did not expect to continue when they signed up for the first course to change their minds and what factors discourage students who initially expected to continue but who decided to

---

[1]For example, Becker and Watts(1996) find that over 50% of economics instructors use multiple choice exams at least half the time. At the same time, Lumsden and Scott (1986) find that female economic students perform worse than male economic students on multiple choice exams but better than males on essay exams. In addition, Bartlett (1996) argues strongly for alternative pedagogy that appeals to women.

stop.

Not surprisingly, we find that attitudes formed prior to taking introductory economics affect students' decisions. In particular, those students who entered the first economics class considering economics as a possible major are more likely to pursue economics. We also found, however, that experiences in class matter. Students who receive higher grades in economics relative to their other classes, who are confident of their ability to understand economics, and who believe economics considers the ideas and issues in which they are interested are more likely to continue to study economics.

To gain more insight into these relatively straightforward conclusions, we then utilize our rich data set to examine the student and instructor characteristics that influence the students' relative grades, their confidence, their perception of relevance, and their predisposition to becoming an economics major. Although there are many relevant factors that an introductory economics teacher cannot influence directly (e.g., high school math preparation or the student's GPA), we are able to make some specific recommendations about factors that introductory teachers can affect. For example, including a warm-up activity at the beginning of the semester is associated with higher relative grades, particularly for women. Devoting a larger percentage of the class time to group problem solving increases student's perception of relevance. This effect is accentuated for females when the ratio of females to males in the class is higher. We also reach a few somewhat surprising conclusions: Discussing topics that are traditionally considered to be of interest to female students increases the confidence of both male and female students and counting participation as a larger percentage of the final grade is associated with lower relative grades for both sexes.

These and other specific recommendations are discussed in more detail in the following three sections. Section 2 describes our data and summarizes instructor, student, class, and college characteristics in our sample. Section 3 provides our main estimation results and Section 4 concludes.

2 Data

Our sample consists of 1,776 students from 93 different sections taught by 67 different instructors at 34 co-ed liberal arts colleges during the Spring of 1999.[2] To collect these data, we started with the top 25 liberal arts colleges as ranked in *U.S. News and World Report*. We added peer institutions used by our college, Hamilton College, in assessing competitiveness of academic salaries, leaving us with 36 colleges on our initial contact list. Of course, having students complete surveys in class required the cooperation of introductory economics instructors; to elicit their support, we made personal contact with an individual at each of the 36 schools. Given the effort involved in completing both the instructor and student surveys, our response rate was quite good: We received responses from 72% of the introductory sections offered in the Spring semester at 34 colleges, and at 19 colleges we had full participation. Most of the instructors in our sample asked students to complete the surveys at the same time they completed course evaluations at the end of the term; in all cases, surveys were completed in class sometime in the second half of the semester. This is a particularly relevant time to elicit student opinion because of its proximity to pre-registration for the next semester. Instructors who did not participate in

[2]The colleges in our sample are: Albion, Amherst, Bates, Bowdoin, Calvin, Carleton, Claremont, Colby, Colgate, Colorado College, Connecticut College, Davidson, Denison, Grinnell, Hamilton, Hartwick, Hobart & William Smith, Kenyon, Macalaster, Middlebury, Oberlin, Pomona, Reed, Skidmore, St. Lawrence, St. Olaf, Swarthmore, Trinity, Union, Ursinus, Vassar, Wesleyan, William & Mary, and Williams.

our survey were unanimous about the reason: they did not want to relinquish class time. Instructors who are more interested in the issue of female enrollments in economics were probably more likely to participate in our survey; however, because we are primarily interested in examining student behavior rather than teachers' decisions, this aspect of our sample selection technique should not affect our main results.[3]

We focused on co-ed liberal arts colleges for a number of reasons. First, this strategy gave us the opportunity to study students in relatively homogenous environments, allowing us to focus on the impact of events that were actually occurring within the classroom. Second, we chose not to include women's colleges in our survey because of the possibility that the environments at these colleges might be substantially different, in which case including them would invalidate our econometric methods. Third, based on findings in Becker and Watts (1996), we believed that liberal arts colleges might be the most fertile ground for finding economics professors who utilized a variety of teaching techniques. Finally, the colleges in our sample are an important source of economics graduate students: these colleges send a disproportionate share of their students on to graduate school.[4]

Even though students at liberal arts colleges may have a different academic experience than undergraduates at larger research universities, the gender differences in economics majors are comparable: Data collected by CSWEP on undergraduate economics majors at liberal arts colleges puts the percentage of female majors at approximately 36% for 1998-99, which is

---

[3]The data, survey instruments, code books, and a more detailed description of our sample selection strategy can be found on line at http:.....

[4]Kasper (1991) shows that during 1980 and 1988, top tier liberal arts colleges contributed 9% of the subsequent economics Ph.D.s awarded.

comparable to female enrollments at all colleges and universities. Thus, our findings from this sample may be relevant to a larger population.

Our approach was two-pronged: Students completed a short questionnaire about their characteristics and attitudes, while instructors completed a questionnaire giving detailed information about how they taught the class. Tables 1A and 1B summarize the relevant variables used in our analysis. Seventy-one percent of the students in our sample were taught by male instructors with an average of 14 years teaching experience. Slightly less than one-half of the students were in a combined micro/macro course, 27% were in an introductory microeconomics course and 21% were in an introductory macroeconomics course. Although we included only institutions categorized as liberal arts colleges, a few did offer business majors and a few more offered a substantial number of business school courses (e.g., accounting, organizational behavior, marketing) as part of the economics major. The average student was in a class of 35 students that was 48% female, although both of these figures had considerable variation. The average amount of class time spent lecturing was 65%, with class discussions being the second most popular use of class time (13%), followed by group problem solving (4%). On average 72% of a student's grade was determined by exam performance and these exams contained predominantly short-answer questions. The average instructor neither strongly agreed nor disagreed with the statement "I make a special effort to include topics of particular interest to female students throughout the entire semester" (FINTRST) and only 22% of the students had instructors who spent 30 minutes or more of class time on topics traditionally considered to be gender-related

(FEMTOP).[5] There was widespread agreement among instructors with the statements "It is very important that students in an introductory economics class learn to use economic models and think analytically" (ANALYT) and "It is very important that students are given opportunities to discuss current events on a regular basis in introductory economics classes" (CEDISCUS).

We used the data collected on student questionnaires to construct a variable that captures unobserved qualities of the teacher. Specifically, we asked students to rate the importance of the professor's reputation in taking the class on a scale of 1 to 5. For each professor, we then averaged the responses of all students in the class, hypothesizing that instructors who had large numbers of students in the class who were taking the class because of their reputation would be considered by the students to be a "good" teacher. Thus, AVGPREP is a measure of teacher popularity, as communicated through the student grapevine. This variable had an average of 2.5, indicating that, on average, the students did not consider professor's reputation to be an important factor in signing up for the class; some instructors, however, had much higher ratings, with a maximum rating of 4.2.

Table 1B summarizes the characteristics of the students in our sample. After dropping seniors and students for whom this was not their first college level economics class, we are left with a sample dominated by first years and sophomores. Self-reported GPAs averaged 87.1 on a 100 point scale and the average student's expected grade in the introductory class was slightly

[5]These topics were suggested by a close reading of Bartlett(1994), Feiner(1993), and Lage and Treglia (1996). They included: labor market discrimination, labor supply decisions of women with children, occupational segregation, comparable worth, affirmative action, comparative advantage applied to the family, housework and the measurement of GDP, increased labor force participation of women, unemployment rates broken down by gender, inflation/unemployment tradeoff by demographic group.

lower, at 86.7. We used three measures of math ability in our estimations: the student's math SAT score relative to the class average (RELSATM), the ratio of the student's math SAT to verbal SAT (SATMV), and the response to a question eliciting their discomfort with graphs.[6] Although a few students expressed discomfort with graphs, the majority of students did not. In addition, math SAT scores were almost 2% higher than verbal SAT scores for the average student in the class, perhaps indicating a small comparative advantage in quantitative skills for students enrolled in introductory economics.

We asked students to rate the importance of several factors in their decision to take introductory economics. The factor that received the highest rating was a desire to understand financial markets (FINANCE) followed by the perceived importance of economics to students' careers (CAREER). A desire to understand current events (CUREVENT) and an interest in public policy (PUBPOL) also received high ratings. The average student agreed fairly strongly with the statement "I like classes in which there is an opportunity to express my ideas and opinions" (EXPRESS) and somewhat agreed that economics "helps me understand the issues and events in which I am interested" (RELEVANT). Slightly more than half of the students in our sample intended to take more economics courses and 10% told us that economics was their intended major. In addition, a substantial number of the undecided majors indicated an interest in majoring in economics when they signed up for the class. However, 21% of the students who indicated at least some interest in taking another economics course when they signed up for their

[6]GRAPHS is the response to: "Please check the statement below that best matches your understanding when your instructor uses graphs in this class: 1=They make sense to me immediately, 2=They don't always make sense, but I easily figure them out, 3=They don't always make sense, but after some work I figure them out, 4=There are some that are very difficult to figure out." This question was adapted from the survey conducted by Dynan and Rouse (1997).

first class became discouraged during the semester: they did not intend to take more economics, even though they expected to when they signed up for the class (DISCOUR=1). Forty-two percent of the students who had little initial interest in another economics class became encouraged students--students who did not initially intend to take more economics but who later changed their minds (ENCOUR=1).[7]

There is considerable variation in our four measures of interest in economics by section, suggesting that events in the classroom are affecting student decisions. For example, the percentage of students taking their first economics class and then declaring an interest in majoring in economics varied from a low of zero in one section to a high of 67% in another. The percentage of discouraged students in a section ranged from zero to 50% while the percentage of encouraged students had an even wider range–from zero to 100% of all students in the section taking economics for the first time.

Table 1B also reports the correlation between individual student characteristics and gender. Although none of the correlations we report are remarkably high, a few do indicate that some attributes may be associated with the student's sex. In particular, math ability, an interest in finance, a predisposition to major in economics, and lower GPAs are positively correlated with being male. Higher relative grades in economics, however, are also positively correlated with being male. Lower overall self-confidence, measured by the variable FREEZEUP, is correlated with being female. Higher confidence in the ability to understand economics, CONFIDEN, is also

[7]Students who were not sure if they would take another economics class when they signed up for the first one were classified as discouraged if, at the time we surveyed them, they indicated they would not take more economics. If they indicated they would now take more economics, we considered them encouraged.

associated with being male. Interestingly, although males reported a stronger interest in finance, both males and females were equally likely to rank economics as important to their career. Finally, males seemed to be more likely to continue in economics and to major in economics and less likely to become discouraged. Becoming encouraged, however, is not strongly associated with a student's gender. In the next section, we explore some of the ideas suggested by these raw correlations further.

3 Estimation Results

We are interested in knowing what factors influence the probability of a student falling into one of four groups: students who, after one semester of economics, told us they intended to major in economics (ECONMAJ=1), students who intend to take more economics classes (CONTINUE=1), discouraged students (DISCOUR=1), and encouraged students (ENCOUR=1). Thus, we estimate four different binary probit models, using student and instructor characteristics as the explanatory variables. Table 2 presents results from a baseline specification that is comparable to the main specification in Dynan and Rouse (1997). Our results are similar to those reported there: A student's relative grade and math ability are determinants of a further commitment to economics, but absolute grade is not. The results reported in Table 2, however, differ from Dynan and Rouse along an important dimension. The gender of the student remains statistically significant in our estimations even after controlling for math ability and relative performance. Males are still more likely to want to be economics majors, more likely to take an additional economics course, and less likely to be discouraged in the first semester. As suggested by the raw correlations discussed earlier, being an encouraged student does not seem to be strongly associated with student gender.

The results reported in Tables 3A and 3B enhance the base specification by including several variables suggested by the literature. We control for classroom and college environment variables (instructor gender, percentage of female students in the class, percentage of female faculty in the department, class size, teaching experience of the instructor, if the college offers a business major, and type of class: microeconomics, macroeconomics, or combined); teaching techniques (percentage of time devoted to lecture, discussion, and group problem solving, a dummy variable for spending 30 minutes or more on topics considered to be of interest to women, and percentage of grade determined by exams); students' attitudes prior to taking the class (advice of family or friends, considering economics as a possible major, class required, and importance of economics to their careers); and their performance and opinions that may have been formed during the semester (expected grade in class, expected grade in class relative to GPA, confidence in their ability to understand economics, perception that economics is relevant, and discomfort with graphs).

Comparing the coefficients for each explanatory variable across all four estimations reveals several consistent conclusions. Students' attitudes prior to taking the class are important. Students who were considering economics as a possible major when they signed up for the class were more likely to tell us they would major in economics and continue studying economics. They were also more likely to be encouraged. Considering economics as a possible major did not have a statistically significant effect on being discouraged. Students who took the class because of the advice of family or friends also behaved as expected–they were less likely to be economics majors, less likely to continue, less likely to be encouraged, and more likely to be discouraged–while students who took the class because they thought economics was important to their career were

more likely to study economics further. Finally, students who took the class because it was required were also more likely to major in economics and continue and were less likely to be discouraged (possibly because more than one economics class is required for their intended concentration).

In addition to the initial (upon entering the class) attitudes towards studying economics, students' performance and opinions formed during the semester influenced their decisions. Students' relative grade in economics is positively associated with being an economics major and being encouraged, while negatively associated with being discouraged. Although not statistically significant at the 10% level, it is also positively associated with continue. All four specifications indicate that students who are more confident of their ability to understand economics and who believe economics to be more relevant to the ideas and issues in which they are interested are also more likely to pursue economics further. As in the base specifications in Table 2, students' absolute grade, EXPECT, was not a significant explanatory variable in any of the estimations, but, in contrast to our initial results, students' math ability had no explanatory ability either. While the specifications reported here used GRAPHS as a measure of math ability, this conclusion does not change when we use our other measures.

Of the factors that entered significantly and consistently in the four probits–students' grades in economics relative to their GPAs, their confidence in their ability to understand economics, their perception that economics is relevant, their predisposition to major in economics, and their perception that economics is important to their career--all except for the perceived importance of economics to a student's future career are positively correlated with being male. Interestingly, the only direct gender effect we find is that male students are less likely to become

encouraged during the semester. Some evidence suggests that the gender of the instructor influences students, with sudents more likely to become encouraged when the gender of the instructor matches their own.[8]

Table 3 also provides some weak evidence that the structure of the course may influence students. Not surprisingly, students in a combined micro/macro introductory course, (COMBINED=1), are less likely to continue. In addition, students in a macroeconomics introductory course, (MACRO=1), are less likely to be discouraged, suggesting that introductory macroeconomics provides students with an experience that more closely matches their expectations. Also, the availability of a business major is associated with a lower probability of being an economics major, but a higher probability of continuing beyond the first course.

Teacher popularity as measured by AVGPREP is associated with a higher probability of encouraged students, giving us a vague suggestion that "better" teachers can ignite a student's interest in economics. However, our attempts to identify the qualities of "better" teachers are not rewarded in this exercise: all other variables we included to capture the effect of teaching techniques or classroom environment did not consistently enter our probit estimations in a statistically significant way.

Although Table 3 allows some interesting conclusions, what we did not find is equally interesting. Specifically, many variables included to measure teaching methods or classroom environment did not enter our estimations is a consistent and statistically significant way.

---

[8] Table 3 also indicates that women are less likely to be encouraged or to continue studying economics when a larger percentage of class time is devoted to lecture, while the opposite is true for men. However, as we discuss later, after correcting for the endogeneity present in these estimations, this variable loses statistical significance.

Concluding that these teaching techniques or environmental factors do not influence students' decisions would, however, be premature: Table 3 reports the coefficients on these variables, holding all other factors constant. Teaching techniques and classroom environment may have an indirect effect on students' decisions by affecting the other factors in our estamtion. We examine this possibility with the estimations reported in Table 4. Here, we attempt to predict students' confidence, their perception of relevance, their relative grade and their predisposition to becoming an economics major, again using instructor, class, and student characteristics.[9]

The results in Table 4 show that, although each of these four variables is correlated with student gender, adding other explanatory variables reduces the gender effects to statistically insignificant levels. Focusing first on the results presented for confidence in the first column, we see that math ability now regains some explanatory power: students who have higher math SATs report being more confident of their ability to understand economics.[10] In addition, students who

---

[9]Results reported in Table 4 are generated using OLS. Because CONFIDEN, RELEVANT, and POSMAJOR are all responses to a student ranking of importance on a scale of 1 to 5, we also estimated these three equations using an ordered probit model and obtained qualitatively similar results.

Each of the estimations also included several other control variables whose coefficients were not statistically significant and are not reported in Table 4. The CONFIDEN regression also included: IGENDER, IGENDER*MALE, WARMUP, FEMTOP*MALE, PART, MALE*PART, CLASS, GRPPF*MALE, GRPPROB, GRPPROB*MALE, PERCFEM, and PERCFEM*MALE. The RELEVANT regression also included: IGENDER, IGENDER*MALE, COMBINED, MACRO, FEMTOP, FEMTOP*MALE, GETJOB, PERCFEM, PERCFEM*MALE, GPA, and EXPECT*MALE. The RELGRADE equation also included: IGENDER, IGENDER*MALE, LECTURE, LECTURE*MALE, GRPPROB, PART*MALE, PERCFEM, PERCFEM*MALE, FEMTOP, FEMTOP*MALE, TCHEXP, and TCHEXP2. The POSMAJOR equation also included: ACTIVITY, ACTIVITY*MALE, CAREER*MALE, GETJOB*MALE, DOJOB, and DOJOB*MALE .

[10]In this regression, we chose to measure math ability with the SAT score of the student relative to everybody else in the class because the confidence of students is expressed in terms of their ability to understand in relation to everybody else in the class. Similarly, in the POSMAJOR

are generally more self-confident and don't freeze up on exams are also more likely to be confident about their economics abilities. Interestingly, higher GPAs for female students are associated with less confidence, but the same is not true for male students. Conversely, students who report expecting higher grades relative to the rest of the class (RELEXP) are also more confident, but male students are a little less so, validating the idea that female students rely more on external feedback to judge their performance.

Teachers with better reputations and more years of teaching experience elicit greater confidence from students, but the effect of teaching experience begins to fall off after about 26 years. Grading on a curve is associated with more student confidence, perhaps because the curve gives students more accurate information about where they stand in relation to others in the class. If this is the reason for the positive association, then it is the dissemination of information about how the rest of the class is doing that is important and not the actual adjustment of grades. Similarly, more group problem solving is associated with greater confidence, particularly when there is a higher ratio of females to males in the class. Again, this activity may allow students to discover more readily their relative standing in the class. Teachers who believe it is particularly important to discuss current events in class had less confident students, possibly because this type of application may be more difficult for students to understand than the typical textbook examples.

We found none of these effects to be gender specific, however. Interestingly, we found that spending 30 or more minutes of class time on topics traditionally considered to be of special

---

regression, we used SATMV (math SAT/verbal SAT) because that most closely resembles the information students have about their math ability at the time they sign up for the class.

interest to women increased the confidence of both sexes.[11] When male instructors cover these topics, however, the increase in confidence is reduced considerably. We did not find a statistically significant effect of instructor gender on student confidence for either male or females in this specification. However, although not reported in table 4, when we do not control for teaching experience, instructor gender becomes negatively and significantly related to confidence, suggesting that instructor gender effects picked up in previous studies may actually be an effect of instructor age. (Results of these estimation and all others discussed but not reported in the paper are available from the authors.)

Turning to the second estimation in Table 4, RELEVANT, we see that math ability is also positively related to a student's perception of relevance (GRAPHS measures discomfort with graphs), most likely because students struggling with understanding graphs may be unable to make connections between economic theory and the real world. Similarly, students with higher class rank and higher expected grades also find economics to be more relevant. Student attitudes prior to taking the class can also affect whether or not they think economics is relevant. Students with stronger interests in finance or public policy, those with a stronger desire to understand current events, and those who thought economics would help them in their career tend to find economics more relevant. Students who think economics will help them do their job (but not those who think economics will help them *get* a job) and those who think it will help them get into graduate school find that economics covers the issues and ideas in which they are interested. As in the confidence regressions, instructor gender does not enter significantly, but more experienced

[11]Lage and Treglia (1996) also conclude that integrating scholarship on women into introductory economics classes improves the performance of both male and female students. However, they find that female students' performance improved relative to men.

teachers have students who rate economics more relevant. Devoting more time to discussion increases students' perception of relevance, but that effect is not gender specific. The net effect of all the coefficients involving group problem solving is that devoting class time to group problem solving is associated with females rating economics as more relevant when the percentage of females in the class is relatively high (about 48% or higher). With fewer females in the class, group problem solving activities decrease the relevance of economics for female students. For male students, the opposite is true: when the percentage of females in the class is relatively low (less than about 42%) more group problem solving increases male students' perception of the relevance of economics.

The third estimation in Table 4 shows determinants of a student's relative grade. Again, math ability is also important in this estimation as well as students' predisposition to major in economics. Students who think economics will help them get a job do relatively better in economics class, possibly because they are concerned about how their transcript will look to a potential employer. (This does not hold true for students who think economics will help them do their job.) Students at colleges in which calculus is required for the major do less well in economics classes, suggesting that the introductory classes in these departments may be taught more rigorously. Doing a warm-up activity at the beginning of the semester also helps students' relative grades (possibly because it facilitates students' abilities to help each other outside of class) and this effect is particularly strong for females. In spite of the fact that math ability matters in determining the relative grade, we were not able to identify a significant coefficient on the interaction of calculus with math ability or calculus with gender. Counting participation as a larger share of the grade is associated with lower relative grades as is having exams account for a

larger share of the grade. While the coefficient on the interaction of exams and student gender is not statistically significant at the 10% level, its p-value of 11% allows us to suggest that having a larger share of the grade determined by exams may disadvantage female students in particular. Although not reported here, we also tried other specifications that included the type of exams given (i.e., multiple choice, short answer, essay) but found no statistically significant effects.

One might think that a student's perception of relevance would affect relative grade: students who find the material relevant might do better in class. However, when we estimate our the relative grade equation and include the measure of relevance (RELEVANT) using two-stage least squares, we find that RELEVANT does not enter significantly into the equation predicting relative grade. This evidence does not, however, invalidate the idea that students that find the material relevant have higher grades because it examines only the relative grade and not the absolute grade. In fact, our estimation of the RELEVANT equation suggests a positive correlation between expected grade and RELEVANT.

Finally, since a student's predisposition to major in economics (POSMAJOR) seemed to heavily influence the decision to continue, we also examined the determinants of students' interest in economics prior to taking the class. Since this student opinion is formed before entering the class, we do not consider any instructor- or class-specific variables in this estimation. The last column of Table 4 shows our results for the POSMAJOR regression. We find that students who have higher math SAT scores relative to their verbal SAT scores are more likely to be considering economics as a possible major. Possible majors also have a stronger interest in finance and public policy but are less interested in understanding current events. They believe that economics is important to their career and that economics will help them to get a job (but not to do their job).

They tend to have slightly lower GPAs and have less of a preference for expressing their ideas and opinions in class. The presence of a calculus requirement for the major or the availability of a business major reduces the likelihood that a student would be considering economics as a possible major, but these effects do not vary by gender. For women, the ability to take business courses within the economics major increases their interest in majoring in economics, but that effect is virtually erased for males.

Before discussing our results further, we turn briefly to a final econometric issue. We have estimated our probits in Table 3 and our supplementary regressions in Table 4 as if there were no simultaneity. However, POSMAJOR is the only variable that we can argue, on theoretical grounds, is predetermined. Therefore, before accepting the results presented above, we must verify that our results are not affected by endogeneity. To do this, we use a test developed by Rivers and Vuong (1988) for exogeneity in a simultaneous probit model. We find that we do not reject exogeneity of CONFIDEN, RELEVANT and RELGRADE in each of our four probit equations at the 5% significance level except in two cases. We reject exogeneity of RELEVANT in the ENCOUR and CONTINUE probits, suggesting that becoming encouraged and/or deciding to continue in economics and the perception that economics is relevant are jointly determined variables. However, when we re-estimate these probits using the two-step method of Rivers and Vuong, we find that none of our major conclusions stated above are affected. Students interest in studying economics further are still influenced by their confidence, their perception of relevance, their relative grade, and their predisposition to major in economics.[12]

[12]As mentioned above, LECTURE and its interaction with student gender loses significance after allowing for endogeneity in these two probits.

Of course, our results examine the decision to study economics beyond one semester, conditional on the student having shown up in an introductory class. We cannot directly address an equally interesting question–the decision by many female students to not enroll in economics. However, as we noted earlier, the percentage of students who are female in the 93 sections of introductory economics in our sample varies considerably, from a low of 14% to a high of 83%. We attempted to predict the percentage of female students in a class using those college, departmental, or instructor characteristics that would be likely to be known by the students during preregistration. Explanatory variables we tried were: the percent of female faculty in the economics department, whether calculus was a requirement for the economics major, the gender of the instructor, whether the department sponsored an extra-curricular activity that addressed issues of importance to women (e.g., special lectures or a "Women in Economics" club), the type of class (micro, macro or combined), whether the college offered a business major, whether the economics department offered several "business" classes and a dummy variable for colleges that had been all-female within the past 50 years. Unfortunately, our efforts to predict the percentage of female students in a class were remarkably unsuccessful and we do not report detailed results here. None of the variables listed above were statistically significant; the allocation of females to different sections of economics appears to be a random event.

In the results we present above, what did not help to explain student behavior is almost as important as what did help. Previous work has suggested that the inclusion of topics specifically of interest to women, collaborative work experiences, instructor gender, class size and the percent of female students matter in the decision of women to continue on in economics. We do not find strong support for these hypotheses, though our inability to find this evidence does not

conclusively show that these factors are unimportant. One possible reason why we cannot find a robust correlation between discussion of female-related topics and female's interest in economics is that our measure of this aspect of classroom dynamics is simply too crude. The measure we used in the above estimations was a dummy variable that indicated that more than 30 minutes of class time was spent on these topics. While we experimented with different cutoffs, it's possible that the one we chose may have been too high or too low. We also experimented with the instructor's attitude towards making a special effort to include these topics (FINTRST) but were not able to generate statistically significant results with this variable.

Our findings do support the idea that collaborative work can help females–but only under the right circumstances. In-class group problem solving increases the relevance of economics to females, but not if the class is dominated by males. In addition, we did not find that increasing the percent of the grade for which collaborative work was accepted (COLLAB) affected females' decisions to study economics in a statistically significant way. We find that instructor gender matters only in a specific circumstance–it can encourage students but not discourage them or significantly affect their decision to major in economics after one semester. Our work also suggests that previous work that has found instructor gender to be an important determinant of student interest may in fact be picking up an effect of instructor age. Because of hiring patterns in the recent past, younger instructors are much more likely to be female than older instructors. Though we find no direct effect of class size on student behavior, we do find an effect of teaching techniques that may be associated with class size. Thus, our work leaves room for class size to still matter through its effects on teaching technique. Finally, we show that the percentage of females in the class is related to student decisions in a fairly complex way. In classes in which

teaching techniques encourage more interaction among students, the percentage of female students in the class does matter. However, in less interactive classes, that externality does not exist.

4 Conclusion

We have found that student characteristics and attitudes that exist prior to setting foot inside an economics class as well as those that are formed during the class are important determinants of the decision to study economics. As teachers, we cannot directly influence the attributes of the students who sit before us on the first day of class, but we can affect those opinions that evolve during the semester. Our investigation allows us to make several specific policy suggestions that will increase the likelihood that a particular student majors in economics, continues in economics, or becomes encouraged and that will decrease the likelihood that students become discouraged.

In particular, allocating more time to discussion and more time to topics that are traditionally considered to be of interest to women will encourage students of both sexes. Evaluating students in ways other than exams and doing a warm-up activity at the beginning of the semester will also help students of both sexes, but may be particularly beneficial for female students. Also, the fact that grading on a curve leads to higher student confidence suggests the importance of clear communication between instructor and student about the student's performance. Finally, incorporating more group problem solving into a class may harm or help students, depending on the gender composition of the class.

5 References

Bartlett, Robin L., 1994, "Macroeconomics: An Introductory Lecture Integrating the New Scholarship on Women," in *Teaching Differently: Facing the Biases of Gender, Culture and Education*, ed. J. Bauer et al.

Bartlett, Robin L., 1996, "Discovering Diversity in Introductory Economics," *Journal of Economic Perspectives*, 10(2): 141-153.

Becker, William E. and Michael Watts, 1996, "Chalk and Talk: A National Survey on Teaching Undergraduate Economics," *American Economic Review*, 86(2): 448-453.

Dynan, Karen E. and Cecilia Elena Rouse, 1997, "The Underrepresentation of Women in Economics: A Study of Undergraduate Economics Students," *Journal of Economic Education*, 28(4): 350-368.

Feiner, Susan, 1993, "Introductory Economics Textbooks and the Treatment of Issues Relating to Women and Minorities, 1984 and 1991," *The Journal of Economic Education* 24(2): 145-162.

Feiner, Susan and Bruce Roberts, 1995, "Using Alternative Paradigms to Teach about Race and Gender: A Critical Thinking Approach to Introductory Economics," *American Economic Review*, 85(2): 367-371.

Ferber, Marianne A., 1995, "The Study of Economics: A Feminist Critique," *American Economic Review*, 85(2): 357-361.

Hall, Roberta M. and Bernice R. Sandler, 1982, *The Classroom Climate: A Chilly one for Women?*, Washington D.C.: Association of American Colleges.

Kasper, Hirschel, 1991, "The Education of Economists: From Undergraduate to Graduate Study," *Journal of Economic Literature*, 29(3): 1088-1109.

Lage, Maureen and Michael Treglia, 1996, "The Impact of Integrating Scholarship on Women into Introductory Economics: Evidence from One Institution," *Journal of Economic Education*, 27(1), 26-36.

Lumsden, Keith and Scott Alex, 1986, "Gender and the Economics Student Reexamined," *Journal of Economic Education*, 18(4): 365-375.

Rivers, Douglas, and Quang H. Vuong, 1988, "Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models," *Journal of Econometrics*, 39: 347-366.

Table 1A: Instructor/Class Characteristics

Variable	Mean	Std. Dev.	Min	Max	Definition
IGENDER	0.711	0.453	0	1	1 if instructor male
TCHEXP	13.755	10.733	1	40	years teaching experience
PFEMFAC	0.231	0.120	0	0.75	percent female econ faculty
ACTIVITY	0.087	0.282	0	1	1 if have female centered activity
MICRO	0.274	0.446	0	1	1 if intro micro
MACRO	0.211	0.408	0	1	1 if intro macro
COMBINED	0.471	0.499	0	1	1 if micro/macro combined
CALCULUS	0.438	0.496	0	1	1 if major requires calculus
BUSINESS	0.123	0.328	0	1	1 if college has business major
ECONBUS	0.141	0.348	0	1	1 if econ major can count 3 or more "business" courses towards major
PERCFEM	0.484	0.121	0.143	0.830	percent females in section
CLASSIZE	34.911	17.518	5	93	class size
AVGPREP	2.471	0.645	1.385	4.244	average professors reputation
LECTURE	65.056	21.573	15	95	% of class time spent lecturing
DISC	13.499	11.524	0	60	% of class time spent in discussion
GRPPROB	4.496	7.042	0	30	% of class time spent in group problem solving
GAMEXPT	3.173	5.831	0	30	% of class time spent on games or experiments
COLLAB	10.655	12.293	0	60	% of grade for which collaborative work accepted
EXAM	71.974	13.385	30	100	exams–% of grade
WRITING	8.104	9.783	0	40	writing assgn-% of grade
QUIZ	6.342	9.209	0	45	quizzes-% of grade
PS	8.256	8.018	0	30	problem sets–% of grade
PART	2.890	4.413	0	15	participation–% of grade
PRES	1.146	3.946	0	30	presentations–% of grade
COMP	1.077	4.893	0	40	computer labs–% of grade
MC	16.323	19.521	0	60	multiple choice questions–% of exams
SHORTA	60.341	28.641	0	100	short answer–% of exams
ESSAY	21.609	24.126	0	100	essay–% of exams
CEDISCUS	4.178	0.982	1	5	instructor's opinion–importance of current events discussion
FINTRST	2.780	1.141	1	5	instructor's opinion–makes special effort to include topics of interest to women
ANALYT	4.526	0.748	2	5	instructor's opinion–importance of learning to think analytically in intro econ
FEMTOP	0.218	0.413	0	1	1 if cover 3 or more gender-related topics
CURVE	0.683	0.465	0	1	1 if grade on curve
WARMUP	0.348	0.476	0	1	1 if do warmup

Total number of observations is 1,776 (excludes seniors and those not taking first college level economics course). Data are drawn from 93 sections taught in Spring '99 by 67 instructors at 34 colleges. Note that characteristics of smaller classes receive less weight in the calculation of instructor and class characteristics because averages are weighted by student respondents.

Table 1B: Student Characteristics

Variable	Mean	Std. Dev.	Min	Max	Corr. With Male	Definition
MALE	0.483	0.500	0	1	1	1 if student male
RELSATM	0.999	0.098	0.591	1.270	0.120	math SAT/class average math SAT
GRAPHS	2.332	0.802	1	4	-0.125	discomfort with graphs
SATMV	1.016	0.131	0.513	2	0.142	math SAT/verbal SAT
GPA	87.074	4.368	68	98	-0.103	gpa
CLASS	1.434	0.653	1	3	-0.011	1=first year, 2=soph, 3=junior,
FINANCE	3.646	1.116	1	5	0.114	reason for taking class–interest in finance
PUBPOL	3.270	1.153	1	5	0.044	reason for taking class–interest in public policy
CUREVENT	3.374	1.161	1	5	-0.047	reason for taking class, interest in current events
POSMAJOR	2.580	1.534	1	5	0.111	reason for taking class, considering econ as major
CAREER	3.540	1.257	1	5	0.028	reason for taking class, importance to career
REQD	2.723	1.582	1	5	0.004	reason for taking class, required
ADVICE	2.816	1.322	1	5	-0.06	reason for taking class, advice of family or friends
GETJOB	3.030	1.122	1	5	0.077	student opinion–economics helps get job
DOJOB	3.392	1.080	1	5	0.019	student opinion–economics helps do job
GRADSCHO	2.950	1.068	1	5	0.022	student opinion–economics helps get into grad school
EXPRESS	4.012	0.939	1	5	0.004	student attitude–likes classes in which can express ideas and opinions
FREEZEUP	2.805	1.299	1	5	-0.151	student attitude–often afraid will freeze-up on exams
RELEXP	0.998	0.064	0.645	1.174	0.063	expected grade/average expected grade for class
EXPECT	86.677	5.935	55	98	0.061	expected grade (on 100 point scale)
RELGRADE	0.996	0.062	0.671	1.237	0.142	expected grade/gpa
RELEVANT	3.476	1.011	1	5	0.063	student attitude–economics helps understand issues in which I am interested
CONFIDEN	3.683	1.010	1	5	0.155	student attitude–I understand the material as well as most of the other people in the class
CONTINUE	0.515	0.500	0	1	0.137	intend to take another economics class
ENCOUR	0.423	0.494	0	1	0.056	increased interest in taking another economics class (excludes students with positive prior)
DISCOUR	0.205	0.404	0	1	-0.141	decreased interest in taking another economics class (excludes students with negative prior)
ECONMAJ	0.103	0.303	0	1	0.084	major or intended major is econ

Table 3A: Full Specification Probits

Independent Variable	ECONMAJ	CONTINUE	DISCOUR	ENCOUR
MALE	-.056	-.939	-1.66	-2.90*
	(1.81)	(.863)	(1.15)	(1.18)
IGENDER	-.332	-.366*	.064	-.472*
	(.407)	(.164)	(.211)	(.214)
IGENDER*MALE	.106	.108	.246	.524**
	(.484)	(.215)	(.280)	(.287)
GRAPHS	-.142	.008	.009	-.023
	(.102)	(.057)	(.074)	(.077)
RELGRADE	3.42*	1.42	-.457*	3.43*
	(1.68)	(.918)	(1.26)	(1.25)
CONFIDEN	.200*	.187*	-.367*	.194*
	(.102)	(.051)	(.064)	(.071)
RELEVANT	.217*	.233*	-.369*	.273*
	(.084)	(.043)	(.057)	(.059)
ADVICE	-.116*	-.141*	.107*	-.087*
	(.059)	(.030)	(.040)	(.040)
POSMAJOR	1.13*	.305*	.025	.261*
	(.114)	(.029)	(.038)	(.041)
REQD	.111*	.067*	-.147*	.011
	(.052)	(.026)	(.038)	(.035)
EXPECT	.006	.011	.005	.009
	(.020)	(.011)	(.014)	(.015)
CAREER	.241*	.268*	-.160	.196*
	(.084)	(.035)	(.0448)	(.045)
BUSINESS	-1.50*	.397*	-.217	-.080
	(.520)	(.169)	(.227)	(.265)
PFEMFAC	-.096	.777	-1.63*	.922
	(1.09)	(.560)	(.716)	(.792)
PFEMFAC*MALE	.200	-.099	2.09*	-.724
	(1.35)	(.742)	(.962)	(1.10)
PERCFEM	.254	-.978**	-.854	-1.15
	(1.16)	(.601)	(.782)	(.729)
PERCFEM*MALE	1.62	.807	.296	.669
	(1.54)	(.836)	(1.13)	(1.11)
CLASSIZE	-.007	.007*	-.005	.017*
	(.009)	(.004)	(.005)	(.005)
CLASSIZE*MALE	.004	-.006	.017*	-.007
	(.012)	(.006)	(.008)	(.008)
AVGPREP	.119	.035	-.128	.171**
	(.144)	(.075)	(.105)	(.094)
MACRO	.334	.017	-.361*	.136
	(.254)	(.145)	(.188)	(.203)
COMBINED	.024	-.344*	.012	.038
	(.238)	(.125)	(.159)	(.170)
LECTURE	-.005	-.009*	.002	-.015*
	(.008)	(.004)	(.005)	(.005)
LECTURE*MALE	-.017	.011*	.003	.025*
	(.011)	(.005)	(.008)	(.008)
Observations	1,318	1,458	1,100	819

* Significant at the 5% level, ** significant at the 10% level. Standard errors are in parentheses. All probits included a constant as well as FEMTOP DUMMY, FEMTOP DUMMY*MALE, TCHEXP, TCHEXP2, DISC, DISC*MALE, GRPPF, GRPPF*MALE, GRPPROB, GRPPROB*MALE, EXAM, EXAM*MALE which were not consistently significant at the 10% level.

Table 3B: Full Specification Probits, Marginal Effects on Probabilities

Independent Variable	ECONMAJ	CONTINUE	DISCOUR	ENCOUR
MALE	-.000	-.361	-.388	-.818*
	(.006)	(.308)	(.273)	(.166)
IGENDER	-.001	-.143*	.014	-.185*
	(.002)	(.063)	(.046)	(.084)
IGENDER*MALE	.000	.043	.057	.205**
	(.002)	(.085)	(.067)	(.111)
GRAPHS	-.0004	.003	.002	-.009
	(.0004)	(.023)	(.017)	(.030)
RELGRADE	.012*	.566	-1.02*	1.33*
	(.009)	(.365)	(.281)	(.487)
CONFIDEN	.0007*	.074*	-.082*	.076*
	(.0006)	(.020)	(.014)	(.028)
RELEVANT	.0008*	.093*	-.083*	.106*
	(.0005)	(.017)	(.013)	(.023)
ADVICE	-.0004*	-.056*	.024*	-.034*
	(.0003)	(.012)	(.009)	(.016)
POSMAJOR	.004*	.121*	.006	.102*
	(.002)	(.011)	(.009)	(.016)
REQD	.0004*	.027*	-.033*	.004
	(.0003)	(.010)	(.008)	(.014)
EXPECT	.000	.005	.001	.003
	(.000)	(.004)	(.003)	(.006)
CAREER	.0008*	.106*	-.036*	.076*
	(.0006)	(.014)	(.011)	(.018)
BUSINESS	-.002*	.153*	-.044	-.031
	(.001)	(.062)	(.042)	(.101)
PFEMFAC	-.000	.309	-.365*	.359
	(.004)	(.222)	(.160)	(.308)
PFEMFAC*MALE	.001	-.039	.467	-.282
	(.005)	(.295)	(.215)	(.429)
PERCFEM	.001	-.389**	-.191	-.449
	(.004)	(.238)	(.175)	(.284)
PERCFEM*MALE	.006	.321	.066	.260
	(.006)	(.333)	(.253)	(.433)
CLASSIZE	-.000	.003**	-.001	.007*
	(.000)	(.002)	(.001)	(.002)
CLASSIZE*MALE	.000	-.002	.004	-.003
	(.000)	(.002)	(.002)	(.003)
AVGPREP	.000	.014	-.029	.067**
	(.000)	(.030)	(.023)	(.036)
MACRO	.002	.007	-.073**	.053
	(.002)	(.057)	(.034)	(.079)
COMBINED	.000	-.136*	.003	.015
	(.001)	(.049)	(.036)	(.066)
LECTURE	-.000	-.004*	.001	-.006*
	(.000)	(.002)	(.001)	(.002)
LECTURE*MALE	-.000	.004*	.001	.010*
	(.000)	(.002)	(.002)	(.003)
Observations	1,318	1,458	1,100	819

* Significant at the 5% level, ** significant at the 10% level. Standard errors are in parentheses. All probits included a constant as well as FEMTOP DUMMY, FEMTOP DUMMY*MALE, TCHEXP, TCHEXP2, DISC, DISC*MALE, GRPPF, GRPPF*MALE, GRPPROB, GRPPROB*MALE, EXAM, EXAM*MALE which were not consistently significant at the 10% level.