PERSONALITY TYPE AS A DETERMINANT OF STUDENT PERFORMANCE IN INTRODUCTORY ECONOMICS: MACROECONOMICS VS. MICROECONOMICS*

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ABSTRACT

Personality type has been shown to impact student performance in introductory economics courses. However, research has yet to ascertain the degree to which this relationship might vary across course types. We utilize a one quarter survey course designed to cover the fundamentals of both microeconomics and macroeconomics in order to test the hypothesis that different personality types, as measured by the Myers-Briggs Type Indicator test, will excel in the two fields of study. We show that although a casual comparison of estimated coefficients across disciplines may imply differences in the role of type in the two fields, these differences are not supported by formal testing. We, therefore, find little support for the notion that the relationship between personality type and performance is different for the two fields.

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INTRODUCTION

Experience has shown that students have no trouble revealing their preferences toward the study of economics. Casual observation has led some to assert that "economics is one of those subjects students either love or hate", as is stated by Borg and Shapiro (1996). Another common, yet noteworthy theme centers on the juxtaposition of microeconomics and macroeconomics. It seems that students rarely find the two branches of economics equally desirable, often expressing a strong preference for one over the other. Given that the two fields are significantly different in their topics and methods, it is probable that students are more likely to excel in the field of study that embraces those methods most consistent with their personal preferences. Furthermore, some degree of self-sorting is apparent among professional economists in a manner consistent with the micro/macro distinction. Variation in student preferences and the self-sorting of economists should not be surprising given the nature of the two branches of economics: macroeconomic theory being highly differentiated, fluid, and evolving, whereas microeconomic theory is somewhat more focused and time-invariant. Taken together these observations suggest that differences in taste concerning the two main branches of economics are associated with different personality/learning types.

Students with certain personality types and learning styles may excel in macroeconomics or microeconomics to varying degrees depending upon the match between their personality characteristics and course content and structure. The importance of this to economics students is clear given that, unlike the informed self-sorting of professional economists, students rarely have the ability, or the necessary a priori information, to choose those economics courses that most closely match their preferences. This is especially true in introductory course where students may have no prior knowledge regarding economics, or perhaps are required to take courses in each.

It has been shown in previous work that personality type does indeed affect student performance in introductory economics courses. In fact, two separate studies find such a relationship, Ziegert (2000), and Borg and Shapiro (1996). However, it is not clear whether these two studies are entirely comparable, as the work by Ziegert examines courses in microeconomics, while Borg and Shapiro focus on courses in macroeconomics. Previous research has not addressed whether the personality types predictive of academic performance in one branch of economics are also predictive in the other. The purpose of this study is to determine whether the relationship between personality type and student performance is

different for microeconomics relative to macroeconomics. These results will potentially help explain differences found in past work, and gain valuable insights into student learning and appropriate pedagogical approaches in introductory economics courses.

PERSONALITY TYPE AND LEARNING STYLES

The measure of personality type we employ is the Myers-Briggs Type Indicator (MBTI) test, which is designed to classify individuals according to personality types consistent with the work of psychologist C. G. Jung. The MBTI is a popular instrument; accordingly, the literature related to the test and its application is immense. A concise overview of the MBTI and Jung's preferences is provided by Isabel Briggs Myers in "Introduction to Type". According to Myers (1998), the MBTI "reports preferences on four dichotomies". These are Introversion vs. Extroversion, Sensing vs. Intuition, Thinking vs. Feeling, and Judging vs. Perceiving. These categories are clarified in Table 1.
The MBTI is designed to "sort" individuals according to these four dichotomies. Each individual has a preference on each dichotomy listed, yielding 16 possible four-letter combinations (for example: ISTJ) or "personality types."

The educational literature is replete with studies showing how various aspects of personality type and student temperament impact academic performance, especially when considered in conjunction with the teaching style of a professor. Fortunately, the results of the MBTI provide information regarding student temperament. The aspects of personality type associated temperament are summarized by Keirsey and Bates (1984) and are reproduced by Borg and Shapiro (1996). A brief summary of their work follows.[1]

Four vital preference combinations (temperaments) associated with student learning are: SP, SJ, NT, and NF. Essentially, following the information in Table 1, individuals choose to focus their attention, take in information, solve problems, and deal with the world around them in ways corresponding to their personal preferences. Combinations of these different preferences yield personality types corresponding to varying levels of comfort with structure, abstract thought, "logical" reasoning, etc. An NT, for instance, will tend to be comfortable with theoretical, logical topics, and demonstrate little need for examples to support theoretical material. NFs, on the other hand, may prefer a significant amount of interaction with classmates, class discussion, and specific examples. An SJ will prefer clear-cut assignments, logical structure to the class and associated material, and are most

comfortable with topics related to concrete facts. SPs prefer high degrees of physical interaction in the classroom with "hands-on" experience, prefer group projects, and do not respond well to typical lecture style course containing little variation in style (Keirsey and Bates, 1984).

TABLE 1*
The Basic Dichotomies of the MBTI

The E-I Dichotomy-- The Focus of One's Attention

Extroversion
Focus on the outer world of people and activity. Energy and attention is directed outward and is received from interacting with people and from taking action.

Introversion
Focus on the inner world of ideas and experiences. Energy and attention is directed inward and is received from reflecting on thoughts, memories, and feelings.

The S-N Dichotomy –Taking in Information

Sensing
Take in information that is real and tangible---what is actually happening. Observant about the specifics of the immediate environment Especially attuned to practical realities.

Intuition
Take in information by seeing the big picture, focusing on the relationships and connections between facts. Seek to grasp patterns. Especially attuned to seeing new possibilities.

The T-F Dichotomy—Making Decision

Thinking
Considers the logical consequences of a choice or action. Examine the pros and cons objectively. Energized by critiquing and analyzing. Problem solvers. Seeks generalizable standards and principles out of specific circumstances.

Feeling
Consider what is important to themselves and to others. Mentally place themselves into the situation to identify with everyone so they can make decisions based on their values about honoring people. Energized by appreciating and supporting others and look for qualities to praise. Seeks to create harmony and treat each person as a unique individual.

The J-P Dichotomy—Dealing with the Outer World

Judging
Prefers a planned, orderly way, seeking to regulated and mange their lives. Decisive.

Perceiving
Prefers a flexible, spontaneous way, seeking to experience and understand life, rather than control it. Detailed plans and final decisions feel confining; prefer to stay open to new information and last minute options. Energized by their resourcefulness in adapting to the demands of the moment.

* This table is an abbreviated replication of the discussion provided by Isabel Briggs Myers in her manual "Introduction to Type"

Ziegert (2000) and Borg and Shapiro (1996) have shown that personality type is predictive of performance in economics courses. Ziegert finds that students of type S and T perform significantly better in introductory microeconomics, while

Borg and Shapiro find that Is perform better that Es in introductory macroeconomics courses. In both studies, performance is measured by course grade. Taking the aforementioned temperaments into account, both Ziegert and Borg and Shapiro find that students with NF temperaments perform at a lower level than their SJ counterparts, but that SPs have no statistically significant difference in performance when compared to student with the SJ temperament. Differences in the two studies are embodied primarily in the magnitude of the associated coefficients implying differing probabilities of success in the course. While the direction of change for both NFs and NTs are identical in these studies, the coefficient for NTs in the Borg and Shapiro study is nearly twice that of those found in the Ziegert study. The differences in coefficients associated with NFs are even more pronounced in the two studies, where the coefficient for NFs in the Borg and Shapiro paper is more than three times that of found by Ziegert. The student/professor temperament match was also found to impact student performance in the Borg and Shapiro paper, but not in the work by Ziegert. Cross-study comparisons should be made with caution, however, as the somewhat ambiguous interpretation of the coefficients from ordered probit regressions makes such comparisons speculative at best, and the independent nature of the two studies eliminates the possibility of formally testing the matter.

While some differences between the past two studies are present, they do not explicitly address the issue of dissimilarities in student performance in microeconomics as opposed to macroeconomics. Consequently, comparing these results may be misleading as the impact of differing study design and course content are unknown. Here we attempt to correct for this deficiency by studying the same topic in a one-quarter course which includes both a micro portion and a macro portion, examining the effect of personality type on performance in each portion of the course separately.

HYPOTHESES

Of primary concern here is the extent to which differences found when comparing the work of Borg and Shapiro with that of Ziegert are due to variations in course content (macro vs. micro) as opposed to study design. Our results, derived from a relatively controlled environment where the same students are tested in both macro and micro, should clarify the extent to which such conclusions can be drawn. This is especially interesting given that the conclusions drawn from comparing these two studies would seem contradictory to our hypothesis presented herein.

Our summary of the MBTI personality types suggests a number of testable hypotheses. First, we anticipate that students with "S" as part of their type are more inclined to succeed in micro due to their preference for detail and tangible facts. Conversely, Ns are more inclined to macro given the "big picture" nature of the subject. Second, we anticipate that students with "J" in their type are more likely to succeed in micro due to the structured nature of the subject, whereas Ps are more apt to succeed to macro which is "more open to change" and is perhaps more flexible. Third, with regard to temperaments, we expect that SJs have an absolute advantage in both subjects, but that advantage may be considerably greater in the micro portion of the course due to the more structured nature of the material. Finally, we expect that NT students will perform relatively better in macro due to its relatively abstract nature.

DATA AND RESEARCH DESIGN

The data were collected in two introductory economics courses, one in Spring 2002, the other in Winter 2003. Each course is a one-quarter survey of both microeconomics and macroeconomics for non-business majors seeking to fulfill part of the university's social science elective requirement. During the first full week of class, the students were given the MBTI self-scorable test. Students were also asked to sign a consent form granting access to the use of their academic records. The analytical data set was created by merging the MBTI scores with student records. We attempt to replicate the research design of Borg and Shapiro and Ziegert where possible, and therefore chose the variables for the analysis accordingly. Definitions are provided in Table 2 below.

Combined enrollment in the two course sections equaled 142 students, 120 of which agreed to participate in the study. Of these, 45 records were missing certain elements of the predictor data (primarily high school GPA and ACT composite score). To avoid the loss of valuable data, we decided to use college GPA (following Ziegert) instead of High School GPA and auxiliary regressions to predict any missing ACT composite scores or college GPAs.[2] This procedure enabled us to retain the 120 records where the MTBI scores were captured. A total of 14 students officially dropped out of the course. Another 4 failed to write at least one exam. We treat these 18 observations broadly as failing to complete the course, leaving 102 observations for analysis.

Each course section was split into 3 segments: an introductory segment dealing primarily with broad economic concepts, the economics discipline and way

of thinking; a micro segment devoted to consumer and producer theory, and selected microeconomic applications; and a macro segment that presented basic macroeconomic concepts and a mixed plate of macroeconomic theory and applications.

Table 2: Variable Definitions

Variable	Description
ENFJ	Dummy variable for student personality type ENFJ
ENFP	Dummy variable for student personality type ENFP
ENTJ	Dummy variable for student personality type ENTJ
ENTP	Dummy variable for student personality type ENTP
ESFJ	Dummy variable for student personality type ESFJ
ESFP	Dummy variable for student personality type ESFP
ESTJ	Dummy variable for student personality type ESTJ
ESTP	Dummy variable for student personality type ESTP
INFJ	Dummy variable for student personality type INFJ
INFP	Dummy variable for student personality type INFP
INTP	Dummy variable for student personality type INTP
ISFJ	Dummy variable for student personality type ISFJ
ISFP	Dummy variable for student personality type ISFP
ISTJ	Dummy variable for student personality type ISTJ
ISTP	Dummy variable for student personality type ISTP
I	Dummy variable for I subtype (relative to E)
S	Dummy variable for S subtype (relative to N)
T	Dummy variable for T subtype (relative to F)
J	Dummy variable for J subtype (relative to P)
NF	Dummy variable for student learning type "NF"
NT	Dummy variable for student learning type "NT"
SP	Dummy variable for student learning type "SP"
AGE	Student age

Table 2: Variable Definitions	
Variable	**Description**
MALE	Dummy variable for male student
NONWHITE	Dummy variable for nonwhite student
COURSE	Dummy variable for Professor/Course Section
ACTR	ACT composite score
GPAR	Current grade point average
CUMHRS	Cumulative hours taken
QRTHRS	Hours enrolled in current quarter
TRANSHRS	Hours transferred
IMR	Inverse Mills Ratio derived from probit selection equation.
CONTINUE	Dummy variable for continued enrollment through macro and micro sections
NINTROQ	Normalized intro quiz score
NINTROT	Normalized intro test score
NMICROQ	Normalized micro quiz score
NMAC1ST	Normalized macro test score where macro taught before micro
NMACROQ	Normalized macro quiz score
NMIC1ST	Normalized micro test score where micro taught before macro
NMICROT	Normalized micro test score
NMACROT	Normalized macro test score
Note: Variables with suffix "1" indicate the micro model; with "2" the macro model	

Instructional methods, course layout, tests, homework, quizzes, and syllabus, were closely replicated in the two course sections. A complicating logistical constraint occurred in Winter 2003 course when the principal instructor in the Spring 2002 course was available to teach only the micro segment of the Winter 2003 course section. This necessitated having a second instructor cover the macro segment of that course section. We control for this effect by specifying the dummy variable, COURSE, taking a value of one where the course is team-taught, zero otherwise. One further difference between the two course sections is in regard

to the order of presentation of the material. The introductory segment was always taught first in each course, with associated exams given prior to the official drop date. However, micro preceded macro in Spring 2002 and this was reversed in Winter 2003. We control for this by including the variables NMIC1ST and NMAC1ST to account for the impact of the presentation of macro (micro) before the micro (macro) material. Though a confounding influence, a fortunate result of this is that in controlling for this order reversal, our results yield a variable with important implications, which we discuss later in our results.

We normalize all quiz and test scores to assume values between 0 and 100 using the following linear scaling formula:

$$YNorm = \frac{100 \times (Y - Y\min)}{(Y\max - Y\min)}$$

where Y equals the corresponding raw quiz or test score.

Students have at their discretion the decision whether to participate in the experiments by continuing enrollment in the course. This decision is influenced by early indicators of performance as well as native ability, personality, and other characteristics. Given the decision to continue enrollment, the performance in the micro and macro segments is influenced by the performance in the segments preceding it, as well as native ability, personality, etc. We specify a system of equations with self-selection as follows:

$$y_{1it} = X_{1it}\beta_1 + y^*_{2i}\delta_2 + u_{1it}$$
$$y_{2it} = X_{2it}\beta_2 + y^*_{1i}\delta_1 + u_{2it}$$
$$I^*_i = Z_i\gamma + e_i$$

where i=1,2, … N students, t=1, 2 courses, y_{1it} is the micro score of the ith student in course t, X_{1it} are exogenous variables predicting the micro score, y_{2it} is the macro score of the ith student in course t, X_{2it} are exogenous variables predicting the macro score, I_i* is the "continue enrollment" decision function of the ith student, *Zi* are exogenous variables predicting enrollment decision. The d_1, d_2, b_1, b_2 and g are unknown parameters and u_{1it}, u_{2it} are random disturbances for the equation system and e_i is a random disturbance for the enrollment decision function. We use the

Heckman two-step estimator that is thoroughly described in most graduate level econometrics textbooks (e.g., Green (1993), Amemiya (1985) and Maddala (1983)). The first step estimates g using probit MLE. The "inverse Mills ratio" is calculated as follows:

$$\hat{\lambda} = \frac{\phi(Z_i\hat{\gamma})}{\Phi(Z_i\hat{\gamma})}$$

where *f* and F are the density function and distribution function of the standard normal evaluated at $Z_i\hat{\gamma}$. In the second step we estimate the combined model using OLS where the dependent variable is positive. The combined model has the following form:

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} X_1 & y_2^* & \hat{\lambda} & & 0 & \\ & 0 & & X_2 & y_1^* & \hat{\lambda} \end{bmatrix} \begin{bmatrix} \beta_1 \\ \delta_2 \\ \alpha_1 \\ \beta_2 \\ \delta_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

which can be rewritten more compactly as

$$y = X\beta + u$$

The parameters of this model can be consistently estimated using OLS. However, because the Heckman model is heteroscedastic, we use FGLS with the following consistent covariance matrix

$$(X'X)^{-1}X'AX(X'X)^{-1}$$

where A is a diagonal matrix the jth element of which is $[y_j - x_j'\hat{\beta}]^2$. See Amemiya (1985, p.370).

The middle right-hand-side variables y_2^* is the macro exam score in the course where macro preceded micro. Similarly, y_1^* is the micro exam score in the course where micro preceded macro. These are defined as follows:

$$y_2^* = \begin{cases} y_2 & \textit{if macro preceded micro} \\ 0 & \textit{otherwise} \end{cases}$$

The combined model specified above is convenient for testing cross equation hypotheses. In particular, we are interested in testing (jointly) if the personality coefficients in macro are the same as in micro and whether the micro exam effect is the same as the macro. This provides us with 3 test scenarios:

Test 1. The personality coefficients in macro are the same as those in micro and the micro exam effect is the same as the macro exam effect.
Test 2. The personality coefficients in macro are the same as those in micro.
Test 3. The micro exam effect is the same as the macro exam effect.

Clearly, 2 and 3 are a decomposition of 1. These tests are easily carried out in the least squares second step by imposing linear restrictions of the (Rb-r) form, computing the corresponding F-statistics, and evaluating these against a critical F of the same numerator and denominator degrees of freedom. The results of these tests are presented in Tables 5 through 7.

RESULTS

Descriptive statistics for our model variables are presented in Table 3. Estimates for the probit selection equation are presented in Table 4, and parameter estimates for the microeconomics and macroeconomics equations are presented in Tables 5-7, where we also present the results of three test scenarios discussed in the previous section. We estimate three separate systems of equations, corresponding to the three aspects of personality type under consideration (i.e., personality type, the individual dichotomies, and temperaments). In each case, we first present a casual comparison of the results for the two fields of study within the context of

each of these three personality type characteristics. We then provide additional results in the form of formal tests designed to determine whether the impact of personality type differs for the two fields.

Table 3: Descriptive Statistics

Variable	Mean	Std.Dev.	Minimum	Maximum
ENFJ	0.0500	0.2189	0	1
ENFP	0.1917	0.3953	0	1
ENTJ	0.0167	0.1286	0	1
ENTP	0.0500	0.2189	0	1
ESFJ	0.0333	0.1803	0	1
ESFP	0.0500	0.2189	0	1
ESTJ	0.0833	0.2775	0	1
ESTP	0.1000	0.3013	0	1
INFJ	0.0333	0.1803	0	1
INFP	0.0917	0.2898	0	1
INTJ	0.0083	0.0913	0	1
INTP	0.0750	0.2645	0	1
ISFJ	0.0167	0.1286	0	1
ISFP	0.0750	0.2645	0	1
ISTJ	0.0917	0.2898	0	1
ISTP	0.0333	0.1803	0	1
I	0.4250	0.4964	0	1
S	0.4833	0.5018	0	1
T	0.4583	0.5004	0	1
J	0.3333	0.4734	0	1
NF	0.3667	0.4839	0	1
NT	0.1500	0.3586	0	1
SP	0.2583	0.4396	0	1
AGE	21.0583	2.5282	19	35

Table 3: Descriptive Statistics				
Variable	**Mean**	**Std.Dev.**	**Minimum**	**Maximum**
MALE	0.6667	0.4734	0	1
NONWHITE	0.2750	0.4484	0	1
COURSE	0.4333	0.4976	0	1
ACT_R	24.7141	4.3822	14	34
GPA_R	2.7607	0.8986	0	4
CUMHRS	51.4846	35.9669	0	156
QRTHRS	9.3917	2.6735	0	14
TRANSHRS	9.6846	18.8692	0	95
IMR	0.0000	0.4751	-2.0918	1.65643
CONTINUE	0.8500	0.3586	0	1
NINTROQ	54.5917	20.6020	1	100
NINTROT	69.5417	21.9181	1	100
NMICROQ	65.2083	32.8313	0	100
NMICROT	60.6833	29.1034	0	100
NMACROQ	49.6389	28.1247	0	100
NMACROT	62.0917	30.3127	0	100
NMAC1ST	30.7500	40.5989	0	100
NMIC1ST	35.5500	38.6688	0	97

First, in Table 5, we present the estimates for the model which includes all 16 personality types, though these results should be interpreted with caution given that some of these types are sparsely populated in the sample. A casual examination of these results reveals that some aspects of personality type are relevant in determining student performance in both macroeconomics and microeconomics, though the results suggest that this relationship may not be identical for the two fields. In the microeconomics equation students with the ISTJ personality type performed significantly better than their INTJ counterparts, as did INFPs. ISFJs, on the other hand, performed significantly worse. The results for the macroeconomics portion of the class vary somewhat form this as differences exist in both significance and magnitude of coefficients.

Table 4: Probit Selection Equation Results				
	Coeff.	**Std .Err.**	**t-ratio**	**P-value**
INTERCEPT	-4.8962	3.5370	-1.3843	0.1663
NF	0.6234	0.5952	1.0475	0.2949
NT	0.5472	0.7570	0.7228	0.4698
SP	0.3533	0.7105	0.4973	0.6190
AGE	0.0764	0.1549	0.4928	0.6221
MALE	-0.2855	0.4288	-0.6657	0.5056
NONWHITE	-0.2279	0.4992	-0.4566	0.6480
PROFB	0.8513	0.5879	1.4480	0.1476
ACTR	-0.0124	0.0543	-0.2286	0.8192
GPAR	0.0156	0.2839	0.0551	0.9561
CUMHRS	-0.0052	0.0101	-0.5206	0.6027
QRTHRS	0.1243	0.0926	1.3416	0.1797
TRANSHRS	0.0037	0.0153	0.2419	0.8089
NINTROQ	0.0311	0.0153	2.0344	0.0419
NINTROT	0.0289	0.0104	2.7778	0.0055
Dep Var = CONTINUE				

First, as was the case in microeconomics, ISTJs perform at a higher level that do INTJs, while ISFJs tend to do worse. The INFP coefficient, however, fails to achieve significance, while the coefficient for ENTJs suggests they perform significantly worse that those with the INTJ type. Past performance in the class, as illustrated by the variables NINTROQ1, NINTROT1, and NMacro (NMicro) Q1, cumulative GPA all have a positive impact on student performance in microeconomics, while in macroeconomics cumulative GPA does not. On the surface, personality type would appear to impact student performance in both micro and macroeconomics, with slight variations, primarily in the performance of INFPs and ENTJs. While we did not hypothesize about potential differences between the personality types, we see little evidence in these results that would support the hypotheses of our paper. This evidence suggests limited differences in the two fields, yet more formal tests are needed to verify this. Therefore, in an attempt to

verify this conclusion, we test the restriction that the joint effect of personality type is the same across the macro and micro equations (see Test 2, Table 5)). The results of the test suggest that we cannot reject the null that jointly, the personality type effect is the same.

Table 5: Personality Type Estimates

	Coeff.	Std.Err.	t-ratio	P-value	
INTERCEPT1	-15.6933	15.1009	-1.0392	0.3004	
ENFJ1	5.5633	5.7938	0.9602	0.3386	
ENFP1	2.6584	4.9857	0.5332	0.5947	
ENTJ1	1.2697	6.4516	0.1968	0.8443	
ENTP1	-3.1968	6.6997	-0.4772	0.6340	
ESFJ1	1.1699	4.6234	0.2530	0.8006	
ESFP1	7.8425	5.5431	1.4148	0.1593	
ESTJ1	7.4340	5.1562	1.4418	0.1515	
ESTP1	7.4668	5.3751	1.3892	0.1669	
INFJ1	3.6184	6.9535	0.5204	0.6036	
INFP1	10.2049	4.9761	2.0508	0.0421	**
INTP1	3.1440	4.4350	0.7089	0.4795	
ISFJ1	-18.8074	6.9225	-2.7169	0.0074	***
ISFP1	2.9385	5.1410	0.5716	0.5685	
ISTJ1	10.0790	5.0974	1.9773	0.0499	**
ISTP1	-0.5628	5.0117	-0.1123	0.9107	
AGE1	0.1457	0.3540	0.4115	0.6813	
MALE1	3.1587	2.3668	1.3346	0.1841	
NONWT1	1.4161	2.4787	0.5713	0.5687	
COURSE1	-12.8019	8.0521	-1.5899	0.1141	
ACTR1	0.0287	0.3327	0.0863	0.9314	
GPAR1	2.8646	1.4427	1.9856	0.0490	**
CUMHRS1	0.0078	0.0330	0.2348	0.8147	
QRTHRS1	0.3423	0.6937	0.4935	0.6224	

Table 5: Personality Type Estimates					
	Coeff.	**Std.Err.**	**t-ratio**	**P-value**	
TRNHRS1	-0.0138	0.0638	-0.2169	0.8286	
NINTOQ1	0.2315	0.1064	2.1765	0.0311	**
NINTROT1	0.4817	0.1300	3.7062	0.0003	***
NMICROQ	0.1627	0.0656	2.4818	0.0142	**
NMAC1ST	0.1041	0.0882	1.1804	0.2398	
IMR1	32.2235	7.7675	4.1485	0.0001	***
INTERCEPT2	-6.9577	9.9193	-0.7014	0.4842	
ENFJ2	-1.1303	4.1357	-0.2733	0.7850	
ENFP2	-4.7434	3.7394	-1.2685	0.2067	
ENTJ2	-11.1587	4.9583	-2.2505	0.0259	
ENTP2	6.0220	4.9115	1.2261	0.2222	
ESFJ2	0.9379	3.2906	0.2850	0.7760	
ESFP2	2.6213	6.7003	0.3912	0.6962	
ESTJ2	2.9034	5.1865	0.5598	0.5765	
ESTP2	1.1367	3.8982	0.2916	0.7710	
INFJ2	-0.3707	4.4042	-0.0842	0.9330	
INFP2	4.6407	3.3409	1.3891	0.1670	
INTP2	-3.4858	4.6754	-0.7456	0.4571	
ISFJ2	-12.5858	5.7834	-2.1762	0.0312	**
ISFP2	0.4068	4.0173	0.1013	0.9195	
ISTJ2	7.9640	3.9349	2.0239	0.0448	**
ISTP2	9.4226	5.1848	1.8174	0.0712	*
AGE2	-0.0483	0.2936	-0.1645	0.8695	
MALE2	2.0824	1.7851	1.1665	0.2453	
NONWT2	-0.6731	2.0020	-0.3362	0.7372	
COURSE2	39.1603	7.0952	5.5193	0.0000	***
ACTR2	-0.0881	0.3007	-0.2928	0.7701	
GPAR2	1.9003	1.6049	1.1841	0.2383	

Table 5: Personality Type Estimates					
	Coeff.	**Std.Err.**	**t-ratio**	**P-value**	
CUMHRS2	0.0388	0.0263	1.4756	0.1422	
QRTHRS2	0.1125	0.4259	0.2640	0.7921	
TRNHRS2	0.0310	0.0533	0.5819	0.5616	
NINTOQ2	0.0963	0.0758	1.2715	0.2056	
NINTROT2	0.1815	0.0963	1.8845	0.0615	*
NMACROQ	0.2960	0.0645	4.5927	0.0000	***
NMIC1ST	0.4118	0.0927	4.4414	0.0000	***
IMR2	9.3710	6.1305	1.5286	0.1286	
Restriction Tests					
MBTI	**F-Stat**	**DF (n,d)**	**Prob**		
Test 1	0.9038	16,144	0.5661		
Test 2	0.7707	15,144	0.7080		
Test 3	3.9245	1,144	0.0495	**	
Note: * = 0.10 significance; ** = 0.05 significance; *** = 0.01 significance.					

Table 6 contains the results for the individual personality traits. Here we find fewer significant coefficients than was the case in the previous model. Note that none of the individual dichotomies are significant in the microeconomics equation, though gender, GPA, and performance in the introductory portion of the course are significant. The macro equation yields quite different results. Here we find that Is tend to perform better than Es, and that Ss perform better than Ns. Other results are reasonably consistent with our other models/equations, and teaching micro first is again a significant determinant of student performance. In interpreting these results, it should be noted that any lack of significance of this measure of personality type is not entirely surprising given the seemingly superior relevance of personality type and temperament suggested in the literature. Nonetheless, we do see evidence of differences in the results of macro relative to micro. While these personality traits appear to play no significant role in determining student performance in microeconomics, the results in macroeconomics show Is and Ss at a relative advantage to Es and Ns. While we had no prior expectations regarding the I vs. E comparison, we had anticipated that Ss would be at a relative advantage in

both fields, but that the advantage may be relatively smaller in macroeconomics. This hypothesis, however, is obviously not supported by our results. Further evidence of this is provided in Table 6 where we report the results of our across equation restrictions on the joint effect of personality trait. Our test fails to reject the null of equal effects across equations, once again bringing into question the notion that the impact of personality traits/characteristics varies across the two fields (see Test 2, Table 6).

Table 6: Individual Dichotomy Estimates

	Coeff.	Std.Err.	t-ratio	P-value	
I1	0.6523	1.9128	0.3410	0.7335	
S1	1.5445	2.0527	0.7524	0.4529	
T1	-1.0762	1.9168	-0.5615	0.5752	
J1	1.3035	2.0174	0.6461	0.5191	
AGE1	0.2573	0.3840	0.6698	0.5039	
MALE1	4.3361	2.4337	1.7817	0.0766	*
NONWT1	1.2768	2.7790	0.4595	0.6465	
COURSE1	-8.0808	7.7953	-1.0366	0.3014	
ACTR1	0.1180	0.3574	0.3302	0.7417	
GPAR1	2.6077	1.3605	1.9168	0.0570	*
CUMHRS1	-0.0034	0.0298	-0.1153	0.9084	
QRTHRS1	0.2842	0.7276	0.3906	0.6966	
TRNHRS1	-0.0349	0.0715	-0.4876	0.6264	
NINTROQ1	0.2566	0.1077	2.3836	0.0183	**
NINTROT1	0.4317	0.1453	2.9713	0.0034	***
NMICROQ	0.1807	0.0694	2.6019	0.0101	**
NMAC1ST	0.0653	0.0897	0.7279	0.4677	
IMR1	25.1580	8.9150	2.8220	0.0054	***
INTERCEPT2	-10.1545	12.7568	-0.7960	0.4272	
I2	3.1050	1.8058	1.7194	0.0874	*
S2	4.7012	2.0167	2.3311	0.0210	**

Table 6: Individual Dichotomy Estimates					
	Coeff.	**Std.Err.**	**t-ratio**	**P-value**	
T2	1.0160	2.1849	0.4650	0.6425	
J2	0.1881	1.7358	0.1084	0.9138	
AGE2	-0.1169	0.3900	-0.2998	0.7647	
MALE2	2.2767	2.0014	1.1375	0.2570	
NONWT2	1.0105	2.0665	0.4890	0.6255	
COURSE2	42.9035	6.8284	6.2831	0.0000	***
ACTR2	0.2721	0.2939	0.9257	0.3559	
GPAR2	2.0068	1.6992	1.1810	0.2393	
CUMHRS2	0.0550	0.0303	1.8178	0.0709	**
QRTHRS2	-0.2982	0.4511	-0.6611	0.5095	
TRNHRS2	-0.0334	0.0554	-0.6020	0.5480	
NINTOQ2	0.0324	0.0804	0.4029	0.6876	
NINTROT2	0.1388	0.0979	1.4180	0.1581	
NMACROQ	0.2901	0.0648	4.4763	0.0000	***
NMIC1ST	0.4608	0.0912	5.0518	0.0000	***
IMR2	1.8823	6.3027	0.2986	0.7656	
Restriction Tests					
I-S-T-J Subtypes	**F-Stat**	**DF (n,d)**	**Prob**		
Test 1	1.9212	5,166	0.0934	*	
Test 2	0.6014	4,166	0.6622		
Test 3	7.4149	1,166	0.0072	***	
Note: * = 0.10 significance; ** = 0.05 significance; *** = 0.01 significance.					

The results for student temperaments are presented in Table 7. As suspected, we find that student temperaments do impact student performance in a significant fashion. In microeconomics we find that NTs are at a relative disadvantage when compared to SJs, though the coefficients associated with other temperaments are not significant. In macroeconomics, NTs are once again at a relative disadvantage when compared to SJs, as are NFs. While we had anticipated

that SJs would be at a relative advantage in both fields of study, we hypothesized that they would be at a larger relative advantage in microeconomics. However, we find the relative disadvantage of NTs to be very similar in the two equations, and NFs are indeed at a relative disadvantage in macro, rather than micro. So while we do find that temperaments play a role in student performance in introductory economics, we find little support for our original hypothesis. Further, any variation in the role of personality type across disciplines once again finds no support in our test of across equation restrictions, which fails to reject the null of equal effects of all temperaments across the micro and macro equations (see Test 2, Table 7).

Table 7: Temperament Estimates

	Coeff.	**Std.Err.**	**t-ratio**	**P-value**	
INTERCEPT1	-15.0451	17.1460	-0.8775	0.3815	
NF1	-0.5549	2.7912	-0.1988	0.8427	
NT1	-6.4661	2.4932	-2.5935	0.0103	**
SP1	-1.9709	2.3607	-0.8349	0.4050	
AGE1	0.3883	0.3677	1.0559	0.2925	
MALE1	5.1599	2.4424	2.1127	0.0361	**
NONWT1	1.9249	2.7272	0.7058	0.4813	
COURSE1	-8.9683	7.4367	-1.2060	0.2295	
ACTR1	0.1206	0.3511	0.3435	0.7317	
GPAR1	2.8417	1.3104	2.1686	0.0315	**
CUMHRS1	-0.0103	0.0296	-0.3478	0.7284	
QRTHRS1	0.3539	0.7130	0.4963	0.6203	
TRNHRS1	-0.0303	0.0712	-0.4257	0.6709	
NINTROQ1	0.2520	0.1026	2.4570	0.0150	**
NINTROT1	0.4363	0.1401	3.1139	0.0022	***
NMICROQ	0.1722	0.0667	2.5800	0.0107	**
NMAC1ST	0.0687	0.0856	0.8026	0.4233	
IMR1	24.7100	8.6291	2.8636	0.0047	***
INTERCEPT2	-8.6539	14.0753	-0.6148	0.5395	
NF2	-5.0671	2.7300	-1.8561	0.0652	*

Table 7: Temperament Estimates					
	Coeff.	**Std.Err.**	**t-ratio**	**P-value**	
NT2	-6.3050	3.1654	-1.9919	0.0480	**
SP2	-1.1182	2.5038	-0.4466	0.6557	
AGE2	0.0230	0.4106	0.0560	0.9554	
MALE2	3.0910	1.8825	1.6420	0.1025	
NONWT2	1.4889	2.0378	0.7306	0.4660	
COURSE2	41.6545	6.8021	6.1238	0.0000	***
ACTR2	0.2817	0.2918	0.9653	0.3358	
GPAR2	2.2429	1.6351	1.3717	0.1720	
CUMHRS2	0.0422	0.0304	1.3883	0.1669	
QRTHRS2	-0.2154	0.4824	-0.4466	0.6557	
TRNHRS2	-0.0248	0.0573	-0.4332	0.6654	
NINTOQ2	0.0473	0.0862	0.5493	0.5835	
NINTROT2	0.1681	0.1005	1.6726	0.0963	*
NMACROQ	0.2783	0.0636	4.3742	0.0000	***
NMIC1ST	0.4378	0.0905	4.8364	0.0000	***
IMR2	2.8425	6.2465	0.4551	0.6497	
Restriction Tests					
Temperaments	**F-Stat**	**DF (n,d)**	**Prob**		
Test 1	2.1064	4,168	0.0822	*	
Test 2	0.7824	3,168	0.5053		
Test 3	6.4532	1,168	0.0120	**	
Note: * = 0.10 significance; ** = 0.05 significance; *** = 0.01 significance.					

COMPARISON TO PAST WORK

As noted previously, prior to this current study, the only evidence available regarding the impact of personality type in macroeconomics relative to microeconomics, was from casual examination of the results of two independent

studies which were not specifically designed to make this determination. Here we present a brief comparison of our results, relative to those found by past authors.

In microeconomics, Ziegert (2000) determined that Ss and Ts performed significantly better than Ns and Fs, and that NFs and NTs performed worse than SJs. This is in contrast to our results for microeconomics which show no significant relationship for the individual personality traits, and that, in terms of temperaments, only NTs perform significantly worse than SJs. In macroeconomics, Borg and Shapiro (1996) find that Is perform better than Es, and that NFs and NTs perform at a lower level than SJs. Whereas our macro results show that not only do Is perform better than Es, but also that Ss perform better than Ns, in addition to NFs and NTs performing more poorly than SJs.

While some similarities appear to exist between our work and past work, the main goal here is to determine the degree to which conclusions drawn from a casual comparison of past work would hold up to formal statistical testing. A comparison of the coefficient signs and magnitudes from the work of Borg and Shapiro with that of Ziegert might lead one to conclude that the role of personality type is significantly different in the two fields. For instance, the two papers show no similarities in the significance of individual dichotomies, and the magnitudes of the temperament coefficients are two to three times larger in Borg and Shapiro (macro) when compared to those found by Ziegert (micro)[3]. Contrasting this with our results, a simple comparison of coefficients might suggest that the relationship for the individual dichotomies is quite different in macro vs. microeconomics, and somewhat different from that suggested by a comparison of past research. One might also conclude the impact of temperaments is only slightly different in the two fields, which of course differs from that suggested by past work. Fortunately, the structure of our study allows the ability to move past casual comparison and perform a formal test of the relationship between personality type and student performance. We find that although the estimates are not identical for the two fields of study, their differences cannot be confirmed through formal statistical testing. This important result confirms the relevance of this current work which allows for formal testing and finds that the results do not support conclusions drawn from a casual comparison of past work.

FURTHER RESULTS

One anomaly in our study worthy of exploitation is that, while great care was taken to ensure that both course sections were taught using identical methods,

the fact remains that the order in which macro and micro were taught was reversed in the two sections. We control for this effect in our modeling, as is demonstrated by the NMAC1ST and NMIC1ST variables, and thus its impact should be negligible for our primary results. We believe, however, that the inclusion of this variable provides a unique opportunity to further our understanding of economic education. Given the often-debated issue regarding the order in which micro and macroeconomics are to be placed in the curriculum, the coefficient on these variables provides valuable information. The variables are designed to determine the effect of performance in macro (micro) on a student's performance in micro (macro) given that the macro (micro) portion of the class was taught first. If a positive, significant, coefficient is found for either of these variables, it implies that material learned in one section of the course had a positive influence on performance in the other, and therefore students benefited from the order in which the material was taught. Notice that in all models, the coefficient of MIC1ST is positive and significant, whereas the coefficient on MAC1ST is relatively small, and insignificant. To further explore this, we test the restriction that the coefficients of MAC1ST and MIC1ST are equal in each model (Test 3 in Tables 5-7). We find that we can reject this null at the .05 level in all models. This result implies that teaching microeconomics before macroeconomics benefits students, whereas the opposite is not true.

CONCLUSION

We construct a study designed to directly compare the relative role of personality type as a predictor of student performance in introductory macro vs. microeconomics. Past work on the role of personality type has failed to effectively address the potential differences in the role of type in determining student performance in introductory macroeconomics as opposed to microeconomics. Previous studies have, coincidentally, been performed on both introductory micro and macro, allowing for comparisons between the two fields that are speculative at best. Interestingly, such comparisons lead one to conclude that the role of personality type is different in the two fields. Our study utilizes a one-quarter survey course designed to cover both macroeconomics and microeconomics, thus allowing a direct comparison, and formal testing, of potential differences in the role of personality type in the two branches of introductory economics. Though a casual comparison of our results would suggest that differences in the two fields do exist, all formal tests reject the notion, implying that personality type plays a similar role

in the two fields of study. Further results suggest that the order in which the two fields are taught plays a significant role in determining student performance. We find that teaching microeconomics first tends to help students in learning macroeconomics, though the reverse is not true.

ENDNOTES

1 For a more detailed description the reader is referred to the work by Borg and Shapiro (1996).

2 These regressions take the following form: 1) LOGACT=3.35798 - NONWHITE*0.13969 + MALE*0.07375 and 2) LOGGPA=1.25178 - NONWHITE*0.09190 - NF*0.15458 - NT*0.33596 - SP*0.15539, where LOGACT and LOGGPA are the log of ACT composite and college GPA, respectively, and the independent variables are defined in Table 2. Predictions are converted to levels for the analysis.

3 Recall that these coefficients are from ordered probit models, and should be interpreted accordingly.

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