

## DETERMINANTS OF STUDENT ACHIEVEMENT IN PRINCIPLES OF ECONOMICS

By Cynthia McCarty, Gene Padgham, and Doris Bennett\*

### Abstract

*This paper seeks to identify factors that influence student learning in college macroeconomics and microeconomics courses. Student and professor gender and personality type, college entrance exam scores, grade point average, class size, and whether the course was micro or macro were hypothesized as explanatory variables for student learning, which was measured by improvement on the Test of Understanding College Economics III (TUCE). We found no statistically significant influence on student achievement from college entrance exam scores or class size. Student gender, matching instructor and student gender, and GPA were significant explanatory factors for performance in principles of both microeconomics and macroeconomics. Student improvement was significantly higher in macro than in micro. (JEL-A22)*

### Introduction

This paper seeks to analyze factors that influence student performance in college principles of macroeconomics and microeconomics courses. Examining factors such as student performance, measured by the improvement on the Test of Understanding College Economics III (TUCE III), the personality types of the professor and student as determined by the Keirsey Temperament Sorter, overall college grade point average, ACT score, gender of the student and the professor, and class size, we can draw some conclusions that will help economics instructors and advisors to better meet student needs. Further, as professors of economics at a university where teaching is a top priority, we are especially concerned about the generally persistently relatively poor performance by women in principles of economics courses here and across the nation.

Having hypothesized that student performance is influenced by the previously listed factors, we evaluated our principles of macro and micro students at Jacksonville State University (JSU) from spring semester 1997 through fall 2002. Our five economics faculty members, three male and two female, participated in collecting data for a sample of 148 microeconomics students and 254 macroeconomics students. On the first day of class, the students took the TUCE III test. Later in the semester they took the Keirsey Temperament Sorter, and then during the final exam they took the TUCE III test again. We also recorded the students' ACT scores (converting from SAT scores as needed), GPA for college work completed prior to the economics course, gender, and class size, with enrollment under 40 designated as "small."

We provide a concise review of the literature on student achievement in principles of economics classes, highlighting research in which gender, personality, and class size have been factors influencing learning. We then provide a brief explanation of the different personality types and the TUCE III. Next we describe the JSU data, our analysis, and the results. Last we offer some possible explanations of our finding and propose some areas for future research.

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## Literature Review

Research on improving the rather weak performance of students in college principles of economics has been extensive in recent years. In a paper advocating reform, Becker (1997) noted that grades in economics classes are often lower than grades in other college departments. Further, women have consistently performed worse than men. Thus, a focal point for much of the research has been an attempt to explain the relatively low performance of women in the principles of economics courses, even after adjusting for math background, ACT, and GPA (Anderson, Benjamin and Fuss 1994; Ballard and Johnson 2005; Becker 1997; Dynan and Rouse 1997; Greene 1997; Ziegert 2000).

Borg and Shapiro (1996) first noted that gender was not a significant factor in determining student performance once student personality type was introduced. Using the Myers-Briggs Type Indicator to determine student and professor personality type and the course grade to determine the student's mastery of the material, they found student gender to be insignificant. They also noted that matching student and professor personality types enhanced student performance. Borg and Shapiro (1996) and Ziegert and Sullivan (1999) concluded that certain broad personality types, introverts and thinkers, tend to perform better in economics courses. However, Ziegert and Sullivan (1999) disagreed that a student/professor personality match improved performance. Although three of the four broad personality categories are distributed evenly between men and women, one is not: most women are "feelers," sensitive, empathetic, and in search of harmony, while most men are "thinkers," cool, analytical and logical (Tieger and Tieger 1998; Ziegert 2000). Given the gender-specific personality type, some argue that if matching personality types enhances learning, then women students would learn better from women professors (Ballard and Johnson 2005; Dynan and Rouse 1997; Jensen and Owen 2001).

However, the reality is that economics remains a field dominated by men. In 2000 less than one-third of undergraduate degrees and doctorates in economics were awarded to women (Ballard and Johnson 2005), while in 1994 only 11 percent of female economics professors were tenured associates (Dynan and Rouse 1997). Ballard and Johnson (2005) found that women tend to have low expectations about their ability to succeed in principles of economics courses, with a major factor being women's relatively low level of competency in math. Several studies (Ballard and Johnson 2005; Anderson et al. 1994; Jensen and Owen 2001) note the importance of math skills in determining student performance in economics.

Another area of concern in the economic education literature has been whether the traditionally large lecture classes for principles of economics provide a beneficial learning environment for the students. Research by Arias and Walker (2004) found a significant negative relationship between class size and student performance. They did not find gender to be significant.

In sum, most recent studies agree that GPA, math ability, college entrance exams (ACT or SAT), and gender are the most important determinants of performance. Males continue to maintain a grade "premium" (Anderson et al. 1994) in principles of economics, while women have less confidence and lower expectations regarding their success in economics.

## Personality Types

The Keirsey Temperament Sorter is a 70-question multiple-choice questionnaire. Although the Keirsey Test is both less complex and less expensive than the Myers-Briggs Test, it also has a high degree of accuracy and is used interchangeably by many universities. The students' answers determine what their preferences are on four scales: where the student likes to focus his/her attention (E or I); the way a student looks at things (S or N), the way a student likes to decide

things (T or F); and how the student deals with the outer world (J or P) (Keirsey and Bates 1984). The four areas of choice are described in more detail below (Lawrence 1982):

1. E = Extroversion. The person's interest flows mainly to the outer world of actions, objects, and persons.  
or I = Introversion. The person's interest flows mainly to the inner world of concepts and ideas.
2. S = Sensing. The person prefers to focus on the immediate, real, and practical.  
or N = Intuition. The person prefers to focus on the possibilities, relationships, and meanings.
3. T = Thinking. The person makes decisions objectively, impersonally, logically.  
or F = Feeling. The person bases decisions primarily on values, subjectively.
4. J = Judgment. The person prefers to live in a planned and orderly way, having things settled.  
or P = Perception. The person prefers to live in a spontaneous, flexible way, preferring to keep options open.

We measured student learning by giving all of our principles students the Test of Understanding in College Economics, 3rd edition, (TUCE III) exam at the beginning and end of the semester and then calculating the difference. The TUCE III for microeconomics and the TUCE III for macroeconomics consist of 33 multiple-choice questions, written by a committee of respected economists. Widely used as an assessment of principles of economics courses, roughly 70 percent of the questions are designed to assess student aptitude in applying economics to solving problems (Saunders 1991). Since 1968 Becker (1997) has found that the only consistently significant variables to influence post-TUCE scores are aptitude measures, such as the pre-test and the SAT and ACT.

Departing from Becker's measure of student performance by using the TUCE exam, Borg and Shapiro (1996), Anderson et al. (1994), Arias and Walker (2004), Ballard and Johnson (2005), Jensen and Owen (2001), and Ziegert and Walker (1999) chose instead to use grades to measure performance in economics (although Ziegert and Walker also used the improvement on the TUCE and post-TUCE). They claimed that the TUCE is no more objective than an individual professor's own tests and that the TUCE reflects the personality types of the professors who composed it. They also found that women earned better overall course grades while men scored significantly higher on the post-TUCE exam. Although their arguments have merit, our goal was to measure the level of improvement in the course, not just the final grade. In order to improve our teaching of economics, we believe that whether a student comes in weak or strong in economics on the first day of class, our success in teaching should be based on how much that student has improved by the end of the course.

## Methodology

The sample consists of observations on 148 students in principles of microeconomics and 254 students in principles of macroeconomics courses from spring 1997 through fall 2002. Students in each section were given the TUCE on the first day of class and then again on the day of the final exam. Student learning in the course was measured as the difference between the TUCE post-test and pre-test. Five professors participated in the study, two women and three men. Student achievement in economics, represented by improvement on the TUCE (DIFF) was hypothesized to

be determined by student and professor gender, class size, student effort and aptitude, student and professor personality, the professor teaching the course, whether student gender and/or personality were the same, and whether the course was macro or micro. The variables are displayed and defined in Table 1.

**Table 1: Definitions of the Variables**

Variable Name	Definition
DIFF	Improvement on the TUCE, the difference between the pre-test and post-test scores, and the dependent variable
SGEN	Student gender, 1 if student is male, 0 if female
PGEN	Professor gender, 1 if male, 0 if female
SIZE	Class size, 1 if large (40 or more students), 0 if small (less than 40 students)
ACT	Student's score on the American College Test
GPA	Student's grade point average
MACRO	1 if the student was enrolled in macroeconomics, 0 if microeconomics
PER variables	Dummy variables representing the 16 personality types identified by the Keirsey Temperament Sorter (ESTJ, ESTP, etc.) or dummy variables representing the four personality dimensions; E versus I, S versus N, T versus F, or J versus P
SSEX	Matching professor and student gender, 1 if same gender, 0 if different gender
SPER	Matching professor and student personality type, 1 if same personality type, 0 if not
PF	Dummy variables for the different professors, 1–5
MACRO interactions	Interactions between the course and personality types

ACT score is a measure of the student's ability. GPA is a measure of how much effort the student has put into his or her studies. SIZE is small if the section had less than 40 students, the average class size in the sample. Small class size, ACT, GPA, matching gender (SSEX), and matching personality (SPER) between student and teacher are hypothesized to have a positive effect on performance. The effect of personality (PER) on performance was measured in one specification of the regression model using the four personality dimensions, i.e., introversion versus extroversion, sensing versus intuition, thinking versus feeling, and judgment versus perception. The 16 personality types formed from the four Keirsey preference dimensions (ESTJ, ESTP, ISFJ, etc.) were used in another specification of the model. Student gender, personality, and the mean DIFF for each of the 16 personality types for the entire sample are shown in Table 2. Two of the professors, a man and a woman, were ESTJ; another two, also a man and a woman, were ESFJ; and the fifth professor, a man, was ISTJ.

The mean and standard deviation DIFF for selected subsamples of selected independent variables are shown in Table 3. When the sample was divided into micro and macro, the macro students' improvement averaged 0.7 points higher than for those in micro. The mean DIFF for male students in the sample was only slightly higher (0.03 points) than that of the female students. The average improvement for students in small classes was also only slightly higher than for those in the larger sections. Extroverted, intuitive, thinking, and perceiving students had slightly higher DIFFs than introverted, sensing, feeling, and judging students.

**Table 2: Student Gender and Personality**

Personality Type	Men	Women	Total	Mean (Standard Deviation)
<b>DIFF</b>				
ESTJ	37	38	75	4.15 (2.55)
ESTP	5	3	8	3.63 (1.41)
ESFJ	31	50	81	4.30 (2.44)
ESFP	5	5	10	4.50 (2.72)
ENTJ	12	10	22	5.41 (2.61)
ENTP	6	4	10	3.60 (2.22)
ENFJ	10	16	26	5.65 (3.58)
ENFP	13	23	36	4.00 (2.53)
ISTJ	20	16	36	4.81 (3.45)
ISTP	1	1	2	3.00 (2.24)
ISFJ	16	38	54	3.81 (2.62)
ISFP	1	2	3	7.67 (2.09)
INTJ	4	7	11	5.36 (3.17)
INTP	2	2	4	3.25 (2.22)
INFJ	7	11	18	4.28 (3.16)
INFP	2	4	6	4.17 (4.07)
<b>Totals</b>	<b>172</b>	<b>230</b>	<b>402</b>	

**Table 3: Mean and Standard Deviation of DIFF for Selected Independent Variables**

Variable	Mean DIFF	Standard Deviation	Number of Observations
Macro	4.63	2.86	254
Micro	3.96	2.58	148
Male students	4.42	2.59	172
Female students	4.39	2.91	230
Small class	4.42	2.79	158
Large class	4.36	2.78	244
Extroversion (E)	4.40	2.64	268
Introversion (I)	4.34	3.05	134
Sensing(S)	4.24	2.66	269
Intuitive(N)	4.66	2.99	133
Thinking (T)	4.44	2.77	168
Feeling (F)	4.34	2.79	234
Judgment (J)	4.06	2.56	79
Perception (P)	4.46	2.83	323

## Regression Results

The empirical model used in ordinary least squares estimation was

$$\text{DIFF} = f(\text{SGEN}, \text{GPA}, \text{ACT}, \text{PGEN}, \text{SIZE}, \text{PER}, \text{SSEX}, \text{SPER}, \text{PF}, \text{MACRO interactions}).$$

In the first estimation, which appears in Table 4, PER, the personality variable, was represented for each student as one of the 16 personality types determined by the Keirsey Temperament sorter.

Personality type INFP and the fifth professor, PF5, were the omitted dummy variables; the Minitab software package automatically removed personalities INTP, ISFP, and ISTP and one of the professors, PF2, because they were “highly correlated with other X variables.” In the original estimate, GPA and the interaction variable for personality type ENFJ in the macroeconomics sections were positive and significant. However, the variance inflation factors indicated the presence of multicollinearity, so backward stepwise regression, with alpha of 0.15, was used to find the best regression, which is shown in the last three columns of Table 4.

**Table 4: Regression Results for 16 Personality Types**

Independent Variable	Original Estimate			Stepwise Estimate		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
CONSTANT	1.259	0.396		1.395	0.046	
SGEN	0.502	0.205	2.1	0.559	0.132	1.9
PGEN	-0.301	0.598	2.4			
SIZE	-0.173	0.621	1.6			
ACT	0.036	0.363	1.8			
GPA	0.615	0.025	1.8	0.824	0.001	1.1
MACRO	0.225	0.777	7.9			
ESTJ	0.077	0.952	13.7			
ESTP	0.042	0.977	2.3			
ESFJ	0.079	0.952	15.4			
ESFP	0.554	0.697	2.7			
ENTJ	0.683	0.669	7.3			
ENTP	-1.138	0.560	5.1			
ENFJ	-0.571	0.716	8.2			
ENFP	-1.151	0.437	9.8	-1.617	0.075	3.8
ISTJ	0.933	0.517	9.3			
ISFJ	-0.841	0.531	11.5	-0.773	0.056	1.1
INTJ	1.004	0.467	2.8			
INFJ	0.150	0.907	3.9			
PF1	-0.436	0.586	1.3			
PF3	0.271	0.747	1.5			
PF4	1.501	0.235	1.3			
SAMESEX	0.631	0.107	2.0	0.618	0.093	
SAMEPER	0.215	0.632	1.8			
ESTJ-MAC	-0.467	0.642	5.4			
ESFJ-MAC	-0.074	0.941	6.0			
ENTP-MAC	0.598	0.768	3.9			
ENFJ-MAC	2.971	0.041	5.2	2.351	0.001	1.0
ENTJ-MAC	0.520	0.729	4.5	1.211	0.087	1.0
ENFP-MAC	1.434	0.270	5.8	1.976	0.054	3.7
ISTJ-MAC	-0.664	0.594	5.0			
ISFJ-MAC	0.253	0.817	5.4			
	$R^2 = 13.2\%$	$n = 402$		$R^2 = 10.4\%$	$n = 402$	

In the stepwise estimate, GPA and matching gender for student and professor had significant, positive effects. Students with personality types ENFP and ISFJ had significantly lower DIFFs than other personality types. The interaction variables for personality types ENFJ, ENTJ, and ENFP were positive and significant, indicating that students with these personality attributes may learn more in macro than in micro.

**Table 5: Regression Results for Four Personality Dimensions**

Independent Variable	Original Estimate			Stepwise Estimate		
	Coefficient	p-value	VIF	Coefficient	p-value	VIF
CONSTANT	0.477	0.659		0.686	0.354	
SGEN	0.552	0.149	2.0	0.679	0.066	1.8
PGEN	-0.486	0.398	2.5			
SIZE	-0.126	0.711	1.5			
ACT	0.018	0.641	1.7			
GPA	0.663	0.013	1.8	0.76	0.001	1.1
MACRO	1.414	0.103	9.5	1.35	0.001	1.8
EI	0.436	0.648	11.0			
SN	2.519	0.402	109.4			
TF	0.423	0.378	3.1			
JP	1.875	0.243	22.2	0.597	0.103	1.2
SSEX	0.627	0.096	1.9	0.670	0.068	1.8
SPER-EI	-0.456	0.573	8.2			
SPER-SN	-2.496	0.401	107.4			
SPER-TF	0.541	0.079	1.3			
SPER-JP	-1.070	0.471	19.7			
E-MAC	0.340	0.591	5.3			
S-MAC	-1.034	0.120	5.8	-1.157	0.002	1.9
T-MAC	-0.690	0.273	4.1			
J-MAC	-0.345	0.658	8.3			
PF1	-0.633	0.660	1.4			
PF3	0.207	0.824	1.8			
PF4	1.357	0.281	1.3			
	R <sup>2</sup> = 10.1%	n = 402		R <sup>2</sup> = 7.7%	n = 402	

Since seven of the 16 personality types had relatively few students, 10 or less, we also examined the influence of the four broader personality dimensions on student performance. These results in Table 5 indicate a positive, significant influence on achievement from GPA and matching professor and student gender. Students who were thinking, rather than feeling, scored significantly higher by 0.5 points. As with the specification with 16 personality types, multicollinearity was present, so backward stepwise regression, with alpha of 0.15, was used to find the best combination of independent variables, shown in the last three columns of Table 5.

In the restricted regression, student gender (SGEN) was significant and positive, indicating that male students improved more than female students. GPA and matching student and professor gender (SSEX) were significant and positive. MACRO was also significant and positive, signifying a higher level of achievement in macro than micro. Students who were judging (planned and orderly) scored approximately 0.60 points higher than perceiving (spontaneous and flexible) students. The interaction variable for the sensing versus intuitive dimension was negative, which means that sensing students scored, on average, a point less in macro than the intuitive students.

## Conclusions and Recommendations

Our results identify several factors that contribute to achievement in principles of both micro and macro. In both specifications of our model, the coefficient of GPA was positive and highly significant, while the coefficient of ACT scores was positive but not statistically significant. This result may indicate that, for our sample, effort is more important than ability in student learning in principles of economics. Also in both specifications of the model, matching professor and student gender (SSEX) was positive and significant. Since there are more male professors in economics than female professors, this result may be helpful in explaining why male students, on average, outperform female students in economics.

In the second specification of the model using the four personality dimensions, student gender (SGEN) was positive and significant, indicating that male students improved more on the TUCE, which is consistent with many other studies. In the second specification, students in macro outperformed those in micro, and judging students outperformed perceiving students. Both specifications of the model found some difference in the type of student who performs well in macro versus micro. The macro interaction variables in both models predict that intuitive students outperform sensing students in macro. Unlike most previous work, this research suggests that ACT scores and class size have no significant effect on learning. We recommend that college advisors consider this information when suggesting which course the students should take first (if there is no prerequisite) or, if only one economics course is required, which one is the best “fit” for the student.

## Future Research

Certainly one avenue of further study would be to repeat this study with a larger sample of students and professors. With only three personality types represented by our five faculty, we were limited in our ability to analyze the influence of matching student and professor personality types. In addition, other factors that affect student learning should be considered and analyzed. Course type (lecture versus Internet), math background, seating preferences, age of student, economics background, number of students who drop the course and their personalities, and student major are a few that might have significance.

Further, although we used the difference between the pre- and post-TUCE tests to measure learning, future research should include other measures such as course grade average. One limitation of giving the post-TUCE during the final exam was in motivating the students to do their best when many perceived no measurable benefit in performing well on it. (For example, some students with solid “A” averages tended to perform below expectations, given that a poor performance on the post-TUCE could not lower their overall grade.)

Last, given our results that the personalities of those who excel in macro differ from those who excel in micro, the choice of which course to take first (or solely) is critical. Future research should determine the number of schools where either macro or micro may be taken and where both must be taken, disregarding sequence. In these cases the advisory role is critical: an analysis of the factors the advisor considers before making a recommendation and the student’s performance would be meaningful.

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