"Chicks Don't Dig It: Gender, Attitude and Performance in Principles of Economics Classes"

Christopher R. Bollinger[1] crboll@uky.edu Associate Professor of Economics Department of Economics University of Kentucky Lexington, KY 40506-0034 Phone: (859) 257-9524 Fax: (859) 323-1920	Gail Mitchell Hoyt ghoyt@uky.edu Professor of Economics Department of Economics University of Kentucky Lexington, KY 40506-0034 Phone: (859) 257-2517 Fax: (859) 323-1920	KimMarie McGoldrick kmcgoldr@richmond.edu Associate Professor of Economics Department of Economics Robins School of Business University of Richmond Richmond, VA 23173 Phone: (804) 289-8575 Fax: (804) 289-8878

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[1] Authors Bollinger and Hoyt are in the Department of Economics, University of Kentucky, Lexington, KY 40506; Author McGoldrick is in the Department of Economics, University of Richmond, Richmond, VA, 23173. Authors are listed alphabetically.

Abstract

Women are less likely to major in economics than men. While this simple fact is well documented, the cause of this difference is still up for debate. Most previous research has focused on identifying causes through skill differences and pedagogical practices. Heretofore neglected is the role of students' attitudes towards economics. This work establishes that women and men have no performance differences in principles of economics courses, but that attitudes differ significantly. Furthermore, the finding that women have a significantly more negative attitude towards economics prior to taking the principles course is compounded by the results that indicate a polarization of attitudes after taking the course. In other words, women have more negative attitudes and men have more positive attitudes towards economics after taking the course. Women can do economics, but are less inclined to like it.

I. Introduction

There have been many attempts at understanding why women are less likely than men to major in economics. Although trends suggest that women are better represented among students graduating with a major in economics than in the past, they still constitute a minority with estimates for the 2003 -2004 academic year ranging from 30.3 percent in public institutions to 34.1 percent in private schools. (Siegfried, 2006: 378) Investigations into the impact of pedagogical practices (Jensen and Owen, 2001), learning styles (Borg and Stranahan, 2000a, 2000b; Ziegert 2000), faculty as role models (Robb and Robb, 1999; Rask and Bailey, 2002; Ashworth and Evans, 2001), math skills and interest in subject (Dynan and Rouse, 1997), and attitude (Jensen and Owen, 2001) all provide contributions to understanding why women are less likely to continue in economics. This paper contributes to this literature as it provides a more comprehensive study of attitude differences by gender through the inclusion of a larger number of attitude statements. Second, we link performance and attitude to show gender differences before and after taking a principles course.

In this paper we describe two surveys administered to approximately 2,200 students across 28 instructors at the beginning and end of the spring semester of 2003. We describe the measurement and construction of the economic knowledge and attitude variables used in the study. Preliminary results describing differences in attitude and knowledge suggest that men have more knowledge of and a better attitude towards economics than women prior to taking the course but that there is no difference in the gain in knowledge over the semester. We also present results which indicate that there is little or no difference in knowledge, pre- or post-test, between men and women who have not had a previous economics course. Attitudes between

men and women (in both samples), however, are strikingly different with women viewing economics less favorably and even more so after taking a course.

Next, we present the models to be estimated and discuss potential specification and selection issues. The results in this section confirm initial findings. While women appear likely to appreciate the value of economics, they are not as likely to indicate liking economics. Our final section summarizes these conclusions and suggests that differences in attitudes may be the core problem in attracting more women to the major.

II. Data and Methodology

A. Data

During the fall semester, 2002, the authors designed, tested and revised a survey focused on measuring both knowledge of and attitudes towards economics. The final version of the survey solicited information on student demographics and academic background including gender, age, race, GPA, economics course background (in both high school and college), and time use in activities such as studying. In order to gauge knowledge of economics, the survey included a series of fourteen content oriented questions (specific to either the microeconomics or macroeconomics course in which the students were currently enrolled) based on a subset of the questions developed for the TUCE. Student attitudes towards the discipline are queried using fourteen statements consistent with Hodgin and Manahan (1978) and the Attitude Towards Economics section of the Survey on Economic Attitudes (Soper and Walstad 1983). A companion survey that elicited demographic information was administered to the instructors whose students participated in the survey.

The survey was administered at the beginning and at the end of each course (typically at the first and last class meeting) by twenty-eight different instructors (faculty members as well as graduate teaching assistants) at twelve institutions. We refer to the survey administered at the beginning of the course as the "pre-test" and the survey administered at the end of the course as the "post-test." Students were asked to supply an identifying code (typically the last four digits of their social security number) and the pre and post surveys were then matched. The final sample contains 2,159 students 807 of whom completed both surveys.

Table 1 provides a summary of sample characteristics. The sample is nearly equally comprised of males and females. Approximately fifty percent of the students in the sample are sophomores, as would be expected given that the survey was administered in principles of economics courses. Because the number of nontraditional students at the surveyed schools skews the mean age of the sample, a variable measuring whether the student was above or below the typical age in the class was constructed and this further indicates a homogeneous sample in that only about 13 percent are either above or below the typically aged student. The sample is primarily Caucasian, spends nearly 10 hours a week studying, works nearly the same amount of hours, and participated in very little volunteer activity. The self-reported GPA was just under a 3.0. Many students had a background in economics either at the high school level (32 percent) or as a previous college course although as a result of the typical sequencing of courses this was more likely to be a microeconomics course (45 percent) than a macroeconomics course (8 percent). The typical class size was 190 and 60% were enrolled in a small economics class (defined as <100 students). Interest in the subject of economics is proxied by the response of "I have no opinion on this statement" to the request that students report their level of agreement with the statement "The redistribution of income through taxes and welfare payments is a

legitimate role for government." Although a lack of opinion does not explicitly indicate a lack of interest in economics (and may also imply a lack of confidence in stating an opinion), those who state an opinion are expected to be more engaged in the subject in order to form such an opinion.

The main variables of interest in this study are the measures of economic knowledge and attitude obtained in both the pre and post-surveys which are described in Table 2. As one would hope, average knowledge rose as indicated by 9.27 (out of fourteen) questions answered correctly after taking an economics course compared to 7.67 questions prior. Since the sample consists of the same 807 students, this represents a gain for these students and is highly statistically significant.[2] The aggregate attitude variable consists of the sum of fourteen statements. If the student agrees with a positive statement about economics, the aggregate score is increased by one point. If the student agrees with a negative statement about economics the score is decreased by one. There are eight positive statements and six negative ones; hence the scores can range from -6 to +8. Unlike the literacy results, attitudes remain largely unchanged after taking an economics course with averages of 2.27 and 2.26 and the difference is not statistically significant.

Table 2 also presents economic knowledge and attitude scores by gender. Perhaps the most striking aspect of the table is the fact that both attitude and knowledge scores are higher for men than for women. On average, men score 0.404 points higher on the knowledge post-test than their female counterparts. While statistically significant, this represents only 4% of the mean and only 18% of the standard deviation of the full sample knowledge post-test. Indeed, the correlation between gender and the knowledge post-test is only 0.09. Perhaps more important is the comparison of the gain in knowledge from the pre-test to the post-test. Men gained an

[2] The gain is statistically significant at all conventional levels. The standard error of the difference is 0.086 and the test that the difference is zero yields a test statistic of 18.54.

average of 1.54 points, while women gained an average of 1.67. While both genders have statistically significant gains in knowledge over the course, the gender difference in these gains is not statistically significant. Note that women score 0.54 points lower than men on the knowledge pre-test, suggesting that women enter these courses at a disadvantage. There is no evidence that women are poorer economics students than men. However there is some evidence that the typical woman starts an economics course with a weaker background than her male counterpart.

The comparison of results on attitude by gender also suggests that women score less than their male counterparts. Women score an average 1.34 points lower on the attitude pre-test. This statistically significant difference is also substantial in that it represents 59% of the mean and 52% of the standard deviation of the full sample attitude pre-test. Similarly, women score an average 1.75 points lower than men on the attitude post-test. Indeed, while men's attitude about economics appears to improve as a result of the course, women's attitude actually declines. The change in the differences is, in fact, statistically significant.

The attitude measure is the summation of fourteen different attitude statements. As noted earlier, six of the statements can be view as negative (for example "I hate Economics") and eight of the statements can be viewed as positive (for example "I enjoy reading articles about economic topics"). In order to better understand the underlying causes for the above described attitude differences, we disaggregate the attitude measure and report the proportion of students agreeing with the statement on the pre and post-test (see Table 3). We first present a summary of general differences before turning to gender specific differences.

In all but two questions, the proportion of students agreeing with the statement rose after taking an economics course. The two statements which had falling proportions were "On

occasion I read an unassigned book in economics" and "I would be willing to attend a lecture by an economist." All other statements saw an increase from the pre to the post-test. This implies an interesting polarization. In the pre-test, only 4.1% of students agreed with the statement "I hate economics." In the post-test that proportion had risen to 9.5%. However, in the pre-test 40% of students agreed with the statement "I enjoy economics" and that proportion also rose to 46% by the post-test. Prior to an economics class, approximately 55.9% of students neither enjoy nor hate economics. After the economics class only 44.5% did not feel strongly one way or another. In general, having an economics class seems to polarize students across all but two of these indicators. The two statements that were not significant include "Studying economics is a waste of time" and "Economic ideas are dumb" each category having less than one percent agreement in the pre-test. These last two statements compared to other statements are fairly extreme and it is not surprising students would not agree as that would be an apparently bad reflection on the student.

Table 3 also indicates significant differences by gender in twelve of the fourteen attitudinal statements. What is interesting, however, is the direction of those differences. In every significant case, women have a more negative attitude than their male counterparts across both pre and post-test results. For example, women are less likely to agree with statements such as "I enjoy reading articles about economics," that "economics is easy for me to understand," or that "economics is one of my favorite subjects." Alternatively, women are more likely to agree with statements such as "I hate economics," "economics is one of my most dreaded subjects," and "economics is a difficult subject for me." Taking a course in economics also appears to

exacerbate these differences across all statements. Thus, disaggregated results suggest that the overall gender differences in attitude are not driven by any particular statement.[3]

It appears that women's positive attitudes about economics decline after having taken a course, while the positive attitudes of men increase. In order to examine and isolate these differences in attitudes we also consider students who have never had any formal exposure to economics and thus should not have any predispositions to be biased in their attitudes towards economics as a result of the course material. The initial survey asks students if they have had a previous college level or high school level course in economics. Table 4 presents the two attitude and two knowledge test scores by gender for students who have never had a formal economics course before this one. It is interesting to note that in Table 2, there are more males than females, while in Table 4 there are more females than males. Indeed, of the 417 males in our survey, only 26% of them are enrolled in their first economics course. In contrast 36% of the 390 women are enrolled in their first economics course. Men are more likely to be enrolled in a second economics course than their female counterparts. The knowledge and attitude patterns demonstrated in Table 2 appear to persist, but with much weaker pre-test differentials. Indeed, the difference between men and women in pre-test knowledge in Table 4 is only 0.22, and is not statistically significant. Similarly, the post-test difference between gender is only 0.27 and is also not statistically significant. The difference in gains is only 0.05. There is little or no difference in knowledge, pre- or post-test, between men and women who have not had a previous economics course.

[3] It is important to note that these differences do not account for student characteristics that may contribute to such differences but more sophisticated tests (reported below) confirm these results.

The attitude scores, however, tell a much different story. Women who have never taken a formal economics course have a statistically significant 0.81 point lower attitude score than their male counterparts. After completing their first course, the difference in attitude scores more than doubles, to a 2 point difference which is highly significant. As with Table 2, women's positive attitudes fall (although not statistically significantly), while men's positive attitudes rise after the course. Like those for the total sample, these results are not driven by any single attitudinal statement.[4] Clearly, even though women appear to gain in understanding, they do not like the subject. Exposure simply exacerbates this important difference between men and women.

One interesting regularity appears to be that students in general think highly of the discipline. Attitudes at the end of the economics course indicate that only 2.9% of students agreed with the statement that "economics is a waste of time." Similarly, 79.2% of students agreed with the statement "economics is practical" (row 13). The two cases where the gender difference was insignificant represent questions about the value of economics in general. Women are not more likely to find studying economics as a waste of time than men (and contrary to folk wisdom, only 21% of students think economics is dull). Only 1.1% of all students think "economic ideas are dumb," and the difference between men and women is so small as to be zero.

B. Estimation Models

Previous research suggests that there are two ways to assess economic learning and, by extension, attitudinal changes. (Becker, Greene, and Rosen, 1990, p. 232) The first is a 'change-

[4] Results from Table 3 were replicated for the sample of first economics course subsample and are available upon request.

score model' in which the dependent variable is specified as the difference between the post-test and pre-test values. Alternatively, in the 'attainment model' post-test values are regressed on pre-test measures. In either case, the attempt to measure changes over the course of a semester is not without problems including sample selection bias (resulting from the lack of some students taking the post-test), missing observations (as a result of incomplete surveys), and self-selection into a course. (Becker, Greene, and Rosen, p. 239)[5] Additional issues arise in the interpretation of results associated with many specifications previously estimated. Missing previous period values for key variables typically require change score models to make restrictive assumptions that are not intuitively appealing in order to circumvent the associated modeling problems. Furthermore, problems associated with unobserved heterogeneity still exist.[6]

Because we are interested in the impact of demographic variables (in our case, gender) on knowledge attainment and attitudes, we consider the following structural break model:

$$(1) K_{it} = x_i'(\beta+\theta) + (\rho+\tau)K_{it-1} + (\gamma+\kappa)A_{it} + (\delta+\eta)A_{it-1} + u_{it}$$
$$(2) A_{it} = z_i'(\alpha+\omega) + (\varphi+\psi)A_{it-1} + (\lambda+\xi)K_{it} + (\pi+\zeta)K_{it-1} + v_{it}$$

$$(3) K_{it-1} = x_i'\beta + \rho K_{it-2} + \gamma A_{it-1} + \delta A_{it-2} + u_{it-1}$$
$$(4) A_{it-1} = z_i'\alpha + \varphi A_{it-2} + \lambda L_{it-1} + \pi K_{it-2} + v_{it-1}.$$

The variables A_{it} and K_{it} are the post–test attitude and knowledge scores, while A_{it-1} and K_{it-1} are the pre-test attitude and knowledge scores. The vectors x_i and z_i contain demographic characteristics and may contain common elements but have sufficient exclusion restrictions to allow identification. Only the composite parameters of the model (those in the K_{it} and A_{it} model) are identified. It is, in general, impossible to identify all of the parameters of the model

[5] A test for sample selection for the final model specified below was conducted. Results suggest no evidence of sample selection bias. Appendix section 2B and Table 3 provides additional details of this test and the associated results.

[6] A more detailed explanation of the underlying models and required restrictive assumptions is provided in Appendix 1.

without at least one additional time period of observation (t-2). The intuition for why only the composite variables are identified is rather straightforward. Consider the term (β+θ) and suppose that x_i only contains gender. The coefficient β measures how gender affects knowledge growth prior to the time period in which the class is taken (it is not difficult to show that the growth rate is determined by β/(1-ρ) in equation (3) above). The term θ measures the difference in growth rates (or knowledge accumulation) that is specific to the course. Without multiple periods prior to the course, it is impossible to tell how growth occurred prior to the course. Hence it is impossible to tell how the course specifically effects growth. Thus all that can be identified is the composite β+θ term.

Vectors x_i and z_i contain variables chosen, to the extent possible, for consistency with previous research. Manahan (1983) proposed an "educational production function for principles of economics" and serves as a departure point for our variable inclusion strategy. That model suggests that post-course knowledge (TUCE) is a function of demographic characteristics of the student, measures of the student's academic ability, the student's effort, a pre-course measure of knowledge, and a post-course measure of the student's attitude. Attitude was modeled as a function of demographic characteristics, the student's effort, expected grade, a pre-course measure of literacy, and the post-test literacy score. Similar models have been estimated subsequently, most recently by Grimes et al (1989) for a sample of college students and Walstad and Soper (1989) using a sample of high school students.

Estimation equations based on the structural change model described above and including variables consistent with previous literature are based on the following general specification:

(5) knowledge attainment: $K_{it} = \beta_0 + \beta_1 K_{it-1} + \beta_2 A_{it-1} + \beta_4 Acad_{it-1} + \beta_5 Dem_{it-1} + \beta_7 Time_{it-1} + \beta_8 Inst + \varepsilon_{it}$

(6) attitude attainment: $A_{it} = \beta_0 + \beta_1 K_{it-1} + \beta_2 A_{it-1} + \beta_4 Acad_{it-1} + \beta_5 Dem_{it-1} + \beta_7 Time_{it-1} + \beta_8 Inst + \varepsilon_{it}$

The vector "Acad" represents variables measuring academic characteristics of the student including cumulative GPA, three indicators for previous micro, macro or high school economics courses, an indicator for whether the current course is microeconomics or macroeconomics, and a proxy for interest in subject. The subscript t-1 denotes that these variables were taken from the survey administered at the beginning of the course. The vector "Dem" represents demographic variables including gender, race, and father's education. It also includes a set of indicators for class standing (sophomore, junior and senior) and a pair of indicators for whether the student was younger or older than typical students of the class standing (e.g. a freshman is typically eighteen or nineteen, while a senior is typically twenty-one or twenty-two). The vector "Time" measures the number of hours per week the student spends working, studying, volunteering and participating in extracurricular activities. The vector "Inst" contains information about the instructor (gender and an indicator for Ph.D.) and institution (whether the institution receives state funding and course class size).

The instrumental variables estimation of the simultaneous system requires exclusion restrictions. Excluding pre-test knowledge from the attitude equation is consistent with the work of Grimes et al. The exclusion of father's education from the attitude equation is motivated by recent work of Altonji and Dunn (1996), while GPA is expected to affect performance but not necessarily attitude. Exclusions from the knowledge equation are also motivated by previous research. Excluding pre-test attitude is consistent with the work of Grimes et al. The variable no opinion identifies students who have no a-priori opinion on a subjective economic statement and is used to proxy general interest in (attitude towards) the topic but should have no effect on

the students overall ability. Younger students are expected to be more enthusiastic (attitude), but are not expected to have differences in ability. [7]

Overall, we find evidence that post-test attitude affects post-test knowledge. (See Table 5.) The coefficient on post-test attitude in the post-test knowledge equation is about 0.10 test units. A one standard deviation difference in attitude (2.94 units) will result in a 0.294 unit difference in knowledge scores. While not an overwhelming determinant of knowledge, it will clearly have the largest impact of all policy relevant variables included in the model (GPA and prior knowledge both have a larger impact, but in general are not under the control of the instructor).

The coefficient on post-test knowledge in the attitude equation is positive, but not statistically significant. We conclude that while it is possible that the system is simultaneous, we do not have strong evidence for knowledge affecting attitude. We continue to interpret the system as simultaneous since the coefficient is positive and of a large enough magnitude.

An important finding is the large and negative coefficient on attitude for women: on average women have a 0.87 lower attitude score on the post-test than do their male counterparts. Since attitude has an effect upon knowledge (on the order of .10), the effect of gender on knowledge, through attitude is -.087. We can use gender differences in important X variables to determine which factors contribute the most to the 0.405 unit gender difference in post-test knowledge. As noted above (Table 2), overall women score 1.75 units lower on the post-test

[7] Standard tests for overidentifying restrictions (see Wooldridge, p. 508) fail to reject the null hypothesis that these variables may excluded from the relevant equations (see Appendix 2 Table 1 for a further explanation and results of these tests). These variables are generally significant predictors of the variables they instrument (GPA, father's education and pre-knowledge are all significant at the 5% or higher level for post-knowledge; pre-attitude, no opinion and under typical age for class are all significant at the 5% or higher level for post attitude).

attitude than their male counterparts: thus approximately 43% of the post-test knowledge differential can be accounted for by post-test attitude differential. We also note that women have a 0.444 unit lower pre-test knowledge score, thus women' post-test knowledge score will be 0.11 units lower (0.444*0.25) than their male counterparts through the pre-test effect on post-test knowledge. This difference accounts for 27% of the difference in gender attainment on post-test scores. Finally, we note that men are twice as likely to be older than women, which accounts for 0.06 points difference in the overall post-test knowledge average. Overall, initial conditions and the attitude variable account for 70% of the relatively small gender differential in post-test knowledge.

Similarly, we note that the coefficient on gender in the post-test attitude equation implies that 50% of the post-test attitude gender differential is due simply to gender. We also find that 44% of gender differential in post-test attitude is due to the gender differential in pre-test attitude. Over 90% of the gender difference in post-test attitude is explained by the gender difference in pre-test attitude combined with the gender difference in the growth rate. Since much of the knowledge difference is due to either attitude or to the initial condition of knowledge (which should have been affected by gender differences in attitude in similar ways), we can conclude that the small gender differential in knowledge in primarily explained by attitudes about the course.

IV. Disaggregating the Attitude Measurement

Again, to determine whether the impact of attitude is driven by a particular statement, we test the impact of the disaggregated measure. Table 6 presents the marginal effect (differential) from gender in the estimates of probit models on the response to the individual statements. The

linear probability model responses were nearly identical (and are available upon request). The covariates included in the model are similar to those in the first column of Table 5 and include pre-test attitude (disaggregated and statement specific), pre-test knowledge, demographic, academic, time, and instructor/institutional characteristics. Consistent with aggregate results, post-test knowledge does not have a significant impact on attitude. As expected, pre-test attitude is a significant determinant of post-test attitude. The third column of Table 6 presents the difference in probability (marginal effect) of agreeing with the statement if you are a woman. For example women are 9.5% less likely to agree with the statement "I enjoy reading articles about economic topics." Models for the statements "Studying economics is a waste of time" and "Economic ideas are dumb" were unstable and had no significant explanatory variables, largely due to the lack of variation in the response.

Results from Table 6 suggest that the aggregate results presented in Table 5 do not appear to be driven by any one particular statement. Although in 5 cases (rows 4, 6, 8, 13, and 14) the coefficient on gender was statistically insignificant, without exception, the coefficients imply that women are more likely to agree with negative statements about economics (rows 2,4,7, and 10) and less likely to agree with positive statements about economics (rows 1,3,5,8,9,11,12, and 13) than their male counterparts. In many cases, the coefficient on gender is quite large in magnitude relative to the overall probability of agreeing with the statement. For example, 16.6% of all students agree with the statement "Economics is a very difficult subject for me" (row 10). The coefficient implies that women are 16.6% more likely to agree with this statement than men. 34.3% of all students agree with the statement "Economics is easy for me to understand" (row 3), and the gender coefficient implies that women are 18.9% less likely to agree with this statement than men.

The question-specific results presented here further strengthen the results in the previous section. Women do not view economics favorably. While in general they do see the value of economics, they are less likely to enjoy it and are more likely to claim that they find it difficult to understand. Perhaps most importantly, it is not simply that women arrive at their first economics class with a bad attitude. The strength of their dislike for the subject grows with exposure. It is something about how economics is taught and the subject itself that they appear to dislike.

IV. Conclusion

Gender differences in the probability of majoring in economics have received a great deal of attention in the literature. Potential explanations for these differences have included pedagogical practices, learning styles, role model effects, and quantitative skills. Little has been done to investigate how gender differences in attitudes play a role. We add to this body of literature by first establishing that there is no significant gender difference in performance in principles of economics courses. We then investigate the degree to which attitudes towards economics differ by gender and find that women have significantly more negative attitudes (in the aggregate and across disaggregated measures). Furthermore, these significant differences do not disappear with controls for performance in the course, academic and demographic characteristics, time use allocations, and instructor/institutional characteristics.

The significant gender differences in attitude found above are unlikely to simply measure dissatisfaction with their grades. They are also unlikely to be measures of some innate lack of ability. In fact, taking an economics course tends to polarize attitudes, strengthening women's negative and men's positive attitude toward the subject. This last point leads one to wonder if there is some commonality in our content selection, course structure, or teaching style that is less

amenable to women. If women start out as skeptics, do our courses confirm their worst suspicions? Given the strong indication that women's attitudes are negatively affected by a principles course in economics, future research should place added emphasis on *why* women do not like economics as much. Furthermore, research should investigate whether the differences in attitude are the causal "smoking gun" for why women are less likely to major in economics and pursue graduate work in economics.

References

Altonji, J. G. and T.A. Dunn. 1996. Effects of Family Characteristics on the Returns to Education. *Review of Economics and Statistics.* Vol. 78(4) pp. 692-704.

Ashworth, J. and J.L. Evans. 2001. Modeling Student Subject Choice at Secondary and Tertiary Level: A Cross-Section Study. *Journal of Economic* Education. Vol. 32 (4). p 311-20.

Becker, W.E., W. Greene, and S. Rosen. 1990. Research on High School Economic Education. *Journal of Economic Education*, Vol. 21 (3). P. 231-245.

Becker, W.E. and W.B. Walstad. 1990. Data Loss from Pretest to Posttest as a Sample Selection Problem. *Review of Economics and Statistics*, Vol. 72 (1). P. 184-188.

Borg, M. and H. Stranahan. 2002a. The Effect of Gender and Race on Student Performance in Principles of Economics: The Importance of Personality Type. *Applied Economics.* Vol. 34 (5). p 589-98.

Borg, M. and H. Stranahan. 2002b. Personality Type and Student Performance in Upper-Level Economics Courses: The Importance of Race and Gender. *Journal of Economic Education.* Vol. 33 (1). p 3-14.

Bound, J.,D.A. Jaeger, R.M. Baker. 1995. Problems with Instrumental Variables Estimation When the Correlation between the Instruments and the Endogenous Explanatory Variable Is Weak. *Journal of the American Statistical Society*, Vol 90 (430) pp. 443-450.

Dynan, K. and C. Rouse. 1997. The Underrepresentation of Women in Economics: A Study of Undergraduate Economics Students. *Journal of Economic Education.* Vol. 28 (4). p 350-68.

Grimes, P. W., T. L. Krehbiel, J. E. Nielsen and J. F. Niss. 1989. The Effectiveness of Economics U$A on Learning and Attitudes. *Journal of Economic Education*, Vol.20, No. 2, pp. 139-152

Heckman, J.J. 1979. Sample Selection Bias as a Specification Error, *Econometrica*, 47, 153-161.

Hodgin, R.F. and J. Manahan. 1978. Attitudes toward Economics and Student Cognitive Performance, *Economics: Innovations in Teaching the Introductory Course*, Conference Proceedings of a Symposium at VPI, Blacksburg, Virginia, April.

Jensen, E.J. and A.L. Owen. 2001. Pedagogy, Gender, and Interest in Economics. *Journal of Economic Education*. Vol. 32 (4). P 323-43.

Manahan, J. 1983. An Educational Production Function For Principles Of Economics. *Journal of Economic Education*, Vol. 14(spring): pp. 11-16.

Rask, K.N. and E. Bailey. 2002. Are Faculty Role Models? Evidence from Major Choice in an Undergraduate Institution. *Journal of Economic Education.* Vol. 33 (2). p 99-124.

Robb, R.E. and A.L. Robb. 1999. Gender and the Study of Economics: The Role of Gender of the Instructor. *Journal of Economic Education*. Vol. 30 (1). p 3-19.

Siegfried, J.J. 2006. Trends in Undergraduate Economics Degrees, 1991-2005. *Journal of Economic Education*, vol. 37(3): 376-381.

Soper, J.C. and W.B. Walstad. 1983. On Measuring Economic Attitudes. *Journal of Economic Education.* Vol. 14 (4). p 4-17.

Walstad, W.B. and J.C. Soper. 1989. What is High School Economics? Factors Contributing to Student Achievement and Attitudes. *Journal of Economic Education*, Vol. 20 (winter), pp. 23-38.

Wooldridge, J.M 2003. *Introductory Econometrics: A Modern Approach.* United States: Thompson-SouthWestern Publishing.

Ziegert, A.L. 2000. The Role of Personality Temperament and Student Learning in Principles of Economics: Further Evidence. *Journal of Economic Education.* Vol. 31 (4). p 307-22.

Table 1 Demographic characteristics		
Variable	Overall Sample Mean	Standard Deviation
Female	0.483	0.500
Under Typical Age for Class	0.055	0.227
Over Typical Age for Class	0.074	0.263
African American	0.030	0.170
Asian American	0.014	0.116
Sophomore	0.494	0.500
Junior	0.171	0.377
Senior	0.042	0.201
Father's Education	14.937	2.705
College Cumulative GPA	2.989	0.827
Previous College Micro Class	0.445	0.497
Previous College Macro Class	0.082	0.274
High School Economics Class	0.320	0.467
Microeconomics Course	0.529	0.499
No Opinion	0.245	0.432
Hours Worked in Typical Week	9.955	11.473
Hours Studying in Typical Week	9.871	7.136
Volunteer Hours in Typical Week	0.776	2.042
Extracurricular Activities Hours in Typical Week	8.483	7.326
Number of Students in Class	190.999	182.916
Small Class Size (< 100 students)	0.601	0.490
Instructor Female	0.555	0.497
Instructor has Ph.D.	0.180	0.384
School has State Funding (=1)	0.820	0.384
Sample size	807	

Table 2
Gender Differences in Knowledge and Attitude Scores

	Full Sample			Women			Men			Gender Difference	Diff Test
Variable	Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.			
Pretest Knowledge Score	7.672	2.004		7.395	1.926		7.930	2.042		-0.536	-3.834*
Post-test Knowledge Score	9.270	2.177		9.062	2.199		9.465	2.141		-0.404	-2.639*
Pretest Attitude Score	2.271	2.555		1.579	2.435		2.918	2.497		-1.339	-7.712*
Post-test Attitude Score	2.259	2.946		1.356	2.934		3.103	2.699		-1.747	-8.783*
Change in knowledge	1.599*	2.451		1.667*	2.536		1.535*	2.371		0.132	0.762
Change in attitude	-0.012	2.556		-0.223	2.526		0.185	2.571		-0.408	-2.272*
Sample size	807			390			417				

* denotes significantly different than zero at 5% level, calculated for differences (last column) and changes (last two rows).

Table 3
Gender Differences in Disaggregated Attitude Measurement

	Percentage on Pre test			Diff test	Percentage on Post test			Diff test
Student Indicates Agreement with	Total	Male	Female	Female-Male	Total	Male	Female	Female-Male
I enjoy reading articles about economic topics	34.9	43.2	26.2	-4.23*	33.7	42.2	24.6	-4.92*
I hate economics	4.1	2.2	6.2	2.43**	9.5	5.5	13.9	4.76*
Economics is easy for me to understand	29.5	38.6	19.7	-7.55*	34.3	45.3	22.6	-5.28*
Economics is dull	17	15.6	18.5	1.11	21.2	18.2	24.4	2.13**
I enjoy economics	40.6	48.7	32.1	-4.27*	46	54.7	36.7	-5.74*
Studying economics is a waste of time	0.5	0.2	0.8	1.03	2.9	2.6	3.1	0.54
Economics is one of my most dreaded subjects	10.9	6.0	16.2	5.33*	16.9	8.9	25.4	5.91*
On occasion I read an unassigned book in economics	6.6	9.6	3.3	-3.53*	5.8	8.4	3.1	-3.94*
I would be willing to attend a lecture by an economist	48.1	51.3	44.6	-2.05**	39.9	47.2	32.1	-4.04*
Economics is a very difficult subject for me	17.5	9.8	25.6	6.08*	26.6	16.3	37.7	5.04*
Economics is one of my favorite subjects	12.4	17.3	7.2	-5.54*	21.8	28.5	14.6	-6.85*
I use economic concepts to analyze situations	29.4	36.9	21.3	-5.63*	43.4	52.8	33.3	-5.18*
Economics is practical	76.3	80.6	71.8	-3.66*	79.2	83.5	74.6	-2.03*
Economic ideas are dumb	0.7	0.5	1.0	0.88	1.1	0.7	1.5	1.19
Sample Size	807	417	390		807	417	390	

Table 4
Gender Differences in Knowledge and Attitude Scores
First economics class sub sample

	Full Sample			Women			Men			Gender Difference	Diff Test
Variable	Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.			
Pretest knowledge score	7.149	1.946		7.050	1.878		7.273	2.031		-0.222	-1.616
Post-test knowledge score	8.803	2.273		8.683	2.256		8.955	2.296		-0.271	-1.691*
Pretest attitude score	1.803	2.829		1.496	2.027		2.309	2.274		-0.813	-5.367*
Post-test attitude score	1.952	2.829		1.065	2.738		3.073	2.540		-2.008	-10.780*
Change in knowledge	1.655*	2.595		1.633*	2.577		1.682*	2.630		-0.049	-0.266
Change in attitude	0.096	2.703		-0.432	2.721		0.764	2.538		-1.195	-6.442*
Sample size	249			139			110				

* denotes significantly different than zero at 5% level, calculated for differences (last column) and changes (last two rows).

Table 5 Simultaneous Equation Estimation of Attitude and Knowledge		
	(1)	(2)
	IV-attitude	IV-knowledge
Posttest Knowledge Score	0.178	
	(0.133)	
Posttest Attitude Score		0.101
		(0.046)*
Pretest Knowledge Score		0.252
		(0.038)**
Pretest Attitude Score	0.579	
	(0.037)**	
Female	-0.872	-0.025
	(0.174)**	(0.161)
Under Typical Age for Class	1.058	
	(0.367)**	
Over Typical Age for Class	0.092	0.982
	(0.364)	(0.278)**
African American	-0.005	0.007
	(0.484)	(0.405)
Asian American	0.842	-0.806
	(0.729)	(0.603)
Junior	-0.235	-0.316
	(0.235)	(0.194)
Senior	0.545	0.139
	(0.423)	(0.350)
Father's Education		0.058
		(0.026)*
College Cumulative GPA		0.376
		(0.084)**
Previous College Micro Class	0.170	0.273
	(0.306)	(0.253)
Previous College Macro Class	0.547	-0.304
	(0.316)	(0.266)
High School Economics Class	-0.265	-0.111
	(0.179)	(0.148)
Microeconomics Course	0.494	-0.710
	(0.328)	(0.255)**
No opinion	-0.443	
	(0.199)*	
Hours Worked in Typical Week	0.009	0.000004
	(0.008)	(0.007)
Hours Studying in Typical Week	0.026	0.016

	(0.012)*	(0.010)
Hours Volunteering in Typical Week	-0.029	-0.045
	(0.041)	(0.034)
Hours in Extracurricular Activities per Week	0.004	-0.019
	(0.012)	(0.010)*
Instructor Female	0.228	0.016
	(0.337)	(0.282)
Instructor has Ph.D.	-0.693	-0.194
	(0.267)**	(0.222)
School has State Funding (=1)	0.724	-0.424
	(0.367)*	(0.300)
Small Class	0.389	-0.330
	(0.398)	(0.331)
Constant	-1.721	6.040
	(1.544)	(0.821)**
Observations	807	807
Standard errors in parentheses		
* significant at 5%; ** significant at 1%		

Table 6
Predicted Probability Change Associated with Female Gender (Probit Models)

Dependent Variable: Student Indicates Agreement with	Pretest Knowledge Score Coefficient	Pretest Statement Coefficient	Gender Coefficient
I enjoy reading articles about economic topics	0.013	0.429**	-0.095**
I hate economics	0.002	0.221**	0.070**
Economics is easy for me to understand	0.035**	0.355**	-0.189**
Economics is dull	0.007	0.400**	0.053
I enjoy economics	-0.001	0.372**	-0.131**
Studying economics is a waste of time	0.000	0.461**	0.000
Economics is one of my most dreaded subjects	-0.013	0.325**	0.122**
On occasion I read an unassigned book in economics	0.001	0.262**	-0.021
I would be willing to attend a lecture by an economist	-0.002	0.406**	-0.127**
Economics is a very difficult subject for me	-0.012	0.382**	0.166**
Economics is one of my favorite subjects	0.004	0.514**	-0.102**
I use economic concepts to analyze situations	0.017	0.403**	-0.145**
Economics is practical	0.017*	0.242**	-0.054
Economic ideas are dumb	0.000	0.033*	0.000

* = significant at 5% level, ** = significant at 1% level
Sample Size 807. Controls include all Demographic, Academic, Time and Instructor Variables.

Appendix 1: Model and Specification

Simultaneous dynamic systems, such as typically estimated in this literature are complicated and difficult to consistently estimate. We begin, as a departure point with a relatively general model similar to that proposed by Grimes et al., 1989:

$$L_{it} = x_i'\beta + \rho L_{it-1} + \gamma A_{it} + \delta A_{it-1} + u_{it}$$
$$A_{it} = z_i'\alpha + \varphi A_{it-1} + \lambda L_{it} + \pi L_{it-1} + v_{it}$$

The variables Ait and Lit are the post test attitude and literacy scores, while Ait-1 and Lit-1 are the pre test attitude and literacy scores. The vectors xi and zi contain demographic characteristics and may contain common elements but have sufficient exclusion restrictions to allow identification. A variety of authors have included additional restrictions by assuming δ and π are both zero. Provided sufficient exclusion restrictions exist, this assumption can be tested. The above model can be consistently estimated provided that random or fixed effects do not exist. In the presence of random or fixed effects, coefficients will be biased.

Some authors estimate the above system in first differences. If the above system is the underlying data generating process, then the first difference specification is given as

$$\Delta L_{it} = \Delta x_i'\beta + \rho \Delta L_{it-1} + \gamma \Delta A_{it} + \delta \Delta A_{it-1} + \Delta u_{it}$$
$$\Delta A_{it} = \Delta z_i'\alpha + \varphi \Delta A_{it-1} + \lambda \Delta L_{it} + \pi \Delta L_{it-1} + \Delta v_{it}.$$

In practice, because only a pre- and post-test are given, the terms ΔLit-1 and ΔAit-1 are unavailable. This first difference specification does have the advantage that any unobserved heterogeneity (random or fixed effects) will be differenced out. However, because most of the demographic variables in xi and zi do not vary over time for individuals (for example age and gender) these would also be differenced out. For some characteristics, such as cumulative GPA, which do change over time, two concerns arise. First, the intra-semester timing of the two surveys should result in no change in cumulative GPA and so in practice this difference should drop out. Empirically, of course, we see changes in reported cumulative GPA within the semester: likely due to measurement error which will more significantly bias results in first difference than in level equations. Finally, even if ΔLit-1 and ΔAit-1 are available, problems in estimation arise since Δuit is correlated with Δuit-1 and so ΔLit-1 is correlated with Δuit (similarly for ΔAit-1 and Δvit). These are typically solved by using ΔLit-s and ΔAit-s, (further lags) as instruments, requiring even more periods of observation. These approaches are not available for most applications since sufficient lags are not typically available.

Instead many authors, such as Grimes et al., estimate a hybrid specification: they regress ΔLit on xi, Lit-1 and ΔAit and they regress ΔAit on zi, Ait-1 (possibly) and ΔLit. Using our original model, this hybrid difference equation can be written as

$$\Delta L_{it} = x_i'\beta + (\rho - 1)L_{it-1} + \gamma \Delta A_{it} + (\delta + \gamma)A_{it-1} + u_{it}$$
$$\Delta A_{it} = z_i'\alpha + (\varphi - 1)A_{it-1} + \lambda \Delta L_{it} + (\pi + \lambda)L_{it-1} + v_{it}.$$

It is important to note that this approach will not address unobserved heterogeneity. If uit = μi + εit for all t, then the inclusion of lagged level variables biases the estimated results, in a similar way as the level equations above, through the common error term μi. It is also important to note that in this model, exclusion of Ait-1 from the ΔLit equation (for example) imposes not only the restriction that δ is zero, but also the restriction that γ is zero which would then suggest the equations are not simultaneous (alternatively, one would have to believe that δ = - γ: which seems unlikely). Omission of this variable would bias coefficients. An important point here is that there is no difference in the results from either the first difference or the level specification; the same coefficients are identified under the same assumptions: no unobserved heterogeneity and sufficient exclusion restrictions. The first differencing does not identify an unidentified model.

The above model, however, does not address the fact that the class itself is hypothesized to change parameters in the model. One parameterization of this type of structural break model is

$$
\begin{aligned}
L_{it} &= x_i'(\beta+\theta) + (\rho+\tau)L_{it-1} + (\gamma+\kappa)A_{it} + (\delta+\eta)A_{it-1} + u_{it} \\
A_{it} &= z_i'(\alpha+\omega) + (\varphi+\psi)A_{it-1} + (\lambda+\xi)L_{it} + (\pi+\zeta)L_{it-1} + v_{it} \\
L_{it-1} &= x_i'\beta + \rho L_{it-2} + \gamma A_{it-1} + \delta A_{it-2} + u_{it-1} \\
A_{it-1} &= z_i'\alpha + \varphi A_{it-2} + \lambda L_{it-1} + \pi L_{it-2} + v_{it-1}.
\end{aligned}
$$

Only the composite parameters of the structural break model (those in the Lit and Ait model) are identified. It is, in general, impossible to identify all of the parameters of the model without at least one additional time period of observation. The first difference specification is given as

$$
\begin{aligned}
\Delta L_{it} &= \Delta x_i'\beta + x_i'\theta + \rho\Delta L_{it-1} + \tau L_{it-1} + \gamma\Delta A_{it} + \kappa A_{it} + \delta\Delta A_{it-1} + \eta A_{it-1} + \Delta u_{it} \\
\Delta A_{it} &= \Delta z_i'\alpha + z_i'\omega + \varphi\Delta A_{it-1} + \psi A_{it-1} + \lambda\Delta L_{it} + \xi L_{it} + \pi\Delta L_{it-1} + \zeta L_{it-1} + \Delta v_{it}
\end{aligned}
$$

We note again that estimation of this model would require observation on Lit-2 and Ait-2 as well as the other issued noted above. The hybrid specification favored by Grimes et al. and others can be expressed as

$$
\begin{aligned}
\Delta L_{it} &= x_i'(\beta+\theta) + (\rho+\tau-1)L_{it-1} + (\gamma+\kappa)\Delta A_{it} + (\delta+\eta+\gamma+\kappa)A_{it-1} + u_{it} \\
\Delta A_{it} &= z_i'(\alpha+\omega) + (\varphi+\psi-1)A_{it-1} + (\lambda+\xi)\Delta L_{it} + (\pi+\zeta+\lambda+\xi)L_{it-1} + v_{it}.
\end{aligned}
$$

Again, this specification can only identify composite coefficients and does not clearly address any unobserved heterogeneity. Omission of Ait-1 and Lit-1 would result in biased coefficients unless one believed that (δ+η), the coefficient on Ait-1, and (γ+κ) the coefficient on Ait, were both zero. One must assume that there is no simultaneity to drop Ait-1 from the difference specification. Clearly, if one wishes to estimate these models using first difference dependent variables all lagged levels must be included to estimate the coefficients of interest.

Appendix 2: Specification Testing

A. Testing Validity of Instruments for IV estimation

Instrumental Variables estimation requires two assumptions be met (see Bound et al 1995 and Wooldridge 2003 for complete discussions): the identifying instruments need to be significant predictors of the endogenous variable while being uncorrelated with the dependent variable. We have two endogenous variables: Lit and Ait. We have chosen GPA, father's education and Lit-1 as instruments for Lit. We have chosen Ait-1, no-opinion and younger as instruments for Ait.

Appendix Table 1 presents the reduced from (the first stage for the IV estimation) equations where the first assumption is tested. Column 1 presents the post-test attitude equation. We note that pre-test attitude, younger and no-opinion are all highly significant. The F-test for joint significance has a value of 102.9 and so the null hypothesis of jointly insignificant is rejected at all conventional levels. It should also be noted that these three coefficients are significant in the structural equation as well (see Table 5 in the text).

Column 2 of appendix Table 1 presents the post-test literacy equation. We note that pre-test literacy, GPA and father's education are all highly significant. The F-test (3,782) for joint significance (the formal test recommended by Bound et al 1995) has a value of 26.2 and so the null hypothesis of jointly insignificant is rejected at all conventional levels. These coefficients are significant in the structural equation as well (see Table 5 in text).

When IV estimation has multiple instruments for each endogenous variable, the hypothesis that the instruments are uncorrelated with the residual in the structural equation can be tested. Wooldridge (2003, p. 508) recommends the following procedure. Construct the residuals using the actual endogenous variable (rather than the predictions) and the IV estimated coefficients. Regress this 2SLS residual on all explanatory variables and the instruments. The joint test for significance of the instruments is distributed chi-squared(r-1) where r is the number of instruments (in our models r = 3). Columns 3 and 4 present these results. We note that both individually and jointly the instruments are not significant and thus the null that they are valid instruments is supported. Hence discussion about whether these are valid cross equation restrictions is not necessary as it has been formally tested and the assumption is not rejected.

B. Testing for Sample Selection

Concern arises over possible self selection for the models using the post-test literacy and attitude variables. The original pre-test was administered to 2116 students, 807 of whom completed the post-test. In order to address this, we use the two step Heckman sample selection correction.

We have chosen two variables which enter the selection equation but do not determine post-test literacy or attitude. The first variable, credit hours taken, is believed to affect selection through two avenues. Students who are "course shopping" generally have higher credit hour enrollment to allow them to drop courses after the first week (or perhaps longer) if they don't like it or are finding it difficult. Students who are full time, but taking fewer courses must remain in those courses to maintain full time status which is important for scholarships, student loans, athletic eligibility, and health insurance. Hence, we would expect the probability of remaining in the course through the semester to be lower for students with more credit hours. Yet, there should be little correlation between learning and credit hours.

The second variable is an indicator for college athlete. Because of NCAA rules, athletes are more likely to remain in classes in which they have enrolled. However, conditional upon GPA, prior literacy and attitude, and other characteristics, it would be surprising if being an athlete was related to post-test scores.

Column 1 and 2 of appendix Table 2 present the selection equations, while columns 3 and 4 present estimates from the Heckman two step correction for the IV estimates of the simultaneous system. In both cases, the coefficients on the Mills ratio are statistically insignificant. Qualitatively, the significant variables in the main model presented in Table 5 in the text are quite similar to the selection correction estimates. Hence there is no evidence for selection and little concern that the results in the text are biased because of selection.

Appendix Table 1 Reduced Form (First Stage) Regressions		
	(1)	(2)
	Post-Test Attitude	Post-Test Literacy
Pretest Knowledge Score	0.053	0.258
	(0.045)	(0.038)**
Pretest Attitude Score	0.590	0.061
	(0.036)**	(0.030)*
Female	-0.895	-0.113
	(0.177)**	(0.148)
Under Typical Age for Class	1.065	0.041
	(0.372)**	(0.311)
Over Typical Age for Class	0.256	1.003
	(0.346)	(0.289)**
African American	-0.034	0.006
	(0.493)	(0.412)
Asian American	0.749	-0.724
	(0.727)	(0.609)
Junior	-0.298	-0.341
	(0.238)	(0.199)
Senior	0.576	0.201
	(0.427)	(0.358)
Father's Education	-0.011	0.057
	(0.032)	(0.026)*
College Cumulative GPA	0.081	0.385
	(0.103)	(0.086)**
Previous College Micro Class	0.217	0.294
	(0.310)	(0.260)
Previous College Macro Class	0.490	-0.253
	(0.322)	(0.269)
High School Economics Class	-0.294	-0.140
	(0.182)	(0.152)
Microeconomics Course	0.379	-0.671
	(0.310)	(0.259)**
No Opinion	-0.447	-0.047
	(0.201)*	(0.168)
Hours Worked in Typical Week	0.009	0.001
	(0.008)	(0.007)
Hours Studying in Typical Week	0.030	0.019
	(0.012)*	(0.010)
Hours Volunteering in Typical Week	-0.039	-0.049
	(0.042)	(0.035)
Hours in Extracurricular Activities per Week	0.001	-0.019

	(0.012)	(0.010)
Instructor Female	0.247	0.040
	(0.343)	(0.287)
Instructor has Ph.D.	-0.734	-0.269
	(0.271)**	(0.227)
School has State Funding (=1)	0.655	-0.357
	(0.367)	(0.307)
Small Class	0.335	-0.296
	(0.404)	(0.338)
Constant	-0.433	5.990
	(1.002)	(0.838)**
Observations	807	807
R-squared	0.39	0.22
Valid Instruments F-Test(3,783)	102.91	26.20
Standard errors in parentheses		
* significant at 5%; ** significant at 1%		

Appendix Table 2 Test of Over-identifying Restrictions		
	(1)	(2)
	attitude error regression	literacy error regression
Pretest Knowledge Score	0.007	0.000
	(0.045)	(0.037)
Pretest Attitude Score	-0.001	0.001
	(0.035)	(0.030)
Female	-0.002	0.002
	(0.175)	(0.146)
Under Typical Age for Class	-0.000	-0.066
	(0.367)	(0.307)
Over Typical Age for Class	-0.015	-0.005
	(0.341)	(0.286)
African American	-0.031	0.002
	(0.486)	(0.407)
Asian American	0.036	0.007
	(0.718)	(0.601)
Junior	-0.002	0.004
	(0.235)	(0.197)
Senior	-0.005	0.004
	(0.422)	(0.353)
Father's Education	-0.021	0.000
	(0.031)	(0.026)
College Cumulative GPA	0.012	0.001
	(0.101)	(0.085)
Previous College Micro Class	-0.006	-0.001
	(0.306)	(0.256)
Previous College Macro Class	-0.012	0.001
	(0.318)	(0.266)
High School Economics Class	-0.004	0.001
	(0.180)	(0.151)
Microeconomics Course	0.005	0.000
	(0.306)	(0.256)
No Opinion	0.004	-0.002
	(0.199)	(0.166)
Hours Worked in Typical Week	-0.000	-0.000
	(0.008)	(0.007)
Hours Studying in Typical Week	0.000	-0.000
	(0.012)	(0.010)
Hours Volunteering in Typical Week	-0.001	0.000
	(0.041)	(0.034)
Hours in Extracurricular Activities per Week	0.001	-0.000

	(0.012)	(0.010)
Instructor Female	0.012	-0.001
	(0.339)	(0.284)
Instructor has Ph.D.	0.007	-0.000
	(0.267)	(0.224)
School Has State Funding (=1)	-0.006	0.001
	(0.362)	(0.303)
Small Class	-0.001	-0.000
	(0.399)	(0.334)
Constant	0.219	-0.005
	(0.988)	(0.828)
Observations	807	807
Over-Identifying Restrictions Test F(2,783)	0.48	0.05
Standard errors in parentheses		
* significant at 5%; ** significant at 1%		

Appendix Table 3 IV Sample Selection Regression				
	(1)	(2)	(3)	(4)
	Selection Attitude	Selection Knowledge	Attitude IV (selection corrected)	Knowledge IV (selection corrected)
Mills Ratio			-0.609	0.688
			(1.564)	(1.308)
Posttest Knowledge Score	0.149		0.114	
	(0.045)**		(0.204)	
Posttest Attitude Score		0.076		0.135
		(0.020)**		(0.079)
Pretest Knowledge Score		0.018		0.261
		(0.015)		(0.042)**
Pretest Attitude Score	0.030		0.569	
	(0.013)*		(0.048)**	
Female	0.169	0.216	-0.935	0.075
	(0.061)**	(0.066)**	(0.246)**	(0.246)
Under Typical Age for Class	0.323		0.947	
	(0.145)*		(0.471)*	
Over Typical Age for Class	-0.380	-0.247	0.234	0.889
	(0.119)**	(0.109)*	(0.507)	(0.338)**
African American	-0.009	0.031	-0.004	0.027
	(0.164)	(0.165)	(0.488)	(0.413)
Asian American	-0.072	-0.245	0.878	-0.926
	(0.240)	(0.237)	(0.742)	(0.653)
Junior	-0.106	-0.122	-0.184	-0.378
	(0.078)	(0.078)	(0.269)	(0.234)
Senior	-0.320	-0.331	0.673	-0.003
	(0.130)*	(0.129)*	(0.532)	(0.449)
Father's Education		0.090		0.069
		(0.036)*		(0.034)*
College Cumulative GPA		0.026		0.412
		(0.011)*		(0.111)**
Previous College Micro Class	-0.007	0.008	0.162	0.290
	(0.100)	(0.099)	(0.309)	(0.261)
Previous College Macro Class	0.117	0.048	0.497	-0.277
	(0.113)	(0.113)	(0.346)	(0.276)
High School Economics Class	-0.045	-0.044	-0.244	-0.131
	(0.062)	(0.062)	(0.187)	(0.157)
Microeconomics Course	0.258	0.114	0.380	-0.648
	(0.107)*	(0.100)	(0.437)	(0.285)*
No Opinion	-0.045		-0.425	
	(0.067)		(0.205)*	

Hours Worked in Typical Week	-0.006	-0.006	0.011	-0.003
	(0.003)*	(0.003)*	(0.010)	(0.009)
Hours Studying in Typical Week	0.001	0.001	0.026	0.015
	(0.004)	(0.004)	(0.013)*	(0.011)
Hours Volunteering in Typical Week	-0.009	-0.012	-0.025	-0.053
	(0.012)	(0.012)	(0.044)	(0.037)
Hours in Extracurricular Activities in Typical Week	-0.005	-0.008	0.004	-0.021
	(0.004)	(0.004)	(0.012)	(0.011)*
Instructor Female	-0.165	-0.185	0.290	-0.076
	(0.106)	(0.106)	(0.384)	(0.332)
Instructor has Ph.D.	-0.376	-0.365	-0.535	-0.368
	(0.090)**	(0.090)**	(0.488)	(0.402)
School Has State Funding (=1)	-0.175	-0.284	0.808	-0.566
	(0.125)	(0.123)*	(0.428)	(0.408)
Small Class	-0.012	-0.075	0.388	-0.372
	(0.128)	(0.128)	(0.402)	(0.344)
Credit Hours Registered	-0.031	-0.031		
	(0.017) †	(0.017) †		
Member Athletic Team	0.207	0.211		
	(0.114)†	(0.114) †		
Constant	-0.985	-0.268	-0.619	5.194
	(0.565)	(0.416)	(3.121)	(1.840)**
Observations			2118	2118
†significant at 7%; * significant at 5%; ** significant at 1%				