

Take My Course, *Please*: The Effects of the Principles Experience on Student Curriculum Choice

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Colleges and universities have experienced a dramatic decline in the number of economics majors during the 1990s. Between 1992 and 1994 alone, the number of economics degrees awarded decreased by over 20 percent (Siegfried and Scott 1994; Siegfried 1995). Although some evidence indicates that the trend may be reversing (Siegfried 1997),¹ enrollment levels are still a matter of concern in economics departments throughout the country.

Although recent research has helped to explain the general trend in economics majors,² existing studies provide little in the way of policy guidance for economics departments seeking to stem the decline in majors and in enrollment. Various modifications in the economics principles course have been suggested to increase the number of economics majors. These proposals include assigning popular instructors to principles classes (Margo and Siegfried 1996), employing more female and minority instructors to serve as role models (Catanese 1991), and changing the content and methodology of economics classes to make economics accessible to a broader range of students (Bartlett 1995). However, no systematic analysis has been done of the impact of these proposals on the likelihood that students will pursue further study in economics or become an economics major.³

We used microdata on students taking economics principles courses over a three-year span to determine the effect of student characteristics, instructor characteristics, and structural characteristics of the principles course on a student's subsequent decision to take additional economics classes or pursue an economics degree. Our focus was on variables that may be within the policy control of departments seeking to boost enrollment and increase the number of majors.

DATA AND METHODOLOGY

To analyze the impact of principles instruction on curriculum choice, we obtained data on every student who took principles of economics at Florida State

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University (FSU) during the period fall 1991 through fall 1993. A total of 5,143 students were enrolled in at least one principles course during this period. Of these 5,143 students, 4,744 had not taken principles prior to enrolling at FSU. We matched student files with course enrollment information to obtain data on student characteristics and subsequent curriculum choices. We required three additional factors for inclusion in the sample. First, to ensure proper measurement of post-principles economics course work, we only analyzed students who had graduated by spring 1996 or for whom three years had passed since taking their first principles course. Second, students must not have taken their first principles course prior to the beginning of our sample period, fall 1991. Third, complete data on student characteristics had to be available. A total of 2,528 students met these criteria and were included in the final sample.⁴

The principles courses at FSU are similar to those at many large universities. Two one-semester courses, microeconomics and macroeconomics, make up the principles sequence. Approximately 2,000 students are enrolled in either micro- or macroeconomics each term. Regular and adjunct faculty teach both large lecture classes of approximately 180–220 students and mid-sized classes of 100–130 students. Smaller sections, usually with 45–60 students, are taught primarily by graduate students (TAs). Because the two-course sequence is required for the undergraduate business major, business students make up a large proportion of the enrollees. All sections of micro- and macroeconomics use the same textbook and common final exams. Unlike many schools, FSU has no separate discussion sections. Because of the common text and final exams, all instructors teach the same core material, although additional topics vary with the preferences of the instructor. During our sample period, pedagogy varied relatively little. Although personal teaching styles obviously varied, all of the instructors employed variants of the traditional “chalk and talk” (Becker and Watts 1996) lecture format. This similarity limited what we could discover about the effects of pedagogy on student curriculum choices, but the relative uniformity in teaching formats was also a potential advantage. Because course content, text, and pedagogy were relatively constant, we did not need to try to measure and control for these factors. Instead, we focused our attention on the effects of the classroom setting, student characteristics, and instructor characteristics on the subsequent curriculum decisions of students exposed to an economics principles course.

We assumed that students act as if they seek to maximize expected wealth. Thus, as with any human capital investment, we expected student curriculum choice to be affected by student preferences and the expected costs and returns to education in economics relative to other subjects. If students are fully informed about the costs and benefits to them of an economics education (including their talents in economics vis à vis other subjects) prior to taking principles, then the principles course should have no impact on the probability of taking additional economics courses or majoring in economics. In that case, personal characteristics might explain the choice of curriculum and major, but instructor and course characteristics would have no explanatory value. In the more realistic case of costly information, however, the principles class could inform students about their likely costs of successfully completing future economics classes and

the potential rewards (both psychic and monetary) from further study of economics. Thus we posited three categories of factors determining post-principles curriculum choice: student characteristics and preferences, principles course characteristics (including instructor and structural characteristics), and external market factors affecting the relative return to an economics education. A complete description of the variables used in the analysis appears in the appendix.

Student characteristics that may influence curriculum choice and that we observed in the data included race/ethnicity, gender, mathematical aptitude (measured by standardized test scores), timing of principles enrollment (college credits completed prior to principles), and a previously declared intent to major in a particular subject area.⁵ The student's choice to complete the principles sequence and/or take one or more upper-division courses is partly governed by the student's major requirements.⁶ Some majors require students to complete both principles of economics courses whereas others do not. To control for these constraints, we restricted our analysis of completing principles to students whose majors did not require completion of both principles courses. Variables indicating majors that require economics courses were included as control variables.

Measurable instructor characteristics included rank (regular faculty/adjunct/graduate teaching assistant), gender, grading policies (average grade awarded in principles classes over a five-year span), and perceived instructor quality (measured by receipt of teaching awards).⁷ Structural course characteristics that may affect economics instruction and therefore subsequent curriculum choice included class size and type of course (micro- or macroeconomics). Because classroom constraints lead to class sizes clustering around three discrete levels, we measured class size with three dummy variables: *small* (60 students or fewer), *medium* (61 to 180 students), and *large* (more than 180 students).

If sufficient variation existed in the data, then all 18 combinations of instructor types (TA, adjunct, regular faculty), class sizes (small, medium, large), and number of exposures to a given setting (1, 2) would be analyzed. In practice, TAs are only given small classes to teach, thereby eliminating 4 possible combinations. The distribution of our sample across the remaining 14 combinations of instructor type, class size, and frequency of occurrence is shown in Table 1. To avoid categories containing only a handful of students, we combined some class size-instructor type categories in our empirical analysis. Regular and adjunct faculty primarily teach larger classes and only occasionally are assigned to smaller classes. The 4 possible combinations of exposures to regular faculty and adjuncts in small classes were therefore combined into a single category representing any exposure to a small class taught by either an adjunct or regular faculty member. It is rare that students take both principles courses from adjuncts, consequently one or two exposures to adjuncts were lumped together. Similarly, only a handful of students take both courses in large classes, so one or two large classes were also combined into a single category for analysis. These combinations left us with 8 exposure/class sizes/instructor type categories. We treated the modal category, medium-sized classes taught by regular faculty, as the base group for comparison.

Finally, students may be influenced in each time period by a set of prevailing expectations about the post-baccalaureate job market as well as expectations

TABLE 1
Distribution of Students by Class Size and Instructor Categories, Fall 1991 through Fall 1993

Instructor type and class type	Full sample (<i>N</i> = 2,528 students)	Students not required to take both principles (<i>n</i> = 1,431 students)	Students successfully completing both principles (<i>n</i> = 1,432 students)
One class—teaching assistant, small class	674	403	430
Both classes—teaching assistant, small class	137	78	132
One class—adjunct faculty, small class	47	33	26
Both classes—adjunct faculty, small class	0	0	0
One class—adjunct faculty, medium class	300	155	186
Both classes—adjunct faculty, medium class	11	5	11
One class—adjunct faculty, large class	306	141	223
Two classes—adjunct faculty, large class	2	1	2
One class—regular faculty, small class	129	87	86
Two classes—regular faculty, small class	5	1	5
One class—regular faculty, medium class	1,123	615	712
Both classes—regular faculty, medium class	277	86	268
One class—regular faculty, large class	567	275	359
Two classes—regular faculty, large class	4	4	3

about the costs and prospects among choices of college major. Year-to-year variations in the job market and media coverage can change these expectations. Changes in labor market conditions and the expected relative monetary reward to an economics education beyond the principles courses were captured by a set of time dummies for the 1991–92 school year and the 1992–93 school year.⁸

Students must successfully complete the two principles courses prior to taking any upper-division economics classes at FSU. Upon completing principles, students can take additional economics courses as general electives. However, most upper-division economics students either pursue a minor in economics, a major in economics, or a concentration in economics within some related major like interdisciplinary social sciences or international affairs.⁹ We therefore analyzed three possible outcomes: the probability that, after successfully completing one principles course, a student (1) completes a second principles course, (2) completes any economics courses beyond the principles level having successfully

completed both principles courses, and (3) graduates with a major in economics. Each of these choices was estimated with a probit model.¹⁰

RESULTS

It is interesting to look at what happens to the choice of major between the time a student starts the first principles course and graduation (Table 2). Although only 92 students in the sample graduated in economics without having declared it prior to taking the first principles course, they were drawn from a diverse set of majors, as well as from the ranks of undeclared majors. Individuals who were drawn into the economics major had similar characteristics to those who chose

TABLE 2
Distribution of Majors at Time of First Economics Principles Course by Major at Graduation

Major at time of first principles	Major at graduation				Total
	Business	Economics	Other social science	Other	
Business	976 (77.5)	31 (29.0)	100 (16.9)	227 (14.3)	1,334 (37.6)
Economics	3 (0.2)	15 (14.0)	6 (1.0)	5 (0.3)	29 (0.8)
Other social science	42 (3.3)	30 (28.0)	330 (55.7)	48 (3.0)	450 (12.7)
Other declared major	159 (12.6)	24 (22.4)	114 (19.2)	1,192 (74.2)	1,489 (42.0)
Undeclared major	80 (6.4)	7 (6.5)	43 (7.3)	114 (7.2)	244 (6.9)
Total	1,260 (100.0)	107 (100.0)	593 (100.0)	1,586 (100.0)	3,546 (100.0)

Note: Column percentages are in parentheses.

TABLE 3
Mean Characteristics of Students by Initial and Final Major Choices

Initial/final major	Student characteristics				
	Black	Hispanic	Female	Math score	Credits
Business/economics	0.129	0.323	0.129	328.968	29.032
Business/not economics	0.114	0.050	0.494	329.661	32.111
Other social science/economics	0.067	0.068	0.200	323.167	58.867
Other social science/not economics	0.057	0.069	0.442	317.424	64.129
Other declared major/economics	0.167	0.042	0.375	328.083	45.167
Other declared major/not economics	0.078	0.051	0.561	322.564	58.954
Undeclared/economics	0.000	0.000	0.143	332.143	23.429
Undeclared/not economics	0.099	0.054	0.484	324.402	43.302

other disciplines (Table 3). Apart from the consistently lower rate of selection by female students, no clear pattern explained what was different about these recruits. That may indicate that a consideration of the multivariate influences is required, as we show next.

TABLE 4
Probit Estimates of Students Completing Principles Sequence and of Taking Upper-Division Economics Courses or Majoring in Economics

Explanatory variable	Completed both principles courses (not required to take both)	Completed one or more upper-division economics courses (successfully completed principles)	Graduated with a major in economics (successfully completed principles)
Student characteristics			
Black student	0.0440 (0.87)	-0.1060** (2.30)	-0.0020 (0.32)
Hispanic student	0.0552 (0.86)	-0.0802 (1.63)	-0.0749 (0.06)
Female student	-0.1028** (3.18)	-0.0736** (2.67)	-0.0059 (1.37)
Math score	0.0015** (2.61)	0.0008* (1.86)	0.0000 (0.05)
Business major		-0.1131** (2.98)	-0.0078 (1.47)
Economics major		0.3564** (3.63)	0.0310** (3.30)
Other social science major	-0.0372 (0.72)	0.2178** (4.47)	0.0099 (1.49)
Other non-social science major	-0.1264** (2.96)	0.0269 (0.65)	-0.0057 (0.93)
Other major requiring one principles course	-0.1397** (2.58)	-0.2787** (2.30)	-0.0706 (0.03)
Other major requiring both principles courses		-0.2631** (2.45)	-0.0603 (0.04)
Credits earned prior to principles	-0.0015** (2.93)	-0.0002 (0.28)	-0.0024** (2.61)
Class/instructor characteristics			
Macroeconomics first	0.1386** (3.24)		
One small class—TA	0.0768** (1.98)	0.0611** (2.38)	0.0000 (0.01)
Two small classes—TA		0.0774* (1.69)	0.0181** (2.66)
One or two small classes—adjunct or regular faculty	-0.0050 (0.08)	0.0365 (0.96)	0.0082 (1.54)
One or two medium classes—adjunct	-0.1463** (2.40)	-0.0065 (0.18)	-0.0043 (0.65)
One medium class—regular faculty		0.0280 (1.23)	0.0047 (1.28)

(Table continues)

TABLE4 (Continued)

Explanatory variable	Completed both principles courses (not required to take both)	Completed one or more upper-division economics courses (successfully completed principles)	Graduated with a major in economics (successfully completed principles)
One or two large classes	0.0064	-0.0141	0.0027
—adjunct	(0.10)	(0.39)	(0.47)
One or two large classes	-0.1228**	0.0483*	0.0053
—regular faculty	(2.42)	(1.67)	(1.12)
One female instructor	0.0176	0.0786**	0.0040
	(0.30)	(2.29)	(0.79)
Two female instructors		0.0550	0.0124
		(0.60)	(1.03)
One female instructor × female student	-0.1046*	-0.0256	-0.0147
	(1.71)	(0.58)	(1.58)
Two female instructors × female student		0.0665	0.0125
		(0.46)	(0.79)
Average grade given by instructor(s) over 5 years	-0.0032	0.1471**	-0.0105
	(0.05)	(2.23)	(0.94)
One award-winning instructor	-0.0052	0.0048	0.0014
	(0.16)	(0.20)	(0.34)
Two award-winning instructors		0.0195	-0.0003
		(0.54)	(0.05)
Fixed effects			
Constant	-0.3659	-0.8513**	-0.0119
	(1.37)	(3.69)	(0.32)
1991–92 school year	-0.0381	-0.0290	0.0060
	(0.92)	(0.96)	(1.22)
1992–93 school year	-0.0054	-0.0176	0.0071*
	(0.12)	(0.71)	(1.80)
<i>N</i>	1,431	1,432	1,378
Mean of dependent variable	0.439	0.200	0.033
χ^2 statistic	132.819*	205.542**	75.950

Note: Reported coefficients are marginal effects. * indicates significance at the 10 percent level in a two-tailed test and ** denotes significance at the 5 percent level in a two-tailed test. Absolute values of the asymptotic *t* ratios for the probit coefficients appear in parentheses.

The results of estimating the determinants of curriculum choice for students taking principles of economics are displayed in Table 4.¹¹ The coefficients were transformed to indicate the marginal effects of each variable on the predicted probabilities. For continuous variables, this means the estimated change in the predicted probability from a unit change in the variable, holding other variables at their sample mean. For dummy variables, the marginal effect is the discrete difference between the predicted probabilities when the variable is changed from zero to one. The results reported in Table 4, column one, were based on a sample of students who took at least one principles course but were not required to take both. The results reported in columns two and three were based on a sample

of all students who successfully completed both principles courses (whether required by their major or not). Thus the probabilities in columns two and three should be understood as conditional on the student successfully completing both principles courses.

Student Characteristics

Clearly student characteristics and preferences had a significant impact on both the completion of the principles sequence and curriculum choice beyond the principles level. Women were less likely than men to complete the principles sequence. Consistent with the results of Sabot and Wakeman-Linn (1991), we also found that women were less likely to take additional economics courses beyond the principles course. Blacks and Hispanics were just as likely as non-Hispanic whites to complete both principles courses but had a lower probability of taking further courses in economics.

A student's mathematical ability was also an important factor affecting curriculum choice. The probability of completing the principles sequence was positively correlated with a student's performance on a standardized mathematics exam. A student with a score one standard deviation above the mean (351) on the College Level Academic Skills Test (CLAST) (see description in the appendix) would have had a 0.04 higher probability of completing principles than a student with an average score (327). A student with the highest observed score (430) on CLAST would have a 0.15 higher probability of completing principles than a student with an average score. Similarly, greater mathematical aptitude boosts the probability of taking upper-division courses after completing principles.¹²

As one would expect, declarations of intent to major that were expressed prior to taking economics principles had a strong influence on subsequent curriculum choices. Students who had declared an intent to major in a discipline that requires only one economics course were much less likely to complete the principles sequence than students who did not take economics to satisfy a major requirement. However, upon completing principles, students with majors in business and other fields that require both principles course were much less likely than undeclared majors to pursue further study in economics.

The timing of taking the principles course also mattered. The later in their undergraduate careers that students took the first principles course, the less likely they were to complete the principles sequence and, if they did complete principles, the less likely they were to graduate with a major in economics. This could reflect either differences in tastes or constraints. Students who are adverse to economics may postpone taking principles. Moreover, if economics is taken late in a student's course of study and he or she discovers a liking for the subject, it may be too late to switch majors.¹³

Class Characteristics

Interestingly, the order of instruction in the two principles courses correlated with the probability of completing the two-course principles sequence. Students

who took macroeconomics first were more likely to take both principles courses than students who began with microeconomics.¹⁴

The effects of class size, instructor type, and frequency of exposure were partly significant and indicated that diverse class settings can be attractive. The instructor/classroom setting appeared to have had a number of important effects on student curriculum choices. First, students who took their first principles course in a small class taught by a TA were more likely to complete the principles sequence than were students whose first exposure to principles was in a medium-size lecture taught by a regular faculty member (the omitted category). Students taking their first principles in a very large lecture class taught by a regular faculty member were less likely to take a second principles course than were students who took their first course in a medium-size class with a regular faculty member.¹⁵ Second, at least in medium-size classes, students whose first instructor was an adjunct were less likely to complete principles than were students who began in a class with a regular faculty member. Although this differential could represent superior teaching by regular (tenured and tenure-track faculty), it might simply reflect unmeasured characteristics of the handful of adjunct faculty teaching principles at FSU.¹⁶ Third, of those students completing principles, students who took one or both of their principles courses in a small class taught by a graduate student were more likely to take additional economics courses than were students who only took principles in medium-size classes taught by regular faculty.

The class-size effect was not necessarily monotonic, however. At the 10 percent confidence level, we cannot reject the null hypothesis that students who took at least one large lecture class from a regular faculty member were more likely to take some upper-division economics courses than were students who took both principles courses with a regular faculty member in a medium-size class. Finally, the principles class size appeared to have some impact on the probability that a student would major in economics. Students who took both principles courses in a small class taught by a graduate student were more likely to graduate with an economics major.¹⁷

Instructor Characteristics

Some evidence of gender effects could be seen in our data. As mentioned earlier, female students were less likely than males to complete both principles courses. For those students who took both principles courses, women were also less likely than men to take any upper-division economics courses. However, employing female principles instructors in the classroom did not reduce these disparities. Perhaps because of unmeasured characteristics of specific female instructors at FSU, students who completed the principles sequence and had at least one female principles instructor (faculty or TA) were 7 percent more likely to take some additional economics courses. These effects were invariant to the gender of students, however. Thus, we found no support for the notion that female faculty boost the interest of female students in economics, relative to male faculty, by serving as role models for female students.

The lack of a measurable role-model effect is consistent with previous cross-discipline studies. Canes and Rosen (1995), using panel data on all departments from three universities, found that the gender composition of a department's faculty had no impact on the proportion of the department's undergraduate majors who were women. Similarly, Solnick (1995) found that female students at women's colleges (which have a relatively high percentage of female faculty) who began their college careers in a male-dominated major or were initially undecided were no more likely to graduate in a male-dominated major than were female students in coeducational institutions.

The quality of principles instructors does not appear to significantly influence the curriculum choices of students.¹⁸ Individuals who took their first principles course from an award-winning faculty member or graduate instructor were no more likely to complete the principles sequence than students who took the first course from an instructor who did not garner any teaching awards.¹⁹ Similarly, we found no effect of faculty quality on subsequent decisions to take upper-division economics courses or major in economics. Using student ratings of instructors, rather than awards, as a measure of instructor quality produced similar results.²⁰ These results are consistent with the findings of Siegfried and Raymond (1984). They reported that only 31 percent of students surveyed listed "favorable impression of faculty" and 20 percent gave "teaching reputation of department" as very important reasons for their choice of an economics major.

Instructor grading policies in principles did seem to influence curriculum choice after principles.²¹ In the model explaining the likelihood of taking additional economics courses, the impact of grading policies was highly significant. An increase of a half grade point (e.g., 2.0 to 2.5) in the average grade awarded was associated with a 7 percent higher probability of taking at least one upper-division economics course (contingent on having completed principles). This grading effect did not extend to choosing the major, however. It is unclear whether high grades played a direct role in reinforcing a student's desire to take more economics courses, or if, instead, there could be some correlation between teaching quality and average grade.

CONCLUSIONS

For economics departments seeking to boost upper-division enrollments and to increase the number of students majoring in economics, the principles courses would seem the likely place to effect change. Unfortunately, our results suggest that effective policy tools are rather limited, and we caution against the belief that there are quick fixes to declining majors.

We found that exogenous characteristics and preferences of students are important determinants of student curriculum choice. For example, the likelihood of completing principles and of taking additional economics courses is correlated with mathematical ability. However, the association between student characteristics and subsequent major choice may simply reflect predetermined preferences and choices. Most students have already decided upon a major when they enter the economics principles course, and about three-fourths of the stu-

dents stick with their initial choice. Noneconomics majors, to a significant extent, take economics classes only when explicitly required. Student intransigence is magnified the later in their undergraduate career they take economics principles.²²

Effective tools within the control of departments are class size, staffing of courses, and grading policies. No single type of class setting is uniquely superior. We found that, relative to medium-size classes taught by regular faculty, smaller classes taught by TAs increase the likelihood that a student will complete the principles sequence and boost the probability of subsequently taking upper-division economics courses. Similarly, students who take principles in a large section taught by faculty instructors are less likely to complete the principles sequence. Grading policies in principles appear to impact upper-division enrollments. Students that take principles from instructors with higher class grade averages are more likely to take at least one economics course past principles.

Instructor quality does not appear to significantly affect student curriculum choices.²³ Award-winning principles instructors do not increase the likelihood that students will take additional economics courses or major in economics. We do not dispute the casual observation that “star” principles instructors at some universities boost principles enrollments and enhance the number of economics majors. However, our findings do imply that marginal changes in the quality of principles instructors are unlikely to have quantitatively significant impacts on enrollments and majors.

Female students have a much lower probability than male students of majoring in economics or taking any economics courses past principles. This outcome does not appear to result from a role-model effect, however. The male-female differential in post-principles economics enrollment is the same whether students are taught principles by male or female instructors. Thus, hiring female faculty in the hopes of boosting female enrollments is not likely to be a profitable strategy.

Translating these results into policy recommendations is not straightforward; it would require knowledge of a department’s relevant costs and benefits. Although colleges and universities are increasingly tying departmental resources to the number of enrollments and majors, gaining faculty at the expense of greater numbers of possibly lower quality students is not necessarily desirable. Furthermore, reducing class sizes or lowering grading standards in principles to attract more upper-division students may entail significant costs that outweigh the potential benefits associated with increased enrollments.

Although we have focused on the curriculum choices of students in a single university, we have no reason to expect that the results would differ significantly at other large public universities. The structure and student composition of small liberal arts colleges and elite research institutions could yield different results. It would be constructive to study the effect of varying teaching methods and other aspects of pedagogy that were not observed in our data. It could be that the instructors in this study were constrained by the common finals and other policies preventing them from experimenting with pedagogy. This study provides the first in-depth analysis of the impact of the principles experience on subsequent curriculum choices, but opportunities clearly remain for further analysis.

APPENDIX
Description of Variables Used in Analysis

Variable	Mean at time of first principles (<i>n</i> = 2,528)	Description
<i>Student characteristics</i>		
<i>Black student</i>	0.091	Dummy variable indicating student is black
<i>Business major</i>	0.402	Dummy variable indicating student had declared a major (or intent to major) in business prior to taking first principles course.
<i>Credits earned prior to principles</i>	44.096	Number of credits student earned prior to taking first principles course.
<i>Economics major</i>	0.008	Dummy variable indicating student had declared an intent to major in economics prior to taking first principles course.
<i>Female student</i>	0.517	Dummy variable indicating student is a woman.
<i>Hispanic student</i>	0.050	Dummy variable indicating student is Hispanic.
<i>Math score</i>	326.520	Student's score on the mathematics component of the College Level Academic Skills Test (CLAST). The CLAST measures diverse skill areas, including mathematics, and is required of all students in the higher-education system of Florida.
<i>Other major requiring both principles courses</i>	0.025	Dummy variable indicating student had declared a major (or intent to major) in a degree program, other than business and economics, that requires both principles courses (e.g., fashion merchandising and textiles) prior to taking their first economics course.
<i>Other major requiring one principles course</i>	0.048	Dummy variable indicating student had declared a major (or intent to major) in a degree program, other than business and economics, that requires one principles courses (e.g., apparel design and technology; chemical engineering; clothing, textiles and merchandising, social work) prior to taking their first economics course.
<i>Other non-social sciences major</i>	0.411	Dummy variable indicating student had declared a major (or intent to major) in a degree program other than business, economics, or the social sciences prior to taking their first economics course.

(Appendix continues)

APPENDIX (Continued)

Variable	Mean at time of first principles ($n = 2,528$)	Description
<i>Other social science major</i>	0.103	Dummy variable indicating student had declared a major (or intent to major) in a social science degree program, other than economics, prior to taking their first economics course.
Class/instructor characteristics		
<i>Average grade given over 5 years</i>	2.461	For each principles instructor, the average grade given to all principles students over the period fall 1991–spring 1996. For students completing both principles courses, the variable is averaged over both instructors.
<i>Female instructor</i>	0.289	Dummy variable indicating principles course was taught by a female instructor (graduate student or faculty member).
<i>Female instructor × female student</i>	0.153	Dummy variable indicating female student who took a principles course taught by a female instructor.
<i>Large class—adjunct faculty</i>	0.091	Dummy variable indicating student completed large-lecture principles course (180 or more students) taught by an adjunct faculty member.
<i>Large class—regular faculty</i>	0.203	Dummy variable indicating student completed large-lecture principles course (180 or more students) taught by a regular (tenured or tenure-track) faculty member.
<i>Macroeconomics first</i>	0.764	Dummy variable indicating student's first principles course was macroeconomics.
<i>Medium class—adjunct faculty</i>	0.071	Dummy variable indicating student completed at least one medium-size-lecture principles course (60–179 students) taught by an adjunct faculty member.
<i>Medium class—regular faculty</i>	0.368	Dummy variable indicating student completed a medium-size-lecture principles course (60–179 students) taught by a regular (tenured or tenure track) faculty member.

(Appendix continues)

APPENDIX (Continued)

Variable	Mean at time of first principles ($n = 2,528$)	Description
<i>Small class—adjunct or regular faculty</i>	0.051	Dummy variable indicating student completed a small-lecture principles course (less than 60 students) taught by a regular (tenured or tenure track) faculty member or adjunct faculty member.
<i>Small class—TA</i>	0.216	Dummy variable indicating student completed a small-lecture principles course (less than 60 students) taught by a graduate teaching assistant (TA).
<i>Teaching award</i>	0.385	Dummy variable indicating principles course was taught by a regular faculty member who received a university teaching incentive program (TIP) award for teaching excellence or a graduate student who received the annual award for the best graduate-student instructor.
Fixed effects		
<i>1991–92 school year</i>	0.430	Dummy variable indicating student took principles during the 1991–92 academic year. For first course, it indicates timing of initial principles course; for combination of both courses, it indicates timing of second principles course.
<i>1992–93 school year</i>	0.395	Dummy variable indicating student took principles during the 1992–93 academic year. For first course it indicates timing of initial principles course; for combination of both courses, it indicates timing of second principles course.
Outcomes		
<i>Completed both principles courses</i>	0.589	Dummy variable indicating student completed both principles courses.
<i>Completed one or more upper-division economics courses</i>	0.135	Dummy variable indicating at least one upper division economics course was completed after finishing the principles of economics sequence.
<i>Graduated with a major in economics</i>	0.023	Dummy variable indicating student graduated with a bachelor's degree in economics.

NOTES

1. The U.S. Department of Labor (1996) has also reported that employment of economists, marketing research analysts, and securities and financial sales representatives is expected to grow faster than the average for all occupations in the next decade. Recent reports have indicated a new interest in economics as a major among students at some colleges (e.g., Mabry 1998).
2. Explanations for the decline in economics majors have focused on two possibilities: a reduction in popularity of the undergraduate business major and a decline in the post-graduation returns to the economics major. Cross-sectional evidence suggests that economics is viewed by students as a substitute for the business major (Siegfried and Wilkinson 1982; Willis and Pieper 1996). Salemi and Eubanks (1996) and Brasfield et al. (1996) presented evidence that intertemporal changes in the number of economics majors are correlated with enrollment in undergraduate business programs. In contrast, Willis and Pieper (1996) found that the fall in the number of majors can be explained by a reduction in the return to a bachelor's degree in economics.
3. Sabot and Wakeman-Linn (1991) analyzed the impact of grades in the principles course and of student characteristics on the probability of taking a second economics course but did not control for instructor or classroom characteristics.
4. Observations were discarded most often because of truncation of the sample before and after the observation window in our data collection, rather than from missing values of specific variables. In addition to the results reported here, we also fit the empirical model on a separate sample that was limited to students who had graduated by the end of spring 1996. Observing that the student has graduated confirmed for certain whether the student took more economics. With the graduation requirement, the sample size was smaller, but the results were very similar to those reported in the Results section.
5. Although students may change majors, switching creates some bureaucratic costs. In addition, courses taken previously may not be applicable to a new major.
6. Major selection at FSU is restricted by minimum grade point average (GPA) requirements in a number of programs. During the 1980s, the economics major at FSU (which is located in the College of Social Sciences) was clearly a repository for discouraged business majors who could not meet academic standards imposed by the Business School. However, the economics department imposed its own minimum GPA requirement in 1988. Thus throughout the period of our study, 1991–1993, only a slight differential existed between the grade requirements for business and for economics majors (2.6 and 2.4, respectively). Actual GPAs for (intended) business majors and (intended) economics majors enrolled in principles during the period of our study were nearly equal, 2.84 versus 2.80, respectively.
7. Although the race/ethnicity of instructors is also observable, only two principles instructors at FSU during the sample period were black (both graduate students), and none were Hispanic.
8. The caveat is that time dummy variables may reflect any unknown time-varying influences.
9. No majors at FSU, other than economics, require upper-division courses in the economics department.
10. The choices of taking post-principles economics courses or majoring in economics are conditional on successfully completing the principles sequence. Because students who complete principles are not a random sample of those who initially take economics, we were estimating the conditional effects of the variables in the function. If unmeasured factors such as innate ability or interest in economics influence both the likelihood that a student will complete principles and the probability that the student will take more economics upon completing principles, then the errors from the two equations (completing principles and taking more economics) will be correlated and bivariate probit estimates of taking more economics would be appropriate to obtain the unconditional estimates. As a check, we analyzed these equations with sample-selection bivariate probit models and failed to reject the null hypothesis that the errors in the two equations were uncorrelated, indicating that the conditional and unconditional estimates were not significantly different. For more on the sample selection problem and the bivariate probit model, see Greene (1997, 912, 974–78).
11. In addition to the estimates reported in Table 4, we also estimated models including the age of students, the number of unrestricted electives in their chosen major, and a set of dummy variables representing the time of day and week the principles classes are offered. We did not have strong prior beliefs about the effect of these variables, and an F test of their joint significance failed to reject the null hypothesis that all of their coefficients were zero with p values of .34, .74, and .97, respectively, in the completing principles, taking more economics, and majoring in economics equations. Their inclusion did not significantly alter the estimated coefficients of the remaining variables reported in Table 4.

12. We also tried using two alternative measures of student ability—overall GPA prior to taking principles and SAT scores. With the smaller samples because of missing grade or testing information, neither starting GPA or total SAT scores had a significant impact on any of the curriculum choices.
13. Holding constant the number of units earned prior to principles, we found no significant effect of differences in the number of unrestricted electives across majors on the likelihood of a student taking upper-division economics or majoring in economics.
14. We did not expect the order of instruction to affect subsequent curriculum choice once both principles courses were completed. However, we tested this proposition and found the order of instruction did not have a statistically significant impact on taking upper-division economics or majoring in economics.
15. The effect of class size could be biased if students selected sections in advance and were sorting themselves in some way that correlated with their *unmeasured* attributes. For instance, if absences go unnoticed in large classes, then a larger proportion of students enrolling in large sections may be predisposed to poor attendance.
16. Our measure of teaching quality, receipt of a teaching award, did not apply to adjunct faculty because they are not eligible for such awards. Consequently, the coefficient on adjunct faculty represented the difference between the average adjunct and a non-award-winning regular faculty member.
17. Our finding that principles class size may affect the probability that a student will major in economics runs counter to some previous studies using aggregate data. For example, Siegfried and Wilkinson (1982) found that the effect of class size on the proportion of majors was insignificant for schools with business programs. Brasfield et al. (1996) found no difference in the average size of economics principles classes for departments that experienced increasing numbers of majors between 1989/1990 and 1993/1994 compared with those with decreasing numbers of majors during the same period.
18. There may be other avenues for instructor quality, however. A referee pointed out that “if good teachers attract larger classes, then they would attract larger numbers of students in subsequent economics courses, even if the probability of a given student continuing is no different from other instructors.” To examine this, we fit a censored Tobit model with variable truncation, where the dependent variable was the class enrollment, and it was truncated by the classroom size. This is a particular variation of the standard Tobit that can be estimated in the *Limdep* package. Controlling for time of day and other variables, we found that in a sample of 199 classes, instructor quality, as measured by the Teaching Award variable, did not significantly affect the course enrollment.
19. The faculty teaching award at FSU was called the teaching incentive program (TIP) award. The TIP entailed extensive documentation of teaching performance in all courses, including student ratings, examination tools, and other factors. Winners were determined by multiple faculty committees, and winners received large monetary rewards. The graduate student award is given annually to the best graduate student instructor in the economics department. The winner is determined by a vote of the department’s graduate curriculum committee. Receipt of these awards may be a more objective measure of instructor quality than student ratings alone. Of the 14 regular faculty who taught one or more principles sections during the sample period, 7 received teaching awards. A total of 28 graduate students taught principles during the sample period; 5 were recipients of the annual departmental teaching award. If a faculty member or graduate student was an award winner at any time, all of the classes they taught (before, during, or after receipt of the award) were classified as taught by an “award-winning instructor.” Distinguishing between graduate-student and faculty teaching awards made no appreciable difference in our results; both variables were individually insignificant in all three models.
20. In addition to the estimates reported in Table 4, we also estimated the determinants of curriculum choice with student ratings, rather than teaching awards, as a measure of instructor quality. The measure of student ratings, the percentage of students who agreed with the statement that their instructor was “an effective teacher,” carried a insignificant coefficient in each of the curriculum-choice regressions. Use of student ratings, rather than teaching awards, reduced the sample sizes from 30 to 50 percent.
21. Brasfield et al. (1996) reported the average grade awarded in economics principles classes was actually lower for those economics departments that experienced increasing numbers of majors between 1990 and 1994 compared to those with decreasing numbers of majors during the same period.
22. One possible solution, which we could not explore here, is to offer lower-level courses that have principles as a prerequisite.
23. This is true, of course, unless there is a correlation between quality and the average grade award-

ed by the instructor. That is, students may learn more from better teachers and receive higher grades as a result.

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