

The Gender Gap in Undergraduate Economics Course Persistence and Degree Selection[†]

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Women represent approximately 58 percent of all undergraduates, suggesting that colleges and universities have many potential female recruits into economics (e.g., Ceci et al. 2014). Yet nationwide, women have comprised only one-third of all economics bachelor's degree earners in the United States for over the past twenty years, with that proportion declining slightly since the early 2000s despite increases in the overall number of economics majors (e.g., Siegfried 2016). The reason for the gender gap does not appear to be that women are uninterested in business-related or math-intensive careers. Women represent approximately half of all graduates in business and STEM (Science, Technology, Engineering, and Mathematics) fields, and the gender disparities in degree attainment in many of these fields have decreased over the last two decades. Instead, research shows that women tend to never consider majoring in economics, are significantly less likely than men to take an introductory economics course, and have a lower likelihood of economics course persistence, defined as taking additional economics classes after completing an initial course (e.g., Calkins and Welki 2006).

Several studies have analyzed the determinants of the gender gap in undergraduate economics degree attainment through a variety of factors, including interest in economics, math ability, economics course grades (both absolute and relative), pedagogical methods, class size, and the influence of same-sex role models and

peers (e.g., Goldin 2015). Prior studies have also assessed students' decisions to take an initial college economics course, pursue additional economics courses, and choose either an economics or non-economics major (e.g., Emerson, McGoldrick, and Mumford 2012). Much of that research, however, has failed to incorporate instructor and structural effects, such as class size and course gender composition, in the estimations. What sets our study apart from those done prior is the use of a series of logistic regressions to examine male and female economics course persistence via a combination of student, instructor, and structural characteristics. Furthermore, we estimate the overall marginal effect of the absolute grades in economics by accounting for the marginal contributions of both the absolute grades and the relative grades. Finally, we analyze a student's choice of major among different types of economics degrees, including a Bachelor of Science (BS), a Bachelor of Arts (BA), and an economics minor.

We find that students of both genders who declare economics as their major are more likely to take additional economics courses than their non-major peers. Additionally, students' economics course grades are a significant determinant of course persistence and degree selection, but men and women respond somewhat differently to their absolute and relative grades. Finally, men's economics degree selection is significantly correlated with their math abilities, while women's economics degree selection is correlated with both their math and verbal aptitudes.

I. Data and Methodology

The data are from institutional records for undergraduate students who took economics courses at a large, land-grant university between Fall 2007 and Spring 2015. Each student record contains demographic characteristics, measures of ability, and college coursework. The student

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records are augmented by data regarding course instructors and class enrollments. The Department of Economics, housed within the College of Business and Economics, offers three different economics degrees. The BS and BA degrees both require completion of 30 credit hours in economics. For the BS degree, students must also complete a course in calculus and fulfill a quantitative proficiency requirement of nine additional credits in mathematics or business courses that require calculus. The BA degree does not require calculus, but does additionally require demonstrated proficiency in an ancient or modern foreign language at the intermediate level or better. The economics minor, which requires the completion of 18 credit hours in economics, has no specific math or foreign language requirements.

Following prior research on students' economics course persistence (Emerson, McGoldrick, and Mumford 2012, Rask and Tiefenthaler 2008), we use a series of binary logistic regressions to assess students' propensity to continue taking economics courses beyond their first.¹ We model a student's decision to enroll in Introduction to Macroeconomics conditional on having taken Introduction to Microeconomics (the first course in the economics sequence). We then analyze a student's persistence to an intermediate microeconomics course conditional on the completion of Introduction to Macroeconomics.

The binary logit analysis for students' persistence to Introduction to Macroeconomics controls for student demographic characteristics, math and verbal SAT scores,² prior interest in economics or business, class year at the time of completing Introduction to Microeconomics, absolute and relative Introduction to Microeconomics course grades,³ and the year in which students completed that course. We also include controls for instructor variables,

including the gender and type of instructor (e.g., professor or adjunct instructor), as well as structural variables (i.e., class size and the percentage of female students). Similar variables are used in the binary logit regression for students' persistence to an intermediate microeconomics course along with controls for whether a student was an economics or business major during the semester in which they took Introduction to Macroeconomics.

Students' degree selection is then modeled using a multinomial logit regression, conditional upon students having completed an intermediate microeconomics course. We make use of the measures introduced in the first two specifications, augmenting our analysis by controlling for whether a student took a calculus course. For all regressions, we estimate the average marginal effects separately for male and female students and include academic year fixed effects.

II. Results

Tables 1 and 2 present average marginal effect estimates for men's and women's decisions to enroll in Introduction to Macroeconomics and an intermediate microeconomics course, respectively. Model 1 shows the effect of student characteristics only, while model 2 incorporates instructor and structural variables.

It is important to note that the average marginal effect coefficients for the absolute variables presented below (e.g., *Micro grade*) provide the effect that the economics grades have on the probabilities, holding fixed the relative grades. In reality, the overall marginal effect of the absolute variables involves both the absolute grade and the relative grade. Thus, the absolute (*overall*) measures account for the contributions of both variables to the probabilities. Furthermore, we note that the average marginal effect coefficients on the relative grades provide information about the effect that a change in a student's average course grade has on the probabilities, holding the absolute economics grades fixed.

A. Introduction to Macroeconomics Course Persistence

The results from Table 1 indicate that students of both genders with higher math SAT scores are significantly less likely to persist to Introduction to Macroeconomics. Both male and female

¹Binary logistic analysis, rather than binary probit analysis, provides a better fit for the data used in this study.

²Since SAT scores are reported in units of 10 (e.g., 610), students' SAT scores were divided by 10.

³Course grades are measured on a 0–4 scale (A = 4). Students may also receive plus and minus grades. Relative grades are calculated by taking the grade a student receives in a specific economics course and dividing it by that student's cumulative term GPA. The cumulative GPA measure used to calculate relative grades does not include the grade in the economics course being examined in each model.

TABLE 1—MARGINAL EFFECTS FOR INTRODUCTION TO MACROECONOMICS COURSE PERSISTENCE

Variable	Model 1		Model 2	
	Male	Female	Male	Female
SAT math	-0.005 (0.001)	-0.003 (0.001)	-0.005 (0.001)	-0.003 (0.001)
SAT verbal	0.001 (0.001)	0.0002 (0.001)	0.001 (0.001)	0.0003 (0.001)
Econ major at entry	0.168 (0.039)	0.182 (0.078)	0.165 (0.039)	0.186 (0.076)
Micro grade	0.064 (0.007)	0.059 (0.013)	0.064 (0.007)	0.060 (0.013)
Relative micro grade	-0.032 (0.015)	0.027 (0.044)	-0.031 (0.015)	0.023 (0.044)
Micro grade (overall)	0.053 (0.007)	0.068 (0.009)	0.053 (0.007)	0.067 (0.008)
Micro year fixed effects	Yes	Yes	Yes	Yes
Observations	5,937	5,489	5,937	5,489
Percent correctly predicted	69.4%	70.3%	69.7%	70.3%

Notes: Standard errors are in parentheses and are clustered by students' Introduction to Microeconomics courses. Full results are available upon request.

students who are economics majors at matriculation are significantly more likely to persist to Introduction to Macroeconomics. Additionally, students' microeconomics grades are significant, though the results differ by gender. On average, both male and female students are more likely to persist to Introduction to Macroeconomics if they earn a higher course grade in Introduction to Microeconomics. However, the relativity of the Introduction to Microeconomics course grade measure does not significantly affect women's persistence but is a negative and significant predictor of persistence for men.

B. Intermediate Microeconomics Course Persistence

The results presented in Table 2 are consistent with prior research: math SAT scores have a strong positive effect on both male and female enrollment in an intermediate microeconomics course. Additionally, a higher verbal SAT score significantly decreases a male student's probability of persistence, whereas verbal SAT scores have no significant effect on female students' persistence. A student's choice of major by the time Introduction to Macroeconomics is completed is a significant predictor of persistence to an intermediate microeconomics course for both

genders. Furthermore, the relative and overall Introduction to Macroeconomics grade measures are also positive and significant predictors of enrollment in an intermediate microeconomics course for both genders.

C. Economics Degree Selection

Table 3 provides the average marginal effect estimates from a multinomial logit model of economics degree selection, conditional upon students completing intermediate microeconomics. A student's math ability is a significant predictor of the type of economics degree selected. On average, men with higher math SAT scores have a significantly higher probability of completing a BS in economics, but a significantly lower likelihood of graduating with an economics minor. Women with higher math SAT scores are significantly less likely to earn a BA in economics. Further, a student's verbal SAT score is only a significant predictor of economics degree selection for women. Female students who earn higher verbal SAT scores on average have a significantly higher probability of earning either a BA in economics or an economics minor.

Whether a student is an economics major upon completion of an intermediate microeconomics

TABLE 2—MARGINAL EFFECTS FOR INTERMEDIATE MICROECONOMICS COURSE PERSISTENCE

Variable	Model 1		Model 2	
	Male	Female	Male	Female
SAT math	0.007 (0.001)	0.005 (0.001)	0.007 (0.001)	0.005 (0.001)
SAT verbal	-0.004 (0.001)	0.0001 (0.001)	-0.004 (0.001)	0.0001 (0.001)
Econ major at macro	0.423 (0.043)	0.591 (0.070)	0.420 (0.044)	0.584 (0.068)
Macro grade	0.049 (0.016)	0.009 (0.012)	0.048 (0.016)	0.009 (0.012)
Relative macro grade	0.112 (0.040)	0.196 (0.036)	0.121 (0.041)	0.196 (0.036)
Macro grade (overall)	0.087 (0.009)	0.071 (0.007)	0.089 (0.009)	0.071 (0.008)
Macro year fixed effects	Yes	Yes	Yes	Yes
Observations	3,816	3,305	3,816	3,305
Percent correctly predicted	73.7%	90.4%	73.8%	90.4%

Notes: Standard errors are in parentheses and are clustered by students' Introduction to Macroeconomics courses. Full results are available upon request.

TABLE 3—MARGINAL EFFECTS FOR MULTINOMIAL LOGIT OF ECONOMICS DEGREE SELECTION

Variable	Male students			Female students		
	BS econ	BA econ	Econ minor	BS econ	BA econ	Econ minor
SAT math	0.004 (0.002)	-0.002 (0.002)	-0.004 (0.002)	0.003 (0.002)	-0.004 (0.002)	-0.005 (0.003)
SAT verbal	0.0001 (0.002)	0.0003 (0.002)	0.002 (0.002)	-0.003 (0.002)	0.006 (0.001)	0.009 (0.003)
Econ major at intermediate micro	0.693 (0.037)	0.217 (0.037)	-0.524 (0.025)	0.443 (0.057)	0.333 (0.053)	-0.589 (0.047)
Intermediate micro grade	0.011 (0.026)	-0.061 (0.026)	0.141 (0.031)	0.100 (0.041)	-0.083 (0.027)	0.092 (0.058)
Relative intermediate micro grade	-0.087 (0.094)	0.308 (0.091)	-0.244 (0.112)	-0.302 (0.142)	0.359 (0.119)	-0.250 (0.206)
Intermediate micro grade (overall)	-0.017 (0.018)	0.038 (0.017)	0.062 (0.018)	0.006 (0.019)	0.029 (0.022)	0.014 (0.030)
Intermediate micro year fixed effects		Yes			Yes	
Observations		865			329	

Notes: The reference group consists of students who earned no economics degree. Standard errors are in parentheses and are clustered by students' intermediate microeconomics courses. Full results are available upon request.

course is a robust and significant determinant of graduation with a degree in economics. Compared to males who do not major in economics, men who declare economics as a major at the time of taking intermediate microeconomics have a significantly higher probability of completing a BS degree by 69 percent,

relative to 44 percent for women. In contrast, female economics majors are 33 percent more likely than their non-major female peers to complete a BA degree in economics, compared to 22 percent for men.

Grades in intermediate microeconomics are also significant predictors of economics degree

selection. The overall average marginal effect of the intermediate microeconomics grade is significant only for men and their selection of the BA degree or the economics minor. Additionally, the relativity of the intermediate microeconomics grade measure positively and significantly affects the selection of the BA degree for both genders but provides mixed effects for the other degrees.

III. Discussion and Conclusion

The findings presented in this paper indicate that the decision to major in economics early in one's college career is a robust and significant determinant of economics course persistence and propensity to graduate with an economics degree. As such, a female student's experiences in introductory economics courses, either prior to or during college, may encourage her to enroll in further economics courses and earn an economics degree. Prior research suggests that students who complete a high school economics course are more likely to select an economics major in college (e.g., Bansak and Starr 2010). Thus, one recommendation to increase female representation in economics is to make high school economics courses more attractive to women. Some economists argue that more women may be attracted to the field if the traditional curriculum taught in introductory economics courses is modified to include more topics of interest to women and to rely less on the use of math and graphs (e.g., Feigenbaum 2013). Evidence suggests that making these changes may increase women's confidence in their economics abilities, leading to greater economics course persistence.

Economics departments may also want to consider an examination of grading patterns, given the fact that relative economics course grades are a strong predictor of economics course persistence for women; therefore, female students may be heavily influenced by differences in grading among departments. Grading disparities between economics and other business departments may be particularly important because, at many institutions, business students are required to complete introductory microeconomics and macroeconomics courses, and students may view economics and business degrees as substitutes (e.g., Asarta and Butters 2012).

A student's math and verbal abilities also influence the decision to select a particular

type of economics degree. Women who have a comparative advantage in the verbal section of the SAT exam may choose the BA in economics because it does not require students to take calculus. They may also perceive they have an advantage in the required foreign language component for the BA degree. Likewise, women who have a comparative advantage in math may be more likely to choose the BS degree. Thus, economics departments that offer both a humanities-oriented economics degree and a quantitative degree may provide more options for women who wish to pursue economics as a major.

In summary, our findings suggest that making introductory courses more attractive to women, examining grading patterns within and across colleges, and offering both BA and BS degrees in economics may help to reduce the gender gap in economics course persistence and degree selection.

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