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Gender, Expectations, and Grades in Introductory Microeconomics At a US University

Previous studies have documented a gender gap in the study of economics in Canada, the UK, and the US. Many explanations for this have been considered in the literature. We suggest that one important factor may be women's low expectations about their ability to succeed in economics courses. We find that women expect to do less well than men in an introductory undergraduate microeconomics course, even after controlling for variables relating to family background, academic experience, and mathematics experience. Further, these expectations are partly self-fulfilling, since expected grades are positively and significantly related to performance in the class. We also find that having taken an economics course in secondary school actually has a negative effect on performance. We observe this negative effect for women and men, but it is much more pronounced for women. When both expectations and secondary-school experience with economics are controlled for, the independent effect of gender is quite insignificant.

Key Words (6): Gender, Expectations, Grades, Introductory Microeconomics

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1. Introduction

Research in the 1970s extensively documented the gender gap in the study of economics in the US (John Siegfried 1979). This research found that men chose to major in economics more often than women, and men did better in their economics classes than did women. Though smaller today, the gender gap still exists, and economics remains a discipline dominated by men. The American Economic Association's Committee on the Status of Women in the Economics Profession (2001) reported that in 2000, only 30 percent of US Ph.D.'s in economics were granted to women; women comprised 32 percent of first year Ph.D. students, and were similarly represented at the undergraduate level. A variety of explanations have been offered to explain this gender gap. These include the mathematical nature of economics, pedagogy and testing methods, sociological influences regarding appropriate fields of study for women, and the lack of female role models. For example, using data for the UK, Keith Lumsden and Alex Scott (1987) find gender differences that depend on the format of the examination. Using Canadian data, Roberta Edgecombe Robb and Leslie Robb (1999) find a gender gap in performance in introductory microeconomics.

We suggest other factors that explain part of the gender gap. We focus on the expectations women have when entering introductory undergraduate economics courses. Our data suggest that women have less optimistic expectations of their ability to succeed in such courses, even after controlling for differences in a wide variety of observables. Moreover, it appears that women's negative expectations harm their ability to do well in the course. For most of the women in the sample, these expectations are formed prior to any actual experience with

economics at the college level. Having taken an economics course in secondary school actually has a negative effect on performance in the introductory undergraduate course, both for women and for men. The negative effect is much more pronounced for women.

This paper is concerned with several questions: (1) At the beginning of a course in introductory microeconomics, what factors determine the expectations of women and men as to their performance?, (2) Do these initial expectations have an influence on actual performance?, (3) What explains the differences between the expectations of women and men?, and (4) What explains the differences between the performance of women and men in the course?

We find that women expect to do less well than men in an introductory microeconomics course, even after controlling for a number of variables relating to family background, academic experience, and mathematics experience. Further, these expectations are to some extent self-fulfilling, since expected grades are positively and significantly related to student performance in the class. We find that controlling for expected grades reduces the magnitude and significance of the gender coefficient in a performance regression. When we consider interaction effects between the gender variable and expectations, the results suggest that the largest negative effect of expectations occurs for women who expect a course grade of C+. When both expectations and secondary-school experience with economics are included in the regressions, the independent effect of gender is no longer even close to statistical significance.

2. Women in Economics Courses

In the US, college enrollment by women has increased dramatically over the past two decades, to the point where female undergraduates substantially outnumber male undergraduates nationwide. Yet, these women do not seem much more likely than their predecessors to pursue

majors in some traditionally male-dominated fields, such as economics (Marianne Ferber 1995; Siegfried 1995; Karen Dynan and Cecilia Rouse 1997). A substantial amount of research has addressed the perception that women do more poorly than men in economics courses (Siegfried 1979; John Soper and William Walstad 1988; Julia Heath 1989; Mary Williams, Charles Waldauer, and Vijaya Duggal 1992). A wide variety of explanations have been given as to why women do less well in economics courses, based on the course format or the pedagogical approach of the professor. These include the method of presentation of material (William Becker 1997, 2000; Byron Brown and Carl Liedholm 2002), the gender of the instructor (John Ashworth and J. Lynne Evans 1999) [1], and the use of multiple-choice exams in introductory courses (Lumsden and Scott 1987).[2]

Economics is the college major with the highest annual earnings for women aged 35-44 in the US, and one of the top majors for annual earnings for women at all age levels (Daniel Hecker 1995). Thus, it is interesting that the number of women who major in economics is still relatively low. The choices of women about whether to major in economics may be linked to their experiences in introductory economics courses. Many studies have demonstrated that women do less well then men in introductory economics courses (Siegfried 1979; Lumsden and Scott 1987; Williams, Waldauer, and Duggal 1992; Gordon Anderson, Dwayne Benjamin, and Melvyn Fuss 1994; Robb and Robb 1999; Charles Ballard and Marianne Johnson 2004).[3] This, in turn, makes it less likely that women will choose economics as a major (Dynan and Rouse 1997; Elizabeth Jensen and Ann Owen 2001). However, Williams, Waldauer, and Duggal (1992) find no significant gender differences in student performance in upper-level economics classes.

Thus, it appears that women self-select into additional economics courses beyond the introductory level, and, once there, they do just as well as their male counterparts. Mary Borg and Harriet Stranahan (2002) present further evidence along these lines. They find that female students with certain personality traits do just as well as men in upper-division economics courses.

However, the fact that women are less likely to enroll in introductory economics courses in the first place (Dynan and Rouse 1997) suggests that the reasons why women do not choose economics as a major may be more deeply ingrained. The attitudes that give rise to these choices may be formed prior to any experience with college-level economics courses.

3. Women and Expectations Formation

The literature on expectations formation and the link between expectations and grades is mixed. However, most studies document some gender effect in disciplines that have mathematical content. In a survey of the literature, Peter Burke (1989) concludes that the relationship between gender and school performance is multifaceted, and that a substantial portion of the relationship is not well explained. Burke finds that the degree of femininity or masculinity in a student's gender identity explains a significant portion of his or her grades, and also helps to explain the classes in which the student succeeds. Bernard Rosen and Carol Aneshensel (1978) examine the formation of educational and occupational expectations among men and women. They find that, while male and female expectations are determined by similar variables, women are much more heavily influenced by exogenous social and family background variables than men. Men are more oriented toward social-psychological and achievement variables when forming expectations. Herbert Smith and Brian Powell (1990) find that male

college seniors are more likely to have higher income expectations than otherwise comparable female college seniors. This was despite the fact that women's expectations appear to be just as well informed as men's expectations, regarding the pay levels and the types of work performed in different professions.

If negative perceptions of economics exist prior to enrollment in college courses, then the expectations of women may influence both their performance in introductory economics courses and their desire to continue with additional economics courses. Many studies have shown that traditionally held beliefs can reinforce stereotypes that are difficult to overcome (Siegfried 1979; Michael Anderson, Frank Bechhofer, and Jonathan Gershuny 1994; Ferber and Lauren Young 1997). One such stereotype is that women should not be interested in careers in business, or in fields with a heavy mathematical component (Williams, Waldauer, and Duggal 1992). Social-cultural views could be reinforced by the absence of female role models in economics (Ashworth and Evans 1999; Robb and Robb 1999). Similar evidence has been amassed in fields other than economics. For example, Frances Stage and Peter Kloosterman (1995) find that women's beliefs about mathematics influence their ability to pass remedial math courses on the first attempt. Dynan and Rouse (1997) find that math skills do not explain the gender gap fully. They suggest that women's decisions about whether to major in economics are influenced by information they have acquired or tastes they have formed regarding economics, before entering college.

Some research has examined student expectations and performance directly. Jensen and Owen (2001) find that students who expect to earn higher grades in economics courses, compared to their usual course grades, are more likely to continue in economics. Generally, they find that students who had already considered economics as a possible major before taking an economics course were more likely to become economics majors. Jensen and Owen (2000)

suggest that self-confidence explains part of the reason why women are less likely to enroll in economics classes in the first place, and why, when they do, they are less likely to enroll in further economics classes. Jensen and Owen (2000) find that expected grade is positively and significantly related to confidence.

Collegiate-major segregation by gender, like occupational segregation, can be attributed to social and cultural factors that form student opinions prior to their entering college (Jerry Jacobs 1996). There are many competing theories of segregation by college major, with varying levels of empirical support. For example, it may be that women and men choose fields based on different preferences and/or constraints. Women may prefer jobs that are more social or communal in nature, whereas men may choose a more competitive environment. Women may also prefer fields that lead to careers with greater flexibility of scheduling. Media and university portrayal of careers may also play a role, along with parental and peer influence. (See Jacobs 1996 for a survey of the literature.) Mary Hirschfeld, Robert Moore, and Eleanor Brown (1995) argue that confidence and competitiveness are explanatory factors for the gender gap on the GRE subject test.

We are unable to disentangle fully the complicated social processes that contribute to student attitudes towards economics. Nevertheless, in this paper, we address the relationships between (1) prior beliefs about and experience with economics, and (2) performance in undergraduate economics courses. We assess expectations during the second week of the semester, before students have done any graded work in the course.

4. Description of the Data

In order to examine students' expectations, we conducted a survey of undergraduates who were enrolled in an introductory microeconomics course at a large university in the Great

Lakes region of the US. We examined a total of four sections of the course, taught by the same male professor.[4] Two of the sections were in the Fall Semester of 1998, and two more were in the Fall Semester of 1999.[5] We do not have observations for the students who were absent on the day on which our survey was administered. Our sample population is the 1462 individuals who participated in the survey and completed the course, out of 2313 students enrolled.

The survey consisted of 26 questions, covering personal background, academic background, math ability, and expectations. In addition to the survey data, we have official data from university records on college grade-point average (GPA) and scores on the ACT (a collegiate entrance test), as well as information on student course work.

Survey data were collected on students' gender, race, and family background, as well as the self-reported number of hours spent studying, working for pay, and being involved in extracurricular activities. While male and female students report similar information for most variables, we find that women report spending significantly fewer hours in paid employment ($p < 0.001$) and significantly more hours studying ($p < 0.001$). We use data on GPA and ACT scores to proxy for student aptitude. GPA is measured on a 4.0 scale. A student could receive any of the following course grades: 4.0 (which corresponds to an "A"), 3.5 (B+), 3.0 (B), 2.5 (C+), 2.0 (C), 1.5 (D+), 1.0 (D), or 0.0 (which is a failing grade). ACT scores are measured on a 36-point scale, and are convertible to scores on the Scholastic Aptitude Test (SAT) in a linear fashion. Women had significantly higher GPA's than men, and scored significantly higher on the English portion of the ACT exam. This is consistent with theories that women's verbal skills mature more quickly than men's, leaving men with a comparative advantage in mathematical and analytical areas (Elizabeth Fennema 1987; N.L. Gage and David Berliner 1988). Gender comparisons for variables in this study are shown in Table 1.

<Table 1 about here>

If some women have been discouraged from developing "masculine" math skills, this may hurt their performance in the introductory microeconomics course. Thus, by including several different measures of math skills, we hope to control for actual math skills, so that the remaining influence of expectations can be distinguished. We control for math background by collecting data on the math courses taken by students, as well as their math ACT scores. At our university, as at many universities in the United States, students with sufficiently low scores on a math-placement exam are required to take a remedial-math course. We find that 25.3 percent of the women in our sample were required to take remedial math, versus 22.4 percent of the men. (This difference is significant at the one-percent level.) Men were significantly more likely to have taken calculus, and scored significantly higher on the math portion of the ACT, as reported in Table 1.

In an attempt to understand the factors that contribute to the formation of expectations regarding performance in introductory microeconomics, we asked students a number of additional questions. The survey included questions such as whether introductory microeconomics was required for the student's major field of study, whether the student had previously taken an economics course in secondary school, whether the student had taken economics at another university, and whether the student had already taken introductory microeconomics or macroeconomics at our university.[6] We also asked students to predict the course grade that they expect to receive in the course (on the 4.0 scale described above). We find that, even though women and men were equally likely to have had previous economics experience (including having taken introductory macroeconomics in college, having taken economics in secondary school, or retaking introductory microeconomics in college), men

expected to do better in the introductory microeconomics course ($p < 0.001$). Information on these variables is also reported in Table 1.

As reported in Table 1, 70 percent of students expected that they would earn a course grade of 3.5 (B+) or 4.0 (A), and 97 percent expected to earn a course grade of 3.0 (B) or better. However, men were significantly more likely to report an expected course grade of 4.0 (an A). Jensen and Owen (2000) suggest that women may rely more on outside feedback when judging their performance, which thus influences their confidence and expected grade. In addition, we attempt to control for a number of other influences, to reduce the possibility that our estimates of the effect of expectations might be contaminated by omitted-variables bias. For example, self-selection bias could explain the observed differences in expectations if women are more likely to take microeconomics because they "have to" or "feel they ought to", whereas men are more likely to take microeconomics because they expect to do well in the course. In addition, gender-related private information might influence expectations through the student's major field of study: If humanities majors tend to do less well in microeconomics, and if more of the women than the men in microeconomics are humanities majors, then the difference in average expectations across genders could be due to the overrepresentation of humanities majors among women. In an attempt to control for these effects, we include a variable indicating whether the student was pursuing a major in the College of Business, as well as a variable indicating whether the introductory microeconomics course was required for the student's major.

The actual course grades received by students were substantially lower than their expected course grades. Women overestimated their course grade by an average of 0.85 of a grade point. (The average expected grade for women was 3.39, which is just below a B+, whereas the average actual grade for women in the course was 2.56, which is only slightly above

a C+.) On the other hand, men overestimated by an average of 0.83 of a grade point. (A *t*-test of means indicates that this difference by gender is not significant.)

We also compare students' expected grades in our introductory microeconomics course with their GPA's. On average, women expected to earn a course grade of 3.39, which is 0.54 of a grade point better then they had done in previous course work. On average, men expected to earn a course grade of 3.48, which is 0.73 of a grade point better than they had done on average in their previous course work. This difference was highly significant ($p < 0.001$). The actual average course grade for the women in our sample was 2.56, and the average course grade for the men was 2.66. Thus, while the men and women in our sample over-predict their actual course grade to about the same extent—by nearly a full letter grade—the men believe that they will do much better in introductory microeconomics than in their previous courses, while the women predict that they will do only somewhat better in introductory microeconomics than in their previous courses.

Given this information, it is necessary to consider whether men and women have fundamentally different ways of forming expectations. For example, men might be generally predisposed either to optimism or to self-delusion when it comes to their course work. However, other studies in the literature cast doubt on this hypothesis. Paul Grimes (2002) finds that men are more likely to over-predict their performance on exams, but this effect is not statistically significant. In regressions, Grimes finds that gender is not significantly related either to over-prediction or to the ability of the student to revise his or her predictions given further information. Further, Nan Maxwell and Jane Lopus (1994) find that both men and women tend to overstate their GPA, but they do not find a difference by gender.[7] This evidence indicates that female and male students misperceive their performance in economics courses and misreport

information about their educational attainment in a roughly similar fashion. This suggests that other factors may be at work in determining student expectations of grades in microeconomics.

When we compare the self-reported GPA and ACT with the actual data from university administrative records, we find that the students in our sample overstated their scores on average, although the extent of the overstatements is quantitatively small.[8] (See Table 1.) We find that the men in our sample tend to over-report their GPA by more than women do, although the difference is not statistically significant. On the other hand, the men in our sample over-report their ACT scores by more than the women do, and this difference is statistically significant. However, men do not report higher levels of motivation, nor do they report higher levels of attendance than women.

The 401 students in our sample who had taken introductory macroeconomics previous to introductory microeconomics (or were taking the two courses concurrently) did not expect to fare any better in microeconomics than students with no previous economics experience at the college level.

Since some students did not participate in the survey, we also have to address the problem of selectivity bias in our survey sample (Becker and Walstad 1990; Maxwell and Lopus 1994; Ballard and Johnson 2004). As stated earlier, the 1462 students for whom we have survey information were a subset of the 2313 individuals who were enrolled in the four sections of introductory microeconomics at our university. We have relatively little information on the students who did not take the survey, although we do know that, on average, students who performed less well in the course were more likely to have missed taking the survey. In Figure 1, we compare the distributions of the final grades earned in the course for the entire class and the sample of students who took the survey. The figure shows that students from the sample

(Survey series) did better, on average, than the class as a whole (Class series). Those who took the survey averaged 73 percent correct on all exams, while those who did not take the survey averaged only 64 percent correct; this difference is significant at the one-percent level.

<Figure 1 about here>

Nevertheless, we argue that selection bias is not a problem for the interpretation of our regression results, regarding the relationship between expectations and the gender difference in performance in the introductory microeconomics course. We expect that students who are more likely to attend class (and thus more likely to participate in the survey) are also more likely to have higher expectations of success in the class. However, given the focus of our analysis, this will only create problems if the relationship between attendance and expectations is different for men and women. There is no evidence that this is the case. Excluding 15 names for which the gender of the student could not be definitively identified, we find that about 36% of the women were absent the day the survey was administered, along with about 37% of the men.[9] Ronald Fisher, Jeffrey Guilfoyle, and Liedholm (1997) studied the relationship between attendance and performance in introductory microeconomics courses at our same university.[10] They found that women were no more likely to be absent then men. They also found no significant difference in performance between absent women and absent men.

For some students, we do not have values for two important explanatory variables: Some transfer students do not have ACT scores,[11] and incoming freshmen do not have a university GPA. Because we do not want to drop the transfer students from our analysis, we replace their missing ACT scores with predicted ACT scores. Predicted ACT scores are calculated on the basis of an OLS regression of ACT score on explanatory variables that include information on a

student's academic performance, individual characteristics, and family background. For all non-transfer students, the actual value of the ACT score is used.

First-semester freshmen do not yet have a GPA, but we still want to include first-semester freshmen in the analysis, and we still want to use GPA as an explanatory variable. To accomplish this, we create a categorical dummy variable for GPA. The reference category is first-semester freshmen. Subsequent categories are created on the basis of ranges of GPA; for example, one category includes all students with a GPA between 3.5 and 4.0 (i.e., between B+ and A), and another includes those with a GPA between 3.0 and 3.499 (i.e., between B and B+).

5. Results for Expectations

We first examine the factors that influence student expectations about their performance in the introductory microeconomics course. We follow Becker and Walstad (1990) and Grimes (2002) in specifying the formation of student expectations. We model expectations as being formed on the basis of age, gender, previous academic experience, motivation, and background variables. We also include variables to control for a student's math skills and affinity for math.

Since student expectations were reported as ordered categorical responses (4.0, 3.5, 3.0, etc.), we use an ordered-probit estimation technique. Ordered probit is a regression technique based on binary probability models, but used when the dependent variable is a series of ordered responses. The results of this regression are reported in Table 2. The entire sample is considered in the first specification, in the column marked (1) in Table 2.[12] Holding all else constant, the women in our sample expected to do 0.25 of a grade point less well than men. This result is highly significant. GPA and math experience also have a significant influence on the expectations of the students in our sample. Students who had taken calculus expected to do

significantly better in the introductory microeconomics course, and students who were required to take remedial math expected to do significantly less well. College of Business majors expected to do significantly better, all else equal (perhaps because they are more interested in the subject matter, or perhaps because they need to maintain a minimum GPA in their business core classes).[13] Students for whom introductory microeconomics was required for their major expected to do slightly worse than those electing to take the course. Students with higher reported levels of motivation also expected to do significantly better. Finally, we include the level of parental education, in an effort to control for the influence of family background. If parents have a higher level of educational attainment, we might expect both women and men to have higher expectations of success in an academic setting. The results shown in Table 2 suggest that students whose parents had attained higher levels of education had higher expectations of performance in the microeconomics course, all else equal.[14]

<Table 2 about here>

We also examine whether expectations are different for the students who had previously taken college-level economics (introductory macroeconomics) or secondary-school economics. We would like to know whether students revise their expectations of performance in economics courses, as they acquire more familiarity with economics. In column (2) of Table 2, we see that the magnitude of the gender effect on expectations is about one-third smaller for students with college-level economics experience than for the entire sample.[15] For students who had economics in secondary school (column (3) of Table 2), the gender effect on expectations is once again not as large as the coefficient for the entire sample. Thus, the results in Table 2 suggest that previous study of economics may reduce the discrepancy between the expectations of women and the expectations of men, although the effect is modest in size.

More information on expectation formation can be discerned by looking at separate ordered-probit regressions of expectations for each gender. We report the results from these regressions in Table 3. Math variables remain significant indicators of how students think they will perform in the microeconomics course. It is interesting to note that the coefficient for having taken calculus in Table 3 is very similar for men and for women, but the coefficient for having taken remedial math is more than twice as large for women as for men. In other words, being good at math gives about the same boost to the expectations of women as to the expectations of men, but having problems with math is worse for women's expectations than for men's. Women enrolled in the College of Business strongly expect to do better, and women for whom the course is required strongly expect to do worse.

<Table 3 about here>

Grade-point average is not significant for determining the expectations of women (although it remains highly significant for men). This suggests that women's success in other courses does not translate into expectations of successful performance in introductory microeconomics.

We also investigate the effect on expectations of previous experience with college-level economics. The data indicate that the expectations of both women and men are affected positively by having taken either microeconomics or macroeconomics previously.

However, the expectations of the women in our sample are significantly and *negatively* influenced by their experiences in secondary-school economics. Men are also influenced negatively by secondary-school economics, although the effect is smaller, and is not statistically significant.[16] Thus, when we consider a wide array of previous academic experiences, the results

from Table 3 indicate that the effects on expectations are usually less positive (or more negative) for women than for men.

It is possible that women who have mothers with higher levels of education (and perhaps fathers with higher levels of education, as well) may be less constrained by traditional views on gender roles. Therefore, these women might be more likely to pursue fields of study such as economics. However, the results shown in Table 3 indicate that, all else equal, men's expectations are positively influenced by their mother's education level, while women's expectations are not.[17]

If we take the results of Table 2 together with the results of Table 3, the overall impression is that previous academic experiences certainly do not help to improve the expectations of women very much, and they may actually have negative effects on women's expectations.

6. Results for Performance

Now that we have some idea of what determines expectations of success in introductory microeconomics, we examine whether these expectations are to some degree self-fulfilling. In other words, we investigate whether students with higher expectations perform better in the microeconomics course, all else equal.

Statistical representations of learning models have a long history. Benjamin Bloom (1976) developed what has come to be known as the education production function. The production function assumes that students "produce" knowledge with a variety of "inputs," including intelligence and effort. In addition, the knowledge produced depends on students' personal characteristics. Eric Hanushek (1979) provided a methodological rationale for this

statistical approach to measuring learning. The structural model we estimate is the standard education production function (Stratford Douglas and Joseph Sulock, 1995). Our dependent variable (called "score") is the student's percentage of questions answered correctly on the three examinations in the introductory microeconomics course. Therefore, we estimate:

$$score_i = \beta_0 + \beta_j Z_{ij} + u_i \,, \qquad (1)$$

using Ordinary Least Squares (OLS). In equation (1), score for student i depends on a vector of explanatory variables, j, whose coefficients are indicated by β_j. The values of the explanatory variables are indicated as Z_{ij}, and there is an error term, u.

In Table 4, we show the results from five specifications. In Specification 1, we run a regression of score on the explanatory variables, not including expectations, but including whether students had economics in secondary school. In Specification 2, we add an interaction term between economics in secondary school and gender. In Specification 3 of Table 4, we leave out secondary-school economics and the interaction term, but include student expectations of performance in the class. In Specification 4, we include student expectations of performance in the class as well as the secondary-school variable and the secondary-school/gender interaction term. Finally, in Specification 5 of Table 4, we interact gender with expectations, adding it to the regression specified in the previous column.[18]

<Table 4 about here>

Among the most important determinants of student performance in Specification 1 of Table 4 are GPA, math background and competency, and gender. Compared to first-semester freshmen, students with a GPA of 1.999 or less answered significantly fewer questions correctly

in the course; similarly for students with GPA's in the range of 2.0 to 2.499, and 2.5 to 2.999. Those with a GPA of 3.0 and above answered more questions correctly than did the first-semester students, although the difference was not significant.

The gender coefficient for Specification 1 in Table 4 indicates that, all else equal, the men in this course answered 1.79 percent more exam questions correctly than did the women ($p < 0.001$). This is consistent with earlier studies. Black and Hispanic students do statistically significantly worse than their white counterparts, scoring on average 2.57 points fewer. All else equal, students who work more hours in paid employment have lower scores in the course ($p < 0.001$), and students who report studying more do significantly better ($p < 0.001$).

The coefficients for the math-background variables in Specification 1 indicate that quantitative skills play an important role in determining success in the introductory microeconomics course. We include three variables that measure aspects of math skill, and each of them is quantitatively important and statistically significant. For more discussion of these effects, see Ballard and Johnson (2004).

The coefficients in Specification 1 indicate that students for whom introductory microeconomics is a required course do slightly better than others, although the difference is not significant. Interestingly, those who report that their major is in the College of Business do less well. This result could easily be misinterpreted, and it requires some explanation. Introductory microeconomics is required for all College of Business majors. Thus, when we combine the (positive) coefficient for "Required for Major" with the (negative) coefficient for "College of Business Major", it turns out that the total effect of having a major in the College of Business is small.

Also, at our university, introductory microeconomics is required for entry into the College of Business. (Admission to the College of Business is not automatic.) Thus, the students who report that their major is in the College of Business are indicating a desire to major in Accounting, Finance, Management, or Marketing. Ultimately, however, some of them will probably be denied admission to the College.

In Specification 2 of Table 4, we add an interaction term between gender and having taken economics in secondary school. In this specification, the coefficient on the variable for having taken economics in secondary school is interpreted as the effect for men only, and the coefficient on the interaction term is the additional effect for women who have taken secondary-school economics. The estimates indicate that, all else equal, a man who has taken secondary-school economics will answer 1.73 percent fewer questions correctly in the course. Even more remarkably, the interaction term suggests that a woman who has taken secondary-school economics will suffer an additional penalty of 3.14 percent. Thus, when compared with a man who has not had economics in secondary school, Specification 2 indicates that a woman who has had secondary-school economics would answer (1.73 + 3.14) = 4.87 percent fewer questions correctly, all else equal.

The sign and magnitude of the interaction term between gender and having taken economics in secondary school is important. Equally important is its effect on the gender variable itself. From Specification 1, recall that women answered 1.79 percent fewer questions correctly, all else equal, and this result was significant at the one-percent level. Now, in Specification 2, the inclusion of the gender/secondary-school interaction term decreases the magnitude of the gender coefficient by two-thirds, and the gender coefficient is now

insignificant. (There are no substantial changes to the magnitude or significance of the other variables in the regression, such as those for race, GPA, or math skills.)

This result has two important implications. First, it raises questions about the efficacy of secondary-school instruction in economics, both for women and for men. Second, it suggests that the observed gender gap in undergraduate economics courses may be profoundly influenced by experiences that occur before women set foot in the undergraduate classroom.

In Specification 3 of Table 4, we remove the variable for secondary-school economics, as well as the interaction term between secondary-school economics and gender. Instead, we include expectations as an ordered categorical dummy variable, where the reference category is students who expected to earn a course grade of 4.0 (an A). Thus, Specifications 2 and 3 are both concerned with influences on women's performance that may already be well in place before the course even begins.

Not surprisingly, the estimates from Specification 3 indicate that students who expected to earn course grades below 4.0 did significantly less well in the course than those who expected a 4.0. All else equal, students who expected to earn a course grade of 3.5 scored 4.47 percentage points fewer; students who expected to earn a 3.0 scored 6.53 percentage points fewer than those who expected a 4.0; and students who expected to earn a 2.5 scored 7.93 percentage points fewer. While the other coefficients and significance levels change little, when we include expectations in the regression, the coefficient on gender decreases by nearly one-third.[19]

Recall from Table 3 that having taken economics in secondary school had a negative and significant effect on the expectations of women. Thus, our data indicate that secondary-school economics has a direct effect on student performance, as well as an indirect effect through expectations. All else equal, women who have had economics in secondary school expect to do

less well. But then, even after controlling for those reduced expectations, the women who took economics in secondary school did substantially worse than the men who took secondary-school economics, and these women also did worse than the women who did not take economics in secondary school.

Specification 4 of Table 4 includes the variable for whether the student took an economics course in secondary school, as well as the interaction between gender and having taken economics in secondary school, and it also includes the expectations variables. As in Specification 2, the coefficients indicate that having had an economics course in secondary school is harmful to the prospects of both women and men, but secondary-school economics is especially deleterious effects for women.[20] As in Specification 3, the coefficients on expectations in Specification 4 are large in magnitude, and they are highly statistically significant. Perhaps most important of all, the coefficient on the gender variable in Specification 4 is very close to zero, and is far from significance. Thus, when we control for expectations and for experience with secondary-school economics, the independent effect of gender disappears.

To learn more about the relationship between expectations, gender, and performance, we consider Specification 5 of Table 4, which adds an interaction term between gender and each expected grade level. The results of this regression are reported in the right-hand column of the table. When we include the interaction terms in Specification 5, the magnitude of the gender coefficient increases, but the variable remains insignificant, as it was in Specification 4. Individually, none of the interaction terms (female*expected grade) is significant, either. However, when interpreting these results, we must consider these effects cumulatively.

In Table 5, we use the results from Specification 5 of Table 4 to summarize some information about the interactions of gender, expectations, experience with secondary-school

economics, and performance in the introductory undergraduate course. First, note that only three of the women in our sample expected to earn a grade of 2.0 (i.e., a C) or less in the course, and no men expected to earn a grade of 2.0 or less. Thus, this category is dropped when comparing gender effects. Second, note that the reference category in Table 5 is a male who has taken secondary-school economics, and who expected a course grade of 4.0 (an A).

<Table 5 about here>

As shown in Table 5, the regression coefficients predict that, all else equal, a woman who expected to earn a course grade of 3.0 (B), and who had taken secondary-school economics, would answer 9.45 percentage points fewer questions correctly than a man who had taken secondary-school economics and expected a course grade of 4.0. This is the sum of –2.52 percentage points (the coefficient on being female), plus –6.64 percentage points (the coefficient on expecting to earn a grade of 3.0 instead of 4.0), plus 2.80 percentage points (the coefficient on the interaction term between femaleness and an expected grade of 3.0), plus –3.09 percentage points (the coefficient on the interaction term between female and secondary school), for a total effect of –9.45 percentage points. On the other hand, a man who expected to earn a grade of 3.0 in the course would be expected to differ by –6.64 percentage points from a man who expected a 4.0, all else equal. This is the sum of zero percentage points (the coefficient on being female multiplied by zero), plus -6.64 percentage points (the coefficient on expecting to earn a 3.0 instead of a 4.0), for a total effect of –6.64 percentage points.

When considered separately in Specification 5, the gender variable and the interacted female-expectations variables are not significant. (See Table 4.) However, conducting a joint F-test (Wald test) on these variables indicates that together they are significant at the 3-percent level. Thus, while not fully conclusive, these results provide further evidence that women's

expectations of performance in an economics course have negative effects on their final grades in the course.

It is important to note from Specification 5 of Table 4 that the interaction terms between being female and the higher expected grades are actually positive (although not significant). On the other hand, the interaction term between being female and an expected grade of 2.5 is negative and large (although it is also not significant). This suggests that the problems discussed in this paper do not affect all women symmetrically. If we consider these results for the interaction term, in conjunction with the results from Table 3 on the effect of remedial math on women's expectations, it appears that the difficulties faced by women are disproportionately concentrated among a subset of women.

There are a number of mechanisms by which these expectations could become self-fulfilling. One possibility is that students with higher expectations will work harder, in ways that are not captured by the variable on self-reported number of hours spent studying. The additional effort could take the form of additional hours of study, or it could take the form of more intensive or more effective use of study time. Of course, one possibility is that the expectations variable is merely a proxy for some aspects of ability that are private information for the student, and unobserved by the researcher. However, the fact that those who had prior college experience with economics had only insignificant gender effects on expectations indicates that expectations have at least some real effects. A valuable goal of future research would be to learn more about the precise ways in which expectations of success in introductory economics courses are fulfilled.

7. Conclusions

In an extensive literature, researchers have documented a gender gap in the study of economics in several countries, including Canada, the UK, and the US. For example, women perform less well in economics courses, and are less likely to major in economics. Many explanations for this effect have been considered in the literature. In this paper, we consider whether women's expectations upon entering an introductory undergraduate economics course may influence their performance in the course.

We study the determinants of success in an introductory undergraduate microeconomics course, using data from a sample of 1462 students who took the course at a US university in the Fall Semester of 1998 or 1999. We first consider the factors that influence student expectations of performance in microeconomics. In addition to motivation, math background, previous academic performance, and other variables, gender is a significant determinant of student expectations: The women in the introductory microeconomics course expected to earn a course grade that is lower by one-fourth of a letter grade (0.25 on a 4.0 scale) than the course grade expected by the men, all else equal. The estimates indicate that having taken calculus has a positive effect on expectations, both for women and for men, and the magnitude of the effect is very similar. Having been placed into a remedial-math course has a negative effect on expectations, both for women and for men, but the magnitude of the effect is much larger for women.

To some extent, these expectations are self-fulfilling. We find that expected grades are positively and significantly related to student performance in the class. In addition, controlling for expected grades reduces the significance of the gender coefficient in a performance regression. Examining interaction effects between gender and expected grades further indicates

that expectations have an effect on women's performance that is negative when compared with the effect of expectations on men's performance. This suggests that, to increase representation of women in economics, it may be important to address their expectations of the field, prior to their enrollment in college economics courses.

One very interesting finding is that having taken economics in secondary school has negative effects on performance, both for women and for men. However, the magnitude of the negative effect is much larger for women. When we include the variables for secondary-school experience with economics, the magnitude of the gender coefficient is decreased by even more than it is decreased by the expectations variables. When we include both the expectations variables and the variables for secondary-school experience with economics, the independent effect of gender disappears. This suggests that the observed gender gap in introductory undergraduate economics courses is powerfully influenced by prior experiences and attitudes.

Our data are from one university in the US. Several of our results are consistent with the results from earlier literature, most of which has been carried out with data from Canada, the US, or the UK. Although we would argue that our results have relevance for other universities in the US, it is not possible to test this assertion using our data. It is difficult to assess the relevance of our results for economic education in other countries. We welcome additional research along these lines, for other institutions in the US, and for institutions in other countries.

Nevertheless, on the basis of our results, we tentatively suggest some strategies that may be used in an effort to reduce the gender gap in the study of economics. One strategy is to provide warnings to those students who have taken economics in secondary school, to the effect that they need to redouble their efforts, because this previous experience may not be beneficial. Another strategy is to identify students with deficiencies in mathematics, and to provide remedial

mathematics instruction. This has the potential to help both men and women, but it is likely to have relatively larger effects on women, since women enter the course with less mathematical preparation, on average. In addition, poor mathematical preparation seems to be more damaging to women's expectations than to men's. With regard to the expectations themselves, it may be possible to provide a program of motivation and encouragement, in an attempt to overcome the negative attitudes that many women bring to the study of introductory economics. Further research along these lines would be valuable.

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Figure 1
Grade Distribution

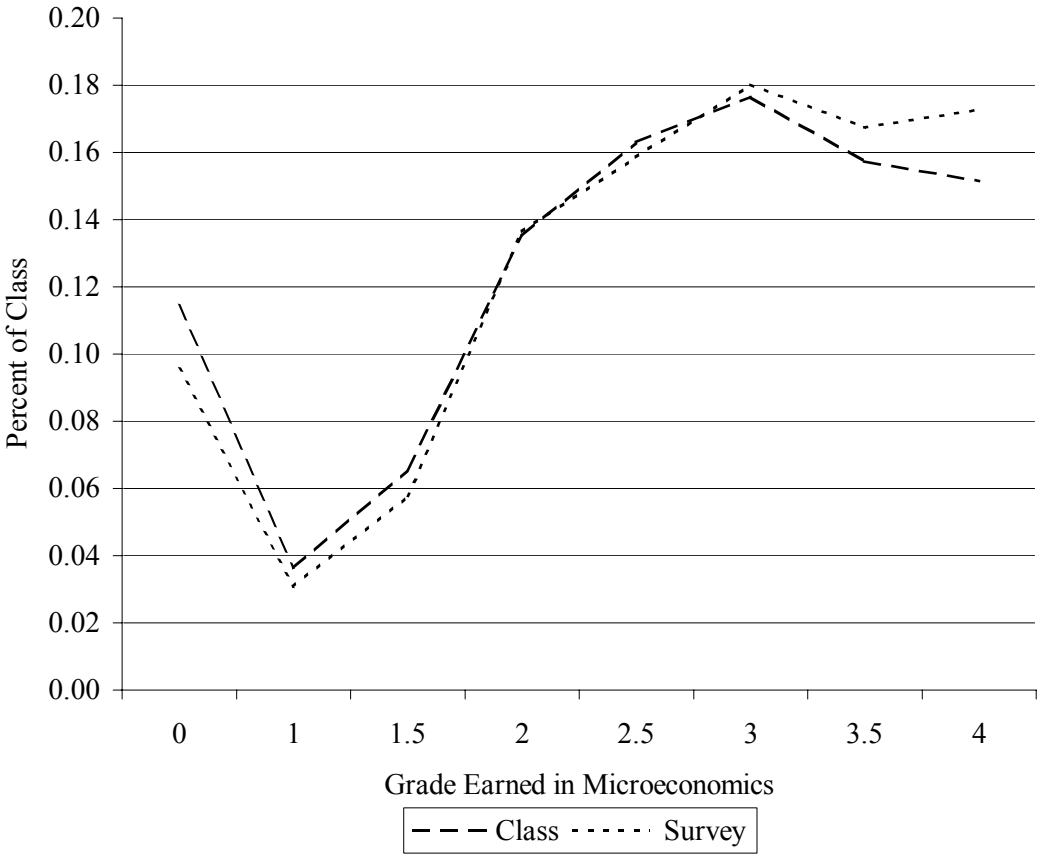

Table 1: Differences by Gender in the Sample

Variable	Women	Men	Significant Difference
Mean Percent Correct in Class	71.53%	73.56%	Yes, $p < 0.002$
Mean GPA (4.0 scale)	2.85	2.75	Yes, $p < 0.001$
Mean ACT Math	22.53	23.57	Yes, $p < 0.001$
Mean ACT English	22.81	22.22	Yes, $p < 0.001$
Taken Calculus	55.36%	64.88%	Yes, $p < 0.001$
Taken Remedial Math	23.32%	22.41%	Yes, $p < 0.010$
Taken Economics in Secondary School	38.20%	39.58%	No
Previously Taken Macroeconomics	27.32%	27.52%	No
Retaking Microeconomics	4.01%	3.80%	No
Required for Major	82.12%	72.61%	Yes, $p < 0.002$
Expected Grade			Yes, $p < 0.001$
Expected 4.0 (A)	17.02%	27.92%	
Expected 3.5 (B+)	50.07%	44.69%	
Expected 3.0 (B)	30.33%	25.03%	
Expected 2.5 (C+)	2.15%	2.36%	
Expected 2.0 (C) or less	0.43%	0.00%	
Average Expected Grade (4.0 scale)	3.39	3.48	Yes, $p < 0.001$
Average Actual Grade Earned in the Class (4.0 scale)	2.56	2.66	Yes, $p < 0.001$
Motivation			No
Very Highly	46.78%	44.04%	
Fairly Highly	45.92%	48.23%	
Somewhat	6.58%	7.08%	
Not Very	0.42%	0.39%	
Unmotivated	0.29%	0.26%	
Attendance			No
Never Miss Class	37.77%	41.28%	
Miss Fewer than 5	54.51%	48.89%	
Miss 5 -10 times	7.58%	9.04%	
Attends Infrequently	0.14%	0.39%	
Never Attends, except for Exams	0.00%	0.30%	
Mean Overreporting of GPA	0.09	0.11	No
Mean Overreporting of ACT	0.02	0.78	Yes, $p < 0.001$

Table 2
Determinants of Expectations, By Economics Experience

Independent Variables	(1) Entire Sample	(2) Those Who Previously Had Taken Macroeconomics	(3) Those Who Had Economics in Secondary School
Gender 1 = female 0 = male	–0.25 (–4.16)*** [a]	–0.18 (–1.56)	–0.19 (–2.00)**
Age	0.02 (1.33)	0.05 (1.69)*	–0.01 (–0.59)
GPA	0.04 (2.66)***	0.05 (1.33)	0.07 (2.78)***
Calculus 1 = yes 0= no	0.36 (5.72)***	0.40 (2.86)***	0.48 (4.68)***
Remedial Math 1 = yes 0 = no	–0.43 (–6.08)***	–0.30 (–2.19)**	–0.27 (–2.37)**
College of Bus. Major 1 = yes 0 = no	0.15 (2.70)***	0.22 (1.99)**	0.09 (1.03)
Required for Major 1 = Yes 0 = No	-0.03 (-0.65)	-0.17 (-1.34)	-0.03 (-0.37)
Mother's Education	0.08 (2.94)***	0.11 (1.90)*	0.09 (2.06)**
Self-Reported Motivation	0.54 (11.83)***	0.50 (5.74)***	0.54 (7.37)***
Number of Obs.	1457	398	567
Pseudo R^2	0.0807	0.0634	0.0863

[a] Numbers in parenthesis are *z*-statistics. The * indicates significance at the ten-percent level; ** indicates significance at the five-percent level, and *** indicates significance at the one-percent level.

Table 3
Expectations Formation by Gender

Independent Variables	Women	Men
Age	0.01	0.03
	(0.65) [a]	(1.47)
GPA	0.01	0.08
	(0.41)	(3.48)***
Calculus	0.45	0.37
1 = yes	(4.71)***	(4.07)***
0 = no		
Remedial Math	–0.57	–0.25
1 = yes	(–5.52)***	(–2.51)***
0 = no		
College of Business Major	0.24	0.04
1 = yes	(2.82)***	(0.52)*
0 = no		
Required for Major	-0.26	0.12
1 = yes	(-3.16)***	(1.74)*
0 = no		
Mother's Education	0.01	0.15
	(0.26)	(3.99)***
Self-Reported Motivation	0.59	0.54
	(8.72)***	(8.39)***
Taken Economics in Secondary School	–0.19	–0.12
	(–2.19)**	(–1.44)
Taken Macroeconomics Previously	0.06	0.12
	(1.02)	(2.34)***
Taken Microeconomics Previously	0.71	0.71
	(3.18)***	(3.37)***
Number of Observations	697	760
Pseudo R^2	0.1030	0.0874

[a] Numbers in parenthesis are *z*-statistics. The * indicates significance at the ten-percent level; ** indicates significance at the five-percent level, and *** indicates significance at the one-percent level.

Table 4
Performance and Expectations in Introductory Microeconomics

Independent Variables	Performance Specification 1	Performance Specification 2	Performance Specification 3	Performance Specification 4	Performance Specification 5
Gender (1 = Female)	-1.79	-0.59	-1.21	-0.02	-2.52
(0 = Male)	(-2.78)*** [a]	(-0.74)	(-1.91)*	(-0.02)	(-0.38)
Race [b]					
Hispanic or Black	-2.57	-2.59	-2.94	-2.96	-3.05
	(-2.11)**	(-2.14)**	(-2.47)**	(-2.48)***	(-2.55)***
Asian/Pacific Islander	-1.02	-1.11	-1.44	-1.52	-1.43
	(-0.78)	(-0.85)	(-1.12)	(-1.18)	(-1.11)
Other	-1.05	-1.27	-1.13	-1.33	-1.38
	(-0.60)	(-0.73)	(-0.66)	(-0.78)	(-0.81)
University Class [c]					
Sophomore	3.23	3.25	3.41	3.42	3.48
	(1.86)*	(1.87)*	(1.99)**	(2.00)**	(2.03)**
Junior	4.56	4.72	4.50	4.65	4.73
	(2.49)***	(2.58)***	(2.50)***	(2.59)***	(2.63)***
Senior	3.49	3.53	3.01	3.04	3.10
	(1.53)	(1.55)	(1.34)	(1.36)	(1.38)
Other	16.00	16.09	15.29	15.36	15.40
	(4.22)***	(4.25)***	(4.10)***	(4.12)***	(4.13)***
Hours Worked in Paid Job Per Week	-0.11	-0.11	-0.11	-0.11	-0.11
	(-3.28)***	(-3.30)***	(-3.45)***	(-3.48)***	(-3.48)***
Hours in Extracurricular Activities Per Week	-0.07	-0.07	-0.07	-0.08	-0.08
	(-1.56)	(-1.62)	(-1.60)	(-1.67)*	(-1.72)*
Hours Reported Studying For All Classes Per Week	0.11	0.12	0.08	0.08	0.08
	(3.11)***	(3.22)***	(2.19)**	(2.29)**	(2.25)**
GPA					
1.999 or less	-11.02	-11.01	-10.15	-10.11	-10.27
	(-4.83)***	(-4.84)***	(-4.52)***	(-4.50)***	(-4.57)***
2.0 to 2.499	-8.56	-8.54	-7.85	-7.80	-7.90
	(-4.29)***	(-4.29)***	(-3.98)***	(-3.96)***	(-4.01)***
2.5 to 2.999	-3.48	-3.60	-3.12	-3.21	-3.30
	(-1.81)*	(-1.88)*	(-1.65)*	(-1.70)*	(-1.75)*
3.0 to 3.499	1.09	0.95	0.91	0.79	0.69
	(0.56)	(0.49)	(0.47)	(0.41)	(0.36)
3.5 to 4.000	2.27	2.18	1.26	1.20	1.11
	(1.16)	(1.11)	(0.65)	(0.62)	(0.57)
Required for Major	0.66	0.67	0.78	0.79	0.80
	(1.17)	(1.19)	(1.40)	(1.43)	(1.44)
College of Business Major	-1.19	-1.24	-1.35	-1.39	-1.40
	(-2.04)**	(-2.12)**	(-2.34)**	(-2.41)**	(-2.43)**
Math ACT Score	0.69	0.69	0.58	0.57	0.57
	(6.37)***	(6.36)***	(5.34)***	(5.31)***	(5.32)***
English ACT Score	0.27	0.27	0.26	0.27	0.26
	(2.77)***	(2.80)***	(2.76)***	(2.79)***	(2.77)***
Taken Calculus	3.33	3.31	2.71	2.68	2.67
	(4.74)***	(4.72)***	(3.89)***	(3.85)***	(3.84)***

Required to Take Remedial Math	-1.90 (-2.43)***	-1.91 (-2.44)***	-1.68 (-2.17)**	-1.67 (-2.16)**	-1.64 (-2.12)**
Took Course in 1999	1.14 (1.88)*	1.14 (1.88)*	1.11 (1.84)*	1.10 (1.83)*	1.06 (1.77)*
Took Economics in Secondary School	-0.25 (-0.39)	-1.73 (-2.02)**	--	-1.46 (-1.73)*	-1.41 (-1.67)*
Economics in Secondary School * Female	--	-3.14 (-2.53)**	--	-3.11 (2.53)***	-3.09 (-2.52)***
Expected Grade [d]	--	--			
3.5 (B+)			-4.47 (-5.63)***	-4.37 (-5.50)***	-4.37 (-4.29)***
3.0 (B)			-6.53 (-7.09)***	-6.53 (-7.09)***	-6.64 (-5.62)***
2.5 (C+)			-7.75 (-3.60)***	-7.93 (-3.69)***	-4.47 (-1.57)
2.0 or less (C or less)			-1.92 (-0.29)	-2.52 (-0.38)	--
Interaction[e]	--	--	--	--	
Female*Expected Grade = 4.0					2.66 (0.40)
Female*Expected Grade = 3.5					2.61 (0.39)
Female*Expected Grade = 3.0					2.80 (0.42)
Female*Expected Grade = 2.5					-5.01 (-0.65)
Constant	48.93	51.42	56.08	58.48	58.49
R-Squared	0.285	0.288	0.311	0.314	0.316
Number of Observations	1462	1462	1462	1462	1462

[a] Numbers in parentheses are *t*-statistics. Significance is indicated by: * significant at the ten-percent level, ** significant at the five-percent level, and *** significant at the one-percent level.
[b] The reference category is "white."
[c] A substantial number of students are first-semester freshmen, who do not yet have a GPA. Therefore, in these regressions, we employ a set of dummy variables, in which the excluded category is first-semester freshmen.
[d] The reference category is "expect a 4.0" in the course. Since only three students expected to earn a course grade of 2.0 or less, it is not surprising that the results for this category are not significant.
[e] As mentioned in footnote d, only three students reported that they expected course grade of 2.0 or less. All three of these students are male. Therefore, we do not include an interaction term for (Female*expected grade = 2.0 or less).

Table 5
Interpreting the Interaction Effects Between Gender and Expected Grade, For Performance Specification 5 of Table 4 (Reference Group is Men Who Took Secondary-School Economics and Expected a Course Grade of 4.0)

Expected Grade	Men	Women
	Total effect (in percentage points) = Expected grade coefficient	Total effect (in percentage points) = Female coefficient + Expected grade coefficient + Interaction term (Female*expected grade) + Interaction term (Female*secondary school)
4.0	0.00	–2.95
3.5	–4.37	–7.37
3.0	–6.64	–9.45
2.5	–4.47	–15.09
2.0 or less	Dropped	Dropped
F-test of Gender and Interaction Terms		F (6, 1429) = 2.32 Prob > F = 0.0312

End Notes

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[1] However, Robb and Robb (1999) find that the gender of the instructor had no effect on the decision of women to take additional economics courses.

[2] In the courses from which our data are taken, all exams consisted exclusively of multiple-choice questions. This format is not necessarily the best pedagogically. However, in view of the logistical difficulties of grading exams for 1200 students, the decision was made to use multiple-choice exams. The multiple-choice format does have the advantage of lending itself to quantitative analysis.

[3] Brown and Liedholm (2002) compare performance in introductory microeconomics courses that are taught in different ways. In a traditional class with live lectures, they find that women do substantially less well than men, and the difference is statistically significant. However, they find that the size of the gender gap is much smaller for online courses, or for courses that are a hybrid of the live and virtual formats, and the gender gaps are no longer significant. In this paper, we only consider courses that were delivered in the traditional format with lectures that are given in person. Thus, we cannot assess the extent to which our results are an artifact of the format in which the course is delivered. Nevertheless, the results of Brown and Liedholm are interesting, and the issue

deserves further investigation. However, we note that Brown and Liedholm find the overall level of achievement to be higher in the live course than in the online or hybrid versions. Thus, in a sense, their results show that the online format reduces the gender gap by harming men more than it harms women. We would prefer to look for ways to reduce the gender gap by improving the performance of women, rather than damaging the performance of men.

[4] Thus, we cannot assess the role of the gender of the instructor, since there is no variation in the gender of the instructor in our data set. In any event, we are mostly interested in expectations formation and in the effects of expectations, rather than in the effects of the gender of the instructor. Moreover, since men form a substantial majority of college instructors of economics, it is essential to try to understand the determinants of student success, even for women who are taught by men.

[5] The four sections were of approximately equal size. In each of the two semesters, the classes met consecutively, on the same days of the week. Both sections in each semester were given the same exams, although different exams were given in the different semesters. We include a dummy variable for semester that is significant at the ten-percent level. In the regressions reported below, we do not include a dummy variable for section within a semester; if it is included, we find that the section dummy is not statistically significant, and the estimated coefficient is close to zero.

[6] Institutional policy at our university allows students to retake up to five classes with no penalties (other than the costs of tuition for additional courses). Thus, students who do poorly in a course can choose to retake the course. In this case, the original course grade is replaced by the grade earned in the retake. In our sample, 57 students were retaking

the introductory microeconomics course. Of these, 28 were women (4 percent of all women in the course) and 29 were men (3.8 percent of all men in the course). There was no significant difference between men and women in the likelihood of retaking the course.

[7] Maxwell and Lopus (1994) refer to the tendency of students to over-report their GPA as the "Lake Wobegon Effect," after the mythical Minnesota town in which all the children are above average. However, in our sample, the extent of the overstatement is fairly small for GPA and for the ACT score. (See endnote 8, below.) We interpret this as meaning that most students feel constrained to be approximately honest when reporting information on past performance, since that information is objectively verifiable. On the other hand, when students report their expected grades in the course, they are very overoptimistic. They can be hopeful about their expected grade without "lying", since the true grade is not yet known at the time of the survey. In spite of the fact that expected grades are a biased predictor of actual grades, the expected grades are still useful statistically.

[8] The ACT is a college entrance exam that is used widely in the US. (The SAT is the other popular college entrance exam.) On average, all students in our sample (men and women together) over-report their ACT score by 0.42 points, and they over-report their GPA by 0.10 points. The correlation coefficient between actual and reported ACT is about 0.77, and the correlation coefficient between actual and reported GPA is about 0.91. The small size of the overstatements is partly caused by the fact that a large number of students report with precision. In our sample, 529 students reported their

official ACT score exactly, and 193 students reported their university GPA accurately to two decimal places.

[9] We do not know whether men and women are absent for different reasons. Investigation along these lines would be an interesting avenue for future research.

[10] Fisher, Guilfoyle, and Liedholm have complete records on attendance at every class for every student. Thus, they have much more information on attendance than we do. We did not take attendance regularly, because of the logistical difficulties of taking attendance in sections with 600 students. Thus, our only information on attendance is whether the student participated in the survey (which indicates attendance on the day the survey was administered) and the student's self-reported attendance habits. We find no statistically significant difference between men and women in the self-reported attendance patterns.

[11] We are missing ACT scores for 106 students. This is because transfer students with over 28 credits are not required to provide an ACT score for admission to the university.

[12] The results in column (1) of Table 2 are based on a sample of 1457 students. The performance regressions, reported below in Table 4, are based on a sample of 1462 students. The difference is that we use age as an explanatory variable in our expectations regressions, but not in our performance regressions. Five students did not report their age, and these observations are dropped from the regressions in Table 2. The observations for students who did not report their age are also dropped from the regressions reported in Table 3, below.

[13] Introductory microeconomics is required for all students who want to major in the College of Business at our university, but it is also required for students in a variety of other disciplines.

[14] Mother's education and father's education are highly correlated. If we enter both of these variables in a regression, the multicollinearity causes both of them to lose significance. However, if we enter either of these education variables by itself, the variable is statistically significant. In this paper, we report regressions in which mother's education is included among the explanatory variables. In regressions using father's education, the coefficients turn out to be fairly similar.

[15] The coefficient is not statistically significant. However, we recognize that an important part of the reason for this difference is that the regressions in column (2) of Table 2 are based on a smaller sample than the regressions in column (1).

[16] This negative effect could arise in any of several ways. For example, it could result from adverse perceptions of the subject matter itself, or from perceptions of the level of difficulty of economics, or from negative feedback received in the secondary-school course. Research to distinguish among these channels would be desirable.

[17] If we replace "Mother's Education" with "Father's Education", we find that the expectations of men and women are positively influenced by their father's education level. However, in this specification, the effect is not statistically significant, either for men or for women.

[18] Lewis Karstensson and Richard Vedder (1974) provide support for including attitudes toward learning in education production functions.

[19] The results for Specifications 2 and 3 of Table 4 are both consistent with Esther Redmount (1995), who argues that the gender differences between men and women cannot be captured effectively with a simple binary variable.

[20] In another regression, we also control for whether students had taken introductory macroeconomics in college. (This regression is not reported explicitly in Table 4.) We find that students who had taken macroeconomics before microeconomics did nearly one percentage point worse in the class than students who had not taken macroeconomics, all else equal ($p < 0.05$). (This is in spite of the result from Table 3, indicating that expectations were improved by having taken macroeconomics.) One possible explanation is that, at our university, the first few weeks of introductory microeconomics are somewhat similar to the first few weeks of introductory macroeconomics. As a result, some students who have already had the introductory macroeconomics course may do well on the first examination, but they may then be lulled into complacency, and do less well later in the semester.