

The Gender Gap in Undergraduate Economics Course Persistence and Degree Selection

Laura J. Ahlstrom¹ and Carlos J. Asarta²

JEL Classification: A10, A22, I20

Keywords: economic education, economics major, gender

Women represent approximately 58% 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 a first college economics course, their economics course

¹ Assistant Professor of Economics, Oklahoma State University

² Professor of Economics, University of Delaware

persistence, and their selection between an economics major and a non-economics one (e.g., Emerson et al. 2012). Much of that research, however, has not incorporated instructor or structural effects (i.e., class size and course gender composition) in the estimations. Our study differs from prior studies in that we use a series of logistic regressions to examine male and female economics course persistence via a combination of student, instructor, and structural characteristics, and we analyze a student's choice of major among different types of economics degrees, including a Bachelor of Science (B.S.), a Bachelor of Arts (B.A.), and an economics minor.

We find that female students are less likely to persist in economics courses beyond those required by their major and are less likely to earn an economics degree than male students. Additionally, we find that students' economics course grades are a significant determinant of course persistence and degree selection, but that men and women respond somewhat differently to their absolute and relative grades. Furthermore, once women declare economics as their major, they have a higher likelihood than their male counterparts of taking additional economics courses. 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 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 B.S. and B.A. degrees require completion of 30 credit hours in economics. For the B.S. degree, students must complete a course in calculus and fulfill a quantitative proficiency

requirement of nine additional credits in mathematics or business courses that require calculus. The B.A. degree does not require calculus but does 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 credits hours in economics, has no specific math or foreign language requirements.

Following prior research on students' economics course persistence (Emerson et al. 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.³ 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 scores⁴, prior interest in economics or business, class year at the time of completing Introduction to Microeconomics, absolute and relative Introduction to Microeconomics course grades⁵, and the year in which students completed that course. This particular analysis also 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 female in a students' Introduction to Microeconomics course). Similar variables are used in the binary logit regression for students' persistence to an intermediate microeconomics course along with controls for whether a student

³ Binary logistic analysis, rather than binary probit analysis, provides a better fit for the data used in this study.

⁴ Since SAT scores are reported in units of 10 (e.g. 610), students' SAT scores were divided by 10.

⁵ Course grades are measured on a 0-4 scale (A = 4). Students may also receive plus and minus grades.

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

Introduction to Macroeconomics Course Persistence

Table 1 Significant 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 Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	5,937	5,489	5,937	5,489
% Correctly predicted	69.4%	70.3%	69.7%	70.3%
Log Likelihood	-3,330.77	-3,156.59	-3,326.96	-3,154.16

Notes: Standard errors are in parenthesis and are clustered by students' Introduction to Microeconomics course. *p < 0.05 **p < 0.01 ***p < 0.001. Full results available upon request.

The results from Table 1 indicate that students of both genders with higher math SAT scores are significantly less likely to enroll in Introduction to Macroeconomics. Both male and female students who are economics majors at matriculation are significantly more likely to persist to Introduction to Macroeconomics. Additionally, students' absolute and relative microeconomics course grades are significant though the results differ by gender. On average, both male and female students are 6% more likely to enroll in Introduction to Macroeconomics if they earn a higher absolute course grade in Introduction to Microeconomics. On the other hand, men who earn a higher course grade in microeconomics relative to their grades in other departments' courses are significantly less likely to enroll in Introduction to Macroeconomics. The effect of women's relative microeconomics course grade is not significant.

Intermediate Microeconomics Course Persistence

Table 2 Significant 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 Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	3,816	3,305	3,816	3,305
% Correctly Predicted	73.7%	90.4%	73.8%	90.4%
Log Likelihood	-2,073.91	-941.94	-2,070.05	-940.12

Notes: Standard errors are in parenthesis and are clustered by students' Introduction to Macroeconomics course. *p < 0.05 **p < 0.01 ***p < 0.001. Full results available upon request.

The results from 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 men's probability of persistence,

with verbal SAT scores having no significant effect on female students' persistence. A student's choice of major by the time they complete Introduction to Macroeconomics is a significant predictor of persistence to an intermediate microeconomics course for both men and women. Relative to students who choose a major outside the college of business and economics, women who select an economics major are 58-59% more likely to enroll in an intermediate microeconomics course, while male economics majors are 42% more likely to persist. Additionally, a student's Introduction to Macroeconomics course grade is also a significant predictor of enrolling in an intermediate microeconomics course, but male and female students have differential responses to their course grades. Women's relative Introduction to Macroeconomics course grades positively affect their persistence to an intermediate microeconomics course though their absolute grades are not significantly correlated with persistence. For men, both their absolute and relative Introduction to Macroeconomics course grades are significant, positive predictors of enrolling in an intermediate microeconomics course.

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 B.S. in economics degree but a significantly lower likelihood of graduating with an economics minor. Women who earn higher math SAT scores are significantly less likely to earn a B.A. in economics. A student's verbal SAT score is only a significant predictor of women's economics degree selection. Female students who earn higher verbal SAT scores on average have a significantly higher probability of earning a B.A. in economics or an economics minor.

Table 3 Significant Marginal Effects for Multinomial Logit of Economics Degree Selection

Variable	Male Students			Female Students		
	B.S. Econ	B.A. Econ	Econ Minor	B.S. Econ	B.A. 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 Int 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)
Int 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 Int 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)
Int Micro Year Fixed Effects		Yes			Yes	
Observations		865			329	
Log Likelihood		-700.92			-231.70	

Notes: The reference group is students who earn no economics degree. Standard errors are in parenthesis and are clustered by students' intermediate microeconomics course. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. Full results available upon request.

A robust and significant determinant of graduating with a degree in economics is whether a student is an economics major at the time of completing an intermediate microeconomics course. This variable has differential effects for men and women. Compared to their non-economics major counterparts, men who declare economics as a major at the time of taking intermediate microeconomics have a significantly higher probability of completing a B.S. degree by 69%, compared to 44% for women. In contrast, female economics majors are 33% more likely than non-majors to complete a B.A. degree in economics, relative to 22% of men. Students of both genders who are economics majors are significantly less likely to earn a minor in economics.

Absolute and relative course grades in intermediate microeconomics are also significant predictors of economics degree selection. On average, female students who earn a higher absolute grade in intermediate microeconomics are 10% more likely to graduate with a B.S. degree. Women who earn higher relative intermediate microeconomics course grades are significantly less likely to select a B.S. degree. On the other hand, there is no significant effect of absolute or relative

intermediate microeconomics course grades for men who choose the B.S. in economics. In contrast, both male and female students who earn a higher absolute intermediate microeconomics course grade have a significantly lower probability of graduating with a B.A. degree while their relative intermediate microeconomics course grades are positively and significantly correlated with choosing a B.A. in economics. In addition, male students absolute and relative intermediate microeconomics course grades are significant predictors of selecting an economics minor, but there is no similar effect for women who choose to minor in economics.

III Discussion and Conclusion

The findings presented in this paper indicate that a robust and significant determinant of economics course persistence and propensity to graduate with an economics degree is whether students choose to major in economics early in their college career. Additionally, the findings suggest that women who choose economics as their major may have stronger economics course persistence than their male counterparts. As such, female students' experiences in introductory economics courses, either prior to or during college, may encourage women 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 (e.g., Bansak and Starr 2010). Since, for female students in particular, the choice of college major may be significantly influenced by taking a high school course in the subject (Malgwi et al. 2005), one recommendation to increase the number of women in economics is to make high school economics courses more attractive to them. Some economists have argued that more women may be attracted to the field if the traditional curricula taught in introductory economics courses is modified by including more topics of interest to women and by reducing the amount of graphs and math in microeconomics (e.g., Feigenbaum 2013). Evidence suggests that making these curricular changes

may increase women's confidence in their economics ability, leading to greater economics course persistence.

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

Another important factor in the process of selecting an economics degree is related to students' math and verbal abilities. The results from this paper indicate that women's relative math and verbal abilities may influence their selection of a particular type of economics degree. Women who earn a verbal SAT score that is greater than their math SAT score may choose the B.A. 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 that degree. On the other hand, women who have a comparative advantage in math may be more likely to choose the B.S. degree. Thus, economics departments that offer both a more humanities-oriented economics degree and a more quantitative degree may provide more options for women 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 B.A. and B.S. in economics degrees may help to reduce the gender gap in economics course persistence and degree selection.

REFERENCES

- Asarta, C. J., & Butters, R. B.** 2012. The Discouraged-Business-Major Hypothesis Revisited: Could Economics Be the Encouraged-Business-Major? *Journal of Economic Education* 43 (1): 19–32.
- Bansak, C., & Starr, M.** 2010. Gender Differences in Predispositions Towards Economics. *Eastern Economic Journal* 36 (1): 33–57.
- Calkins, L. N., & Welki, A.** 2006. Factors that Influence Choice of Major: Why Some Students Never Consider Economics. *International Journal of Social Economics* 33 (8): 547–64.
- Ceci, S. J., Ginther, D. K., Kahn, S., & Williams, W. M.** 2014. Women in Academic Science: A Changing Landscape. *Psychological Science in the Public Interest: A Journal of the American Psychological Society* 15 (3): 75–141.
- Emerson, T. L. N., McGoldrick, K., & Mumford, K. J.** 2012. Women and the Choice to Study Economics. *Journal of Economic Education* 43 (4): 349–62.
- Feigenbaum, S. K.** 2013. Attracting More Women and Minorities into Economics. *Newsletter of the Committee on the Status of Women in the Economics Profession* (Summer): 11–12,16.
- Goldin, C.** 2015. Gender and the Undergraduate Economics Major: Notes on the Undergraduate Economics Major at a Highly Selective Liberal Arts College. Retrieved from http://scholar.harvard.edu/files/goldin/files/claudia_gender_paper.pdf
- Malgwi, C. A., Howe, M. A., & Burnaby, P. A.** 2005. Influences on Students' Choice of College Major. *Journal of Education for Business* 80 (5): 275–82.
- Rask, K. N., & Tiefenthaler, J.** 2008. The Role of Grade Sensitivity in Explaining the Gender Imbalance in Undergraduate Economics. *Economics of Education Review* 27 (6): 676–87.
- Siegfried, J. J.** 2016. Trends in Undergraduate Economics Degrees, 1991-2014. *Journal of Economic Education*, 47 (1): 89–93.