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DOES INSTRUCTOR APPEARANCE AFFECT STUDENT LEARNING OF PRINCIPLES OF ECONOMICS?*

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ABSTRACT

Six classes of the same course on Economic Principles were compared. The test group was taught by the instructor dressed in business attire, while the comparison group was taught by the instructor dressed casually. Results show that the attendance for test students was 2.73 percentage points higher than comparison students and this increase is associated with an improvement in their final exam score of 0.39 percentage points. Final exam scores for test students were 2.62 percentage points higher than comparison students. The indirect and direct effects together indicate that the total effect on learning from instructor attire is 3.01 percentage points. These results are strikingly similar to those from a previous experiment conducted on students at a different university and taught by a different instructor.

Keywords: attendance, attire, exam, experiment, replication, undergraduate.

JEL classifications: A22.

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1. INTRODUCTION

Many business schools and several economics departments have implemented professional dress codes for faculty. The literature supports this to some extent by suggesting that students perceive faculty members dressed in business attire to be better organized, better prepared and more knowledgeable than casually dressed faculty (Rollman 1980; Leathers 1992; Morris *et al.* 1996; Roach 1997; Lavin, Carr & Davies 2009a & 2009b; Lightstone, Francis & Kocum 2011). In economics, Craig & Savage (2014) estimate the effect on student learning of industrial organization from the instructor dressed in business attire and find that the final exam scores for test students were 3.02 percentage points higher than comparison students. They provide two reasons why the test group performed better than the comparison group. The first is an "indirect effect", whereby students perceive a more professional attitude from the instructor dressed in business attire and attend more classes. The second is a "direct effect", whereby business attire positively influences student attention in the classroom through the perception that classroom concepts and activities are more important. This paper tests the robustness of these effects by repeating the Craig and Savage experiment in an alternative environment.

Six sections from an undergraduate course on *Economic Principles* at the *University of Colorado*, *Colorado Springs*, were randomly assigned to comparison and test groups. The 240 students in these classes were taught by the same instructor but pupils were not aware that they were participating in an experiment. Any differences in student characteristics between the comparison and test groups were controlled for in the empirical model of student performance. Model results show that the effect on student performance from instructor attire is both indirect and direct. The attendance for students in the test group was 2.73 percentage points higher than comparison students and this increase is associated with an improvement in their cumulative final exam score of 0.39 percentage points. Controlling for attendance, final exam scores for test group students were about 2.62 percentage points higher than comparison students. The indirect and direct effects together indicate that the total effect on student learning from instructor attire is 3.01 percentage points, which, on average, is the difference between earning a *C* and a *B*- on the final exam. In contrast to previous studies outside of Economics, the results from this evaluation suggest that instructor attire does not affect female and male students differently.

There are several environmental differences between this evaluation and the original experiment. The new evaluation is conducted on students from a smaller University by a different instructor. Moreover, the students are evaluated in a lower-division required class on *Principles of Economics* as opposed to an upper-division elective on *Industrial Organization*. There are also differences in the sample size and the specification of the empirical model. The sub-sample of females in the new evaluation is substantially larger (i.e., 84 compared to 26), and the empirical model controls for time-of day effects, semester effects, and pre-course economic ability and knowledge with the *Test of Understanding in College Economics* (TUCE-4 Microeconomics Test; Walstad *et al.* 2007). Despite such differences, the results from the new experiment are strikingly similar to those from Craig & Savage (2014). In addition, the potential endogeneity of student attendance and experimenter bias are ruled out with a robustness test and with an additional source of external evidence on student opinions from the faculty course questionnaire (FCQ).

In the following section we review the prior literature and state the questions of interest. We then describe the data, outline the empirical model of student performance and present results.

2. PRIOR LITERATURE AND QUESTIONS

We focus on attire in college Economics Departments because several departments or universities, including *Brigham Young University*, *Edith Cowan University*, *Oral Roberts University*, *The Citadel*, *Tristate University*, *University of New South Wales*, *Alabama A&M*, *University of Wisconsin School of Medicine and Public Health*, *Ave Maria University, Columbia University*, *College of Physicians and Surgeons*, *Alabama State University*, *University of Wisconsin*, *Milwaukee*, *Saint Louis University*, *Norwich University*, and *Virginia Military Institute*, have introduced, or experimented with, professional dress codes or guidelines for faculty.

Prior studies on the impacts of faculty attire have focused primarily on college student perceptions of teaching competence using photographs of instructors in non-classroom settings (Bassett 1979; Rollman 1980; Lavin *et al.* 2009a & 2009b, Lightstone *et al.* 2011). Because they do not involve actual student-teacher interactions, Morris *et al.* (1996), Roach (1997), and Dowling (2008) advocate field experiments. However, these experiments often suffer from non-random assignment of instructor attire, measurement error in the important outcome variables of interest, and failure to control for differences between the test and comparison groups that may confound the analyses. Craig & Savage (2014) use a field experiment with random assignment and appropriate controls to model the direct and indirect mechanisms through which instructor attire affects the behaviour of students in the classroom. However, because this is a one-off study, the results could arguably be specific to their environment and, as such, it is not clear that their finding of direct and indirect effects are real or due to chance.

A related literature studies the effects of the attractiveness of professors. For example, Hamermesh & Parker (2005), Smith (2005), and Green, Mixon & Trevino (2005, 2013) find that that more attractive professors score higher on student evaluations, and are more likely to choose employment at teaching-based universities and colleges over research-based universities and colleges. This suggests that attractive professors sort into environments such as liberal arts colleges and universities, where they will earn a greater return on attractiveness. Mixon & Smith (2013) also find that more attractive professors will exploit this feature by offering classes that are more rigorous or desirable from the professor's standpoint.

This study tests the robustness of the indirect and direct effects described by Craig & Savage (2014) by repeating their experiment in an alternative environment. The three questions of interest are: do economics students exposed to the instructor dressed in business attire attend more classes than students who are not exposed to the instructor dressed in business attire; conditional on attendance, do economics students exposed to the instructor dressed in business attire perform better in their final exam than students who are not exposed to the instructor dressed in business attire; and does instructor business attire impact the attendance and/or final exam scores of female and male students differently? In addition, external evidence from FCQ data is used to investigate whether instructor experimenter bias is driving the relationship between instructors' attire and student learning.

3. DATA

The effects from the instructor dressing in business attire in the teaching of economics were evaluated with data from an experiment with six undergraduate classes of *Economic Principles* comprising a total of 240 students.

Experimental Design

During Fall of 2013, Fall and Spring of 2014, and Spring of 2015, six classes of ECON 1010 Introduction to *Microeconomics* at the *University of Colorado, Colorado Springs* were randomly assigned to comparison and test groups. The course teaches fundamental principles of microeconomics and applies these principles to the analysis of the market system and its role in allocating goods and services. The Spring 2014 class and the two Fall 2014 classes served as the test group and were taught with the instructor dressed in business attire. Business attire consisted of a dark business suit, a white or blue business shirt with a tie, and black dress shoes. The two Fall 2013 classes and the Spring 2015 class served as the comparison and were taught with the instructor dressed in casual attire. Casual attire consisted of a collared shirt, jeans, and brown sandals, or black casual shoes. Pictures of the instructor in formal and casual attire can be seen in Figure 1.

Casual Attire Formal Attire

Figure 1: Examples of Instructor Attire

The experimental design aims to minimize any differences between the comparison and the test classes caused by factors other than instructors dressed in business attire. Students registered for each section through an online portal; they indicated their preferences and the system allocated the class on a first-come, first-served basis. Wait-list requests were prioritized by first on the wait list was first to be enrolled should any vacancies appear. Students could be admitted directly with overriding permission from the instructor, however there were no overriding admissions in the sections used in these experiments. Students were not aware that they were being evaluated. No information was provided in the syllabus or to academic advisors prior to registration to inform students that the instructor would be wearing different attire in each class. All classes were taught by the same instructor with the same syllabus, course content and work requirements. The Fall 2013 and 2014 classes ran from either 8:00 to 9:15 a.m. or 1:40 to 2:55 p.m. on Monday and Wednesday; the Spring 2014 and 2015 classes ran from 1:40 to 2:55 p.m. on Monday and Wednesday. The class size was capped at 45, with the smallest size being 40 students by the end of the term and the largest being 43.

Attendance was taken by the instructor at the beginning of every class and converted to a 100-point score for this evaluation, with "100" indicating zero absenteeism. The comparison and the test groups had the same cumulative final exams, graded by the same instructor. The final exam was a multiple choice exam consisting of 70 questions covering the material for the entire course. This final exam score has also been converted to a 100-point score to measure student performance.

Sample Characteristics

Table 1 shows that the comparison group (121 students) and the test group (119 students) are similar across attendance, final exam score, and almost all observable student characteristics. Test group students attended 92.7 percent of classes, compared to 91.5 percent for comparison students, but this difference is not statistically significant. Similarly, the average final exam score for test group students was 58.7 percent, compared to 57.2 percent for comparison students, but this difference is not statistically significant. Comparison students visited the course tutor more. On average, comparison students made 0.64 visits to the tutor throughout the semester, compared to 0.15 visits for test students, and this difference is statistically significant (t = 2.693; Prob > $|t|$ = 0.01). Potential differences between the test and comparison groups are accounted for in the empirical model of student performance with appropriate control variables.

Table 1: Student Characteristics

Variable	Description	Comparison Group Mean (s.e.)	Test Group Mean (s.e.)	Difference in Groups (s.e.)
PRE_TEST	Percentage score in the pre-course test of economic ability and knowledge (TUCE-4 Microeconomics Test).	31.21 (0.861)	32.16 (0.970)	-0.945 (1.296)
VISITS	Number of visits to the tutor during the semester.	0.636 (0.168)	0.151 (0.060)	0.485*** (0.180)
FALL	One if fall semester, zero otherwise.	0.661 (0.043)	0.664 (0.043)	-0.003 (0.061)
AM	One if fall semester, zero otherwise	0.339 (0.043)	0.336 (0.043)	0.003 (0.061)
UNDER_CLASS	One if student was a freshman or a sophomore, zero otherwise.	0.080 (0.031)	0.096 (0.032)	-0.016 (0.045)
MALE	One if fall semester, zero otherwise	0.636 (0.044)	0.664 (0.043)	-0.028 (0.062)
WHITE	One if fall semester, zero otherwise	0.802 (0.036)	0.748 (0.040)	0.054 (0.054)
ATTEND	Percentage of ECON 4697 classes attended	91.46 (1.112)	92.68 (0.892)	-1.223 (1.429)
FINAL_SCORE	Percentage score in the cumulative final exam	57.17 (0.954)	58.74 (1.038)	-1.573 (1.409)
Sample size		121	119	

Note: s.e. is standard error. Symbol **denotes significant at the 0.05 level, and *** at the 0.01 level. For the dummy variables, “Difference in Groups” is a two sample *z* test for the equality of proportions. For the continuous variables, “Difference in Groups” is a two sample *t* test for the equality of means.

For comparison, the appendix presents student characteristics from the sample used in Craig & Savage’s (2014) original experiment. The sample from this new experiment is comprised of relatively more underclassmen, which is expected since *Introduction to Microeconomics* is a lower-division class, while *Industrial Organization* is an upper-division class. There are also more females in the new experiment and students in the new experiment appear to attend more classes. These differences in student characteristics across the two samples are useful as they highlight the alternative environments in which the two experiments are conducted. By comparing the results from the old and new experiments, it is possible to assess the robustness of the effects on student learning of economics from instructor attire.

4. EMPRICIAL MODEL

We follow Craig & Savage (2014) and specify the following empirical model for student $i = 1, \dots, n$:

$$ATTEND_i = \alpha_0 + \alpha_1 TEST_i + \alpha_2 TREND_i + X_i'\beta + e_i \qquad (1)$$

$$FINAL_i = \gamma_0 + \gamma_1 TEST_i + \gamma_2 TREND_i + \gamma_3 ATTEND_i + X_i'\delta + u_i \qquad (2)$$

where *ATTEND* is the percentage of *ECON 1010 Introduction to Microeconomics* classes attended, *TEST* equals one for students randomly assigned to the test group taught by the instructor in business attire and zero for students in the comparison group taught by the instructor in casual attire, *TREND* equals one for Fall 2013 students, two for Spring 2014 students, three for Fall 2014 students, and four for Spring 2015 students, *X* is a vector of control variables, *FINAL* is the student's score on the final exam, α_0, α_1, α_2, γ_0, γ_1, γ_2 and γ_3 are parameters to be estimated, β and δ are vectors of parameters to be estimated, and *e* and *u* are error terms.

Equation (1) tests the effect of instructor attire on student attendance. The parameter of interest is $\alpha_1 = \partial ATTEND/\partial TEST$. If the null hypothesis that $\alpha_1 = 0$ cannot be rejected, this would be taken as evidence that instructor attire has no effect on attendance. The finding that $\alpha_1 > 0$ indicates that students attend more classes when the lectures are presented by an instructor dressed in business attire. Equation (2) controls for student attendance and tests the effect of instructor attire on the student's cumulative final exam score. Here, the parameter of interest is $\gamma_1 = \partial FINAL/\partial TEST$. If the null hypothesis that $\gamma_1 = 0$ cannot be rejected, this would be taken as evidence that, conditional on attendance, instructor attire has no direct effect on student performance. The finding that $\gamma_1 > 0$ indicates that students exposed to instructors in business attire perform better on the final exam than students who were not exposed.

Taken together, the parameters α_1, γ_1 and $\gamma_3 = \partial FINAL/\partial ATTEND$ provide information about the mechanisms through which instructor attire may affect student performance. From equations (1) and (2), the total effect on student performance from instructor attire is:

$$\frac{\partial FINAL}{\partial ATTEND} \cdot \frac{\partial ATTEND}{\partial TEST} + \frac{\partial FINAL}{\partial TEST} \tag{3}$$

The parameters $\gamma_3 \cdot \alpha_1 =$ measure the indirect effect and the parameter $\gamma_1 =$ measures the direct effect. Given $\alpha_1 > 0$, the finding that $\gamma_1 = 0$ and $\gamma_3 > 0$ indicates that the positive effect on student performance from instructor attire is indirect. Namely, because they perceive a more professional attitude toward teaching from the instructor dressed in business attire, students attend more classes, and their increase in attendance improves their cumulative final exam scores. The finding that $\gamma_1 > 0$ and $\gamma_3 = 0$ indicates that the positive effect on student performance from instructor attire is direct only. Restated, because instructor business attire positively influences student perception that classroom concepts and activities are important, students are more attentive to instructor delivery and perform better in the final exam. The finding that $\gamma_1 > 0$ and $\gamma_3 > 0$ indicates that the positive effect on student performance from instructor attire is both indirect, through increased attendance, and direct, through greater attention in the classroom (Craig & Savage 2014).

Following similar studies of student attendance and performance, the vector *X* contains elements that control for student ability, student knowledge and also demographics, as reported in Table 1 (Becker, Greene & Rosen 1990; Romer 1993; Durden & Ellis 1995; Agarwal & Day 1998; Brown & Leidholm 2002; Sosin *et al.* 2004; Barrow & Rouse 2005; Marburger 2006; Savage 2009; Craig & Savage 2014). The controls for student ability and knowledge are *PRE_TEST* (score in the pre-course *TUCE-4 Microeconomics Test*), *VISITS* (number of visits to the class tutor), and *UNDER_CLASS* (one if the student was a freshman or a sophomore and zero otherwise). The demographic and time controls are *MALE* (one if the student was male and zero otherwise) and *WHITE* (one if the student was white and zero otherwise), *AM* (one if the student took a morning class and zero otherwise), and *FALL* (one if the student took a fall class, and zero otherwise).

Note that some of the control variables are measured differently between the old and new experiments because each university records different information about their students. For example, *PRE_TEST* and *VISITS* replace the student's *GPA* and *SAT* score, while *AM* and *FALL* are added to control for time-of-day and time-of-year effects, respectively. The inclusion of *AM* and *FALL* in the model specification helps rule out the possibility that the time of day and/or year could be driving differences in student attendance. For example, because they are more interested in the material and/or more focused on academic goals, motivated students in morning classes may be more likely to attend classes. In addition, fall students may be very different from spring students because the introductory class for a large portion of the students may be their first semester of college which requires adaptation to a new rigor and lifestyle. In subsequent semesters freshman students are likely to have adapted to college life and will be more used to time management etc. and likely to perform better.

5. RESULTS

We report firstly the results of instructor attire on attendance and financial exam performance and then a series of robustness checks of these results.

Effects of Instructor Attire on Attendance and Final Exam Score

Estimates of the attendance equation (1) are presented in column two of Table 2, and estimates of the student performance equation (2) are presented in column three. Because there are student unobservables that are likely correlated across the attendance and performance equations, we estimate the two equations together with the seemingly unrelated regression (*SUR*) estimator.

The *R*-squared for the estimated attendance equation (1) is 0.077. The estimated coefficient on *TEST* of α_1 = 2.725 is significant at the 0.1 level and indicates that, all other things being equal, the attendance for students in the test group was about 2.73 percentage points higher than comparison students. The estimated coefficient on *AM* of 4.432 is significant at the 0.01 level and indicates that students who attend morning classes have higher attendance. The estimated coefficient on *VISITS* of 0.835 is marginally significant at the 0.1 level and indicates that students who more frequently visit their tutor are also likely to attend more classes.

The *R*-squared for the estimated learning equation (2) is 0.203. Similar to Romer (1993), Durden & Ellis (1995), Marburger (2006), Savage (2009), and Craig & Savage (2014), the model estimates show that attendance is a positive predictor of student performance in the cumulative final exam. The estimated coefficient on *ATTEND* of γ_3 = 0.144 is statistically significant at the 0.05 level. Conditional on attendance, the estimated coefficient on *TEST* is γ_1 = 2.620 and statistically significant at the 0.01 level. This indicates that all other things being equal, the final exam scores for test group students were 2.62 percentage points higher than comparison students.

The point estimates of α_1, γ_1 and γ_3 are used to calculate the total effect on student learning from instructor attire from the separate indirect and direct effects. Substituting, and into equation (3) shows that the positive indirect effect on the final exam score is 0.39 (= 0.144 × 2.725) percentage points and the positive direct effect is 2.62 percentage points. The indirect and direct effects together indicate that the total effect on student learning from instructor attire is 3.01 (= 0.39 + 2.62) percentage points. Given the mean *FINAL_SCORE* for comparison students is 77.17, the total effect represents, on average, the difference between earning a *C* (i.e., 77.17) and a *B*- (i.e., 80.18 = 77.17 + 3.01) .

Columns two and three of Table 2 also reveal interesting results with respect to the control variables. Consistent with previous studies of economic education, pre-test score (*PRE_TEST*) is a significant, positive determinant of student performance in Principles of Economics. Similar to Elzinga & Melaugh (2009), male students (*MALE*) and white students (*WHITE*) also perform better. In contrast, the estimated coefficients on *FALL* and *UNDER_CLASS* are both negative and significant. The coefficient on *UNDER_CLASS* indicates that students in their first and second year perform about five percentage points worse on the final exam than juniors or seniors. The coefficient on *FALL* indicates that students in the fall semester score over three percentage points lower on the final exam than students in the spring. We think this identifies the possibility that students in the fall are very different from students in the spring, especially with an introductory class. Specifically, for many underclass students in the fall this will be their first semester of college and a new experience. They are likely to perform better in all

Table 2: Estimates of Attendance and Learning

	SUR		OLS
Independent Variable	**Attendance Equation (1)**	**Performance Equation (2)**	**Reduced-Form Performance Equation (4)**
TEST	2.725*	2.620*	3.013**
	(1.603)	(1.479)	(1.521)
ATTEND		0.144**	
		(0.059)	
TREND	-1.615	-3.375**	-3.608**
	(1.625)	(1.494)	(1.542)
PRE_TEST	-0.091	0.314***	0.300***
	(0.069)	(0.064)	(0.066)
VISITS	0.835*	-0.132	-0.012
	(0.514)	(0.474)	(0.487)
FALL	-0.942***	-3.290*	-3.426*
	(1.893)	(1.738)	(1.796)
AM	4.432**	-1.427	-0.788
	(1.699)	(1.581)	(1.612)
UNDER_CLASS	2.414	-4.961***	-4.613**
	(1.962)	(1.806)	(1.862)
MALE	-1.244	3.482***	3.302**
	(1.478)	(1.359)	(1.403)
WHITE	1.878	2.747*	3.018*
	(1.670)	(6.726)	(1.584)
CONSTANT	90.85***	38.40***	51.51***
	(3.799)	(6.411)	(3.605)
R^2	0.077	0.203	0.183
Chow test	0.662	1.188	
Observations	240	240	240

Note: Dependent variable in column two is percentage of classes attended (*ATTEND*). Dependent variable in columns three and four is cumulative final exam score (*FINAL_EXAM*). Equations (1) and (2) are estimated with the *SUR* estimator. Equation (3) is estimated by OLS. Symbols *denotes significant at the 0.1 level, ** at the 0.05 level and *** at the 0.01 level. Robust standard errors in parentheses. Chow test tests whether the coefficients in the attendance and performance regressions on male and female students are equal.

classes in subsequent semesters after they have adjusted to college life.

Previous studies suggest that females may be more responsive to clothing cues than males (Morris *et al.* 1996; Lavin, Carr & Davies 2009a & 2009b). In their earlier experiment, Craig & Savage (2014) find that instructor attire does not affect female and male students differently. However, they qualify this finding by noting that their model is estimated on a relatively small subsample of females, i.e., 26 out of 158. Although estimated from a much larger subsample of females, i.e., 84 out of 240, the results from this new experiment again provide no evidence to support the specification of separate attendance and performance equations for female and male students, respectively. A Chow test ($F(84, 146) = 0.662$; Prob > F = 0.98), reported in column two of Table 2, did not reject the equality of coefficients between female and male students in the attendance equation. A Chow test ($F(84, 147) = 1.188$; Prob > F = 0.18), reported in column three of Table 2, did not reject the equality of coefficients between female and male students in the performance equation.

Robustness Checks

Potential Endogeneity of Attendance

Because it is randomly assigned, *TEST* is exogenous and the estimates of α_1 and γ_1 are unbiased. However, because students choose to come to class, *ATTEND* is not exogenous. While we control for the potential endogeneity of *ATTEND* in equation (2) by using student characteristics as additional explanatory variables, one could argue that there are still unobserved factors that affect both *ATTEND* and *FINAL* and, as such, our estimate of γ_3 in equation (2) may be biased. Following Craig & Savage (2014), we test the endogeneity of *ATTEND* indirectly by estimating a reduced-form specification of student performance. Substituting equation (1) into equation (2) gives:

$$FINAL_i = \lambda_0 + \lambda_1 TEST_i + \lambda_2 TREND_i + X_i'\eta + v_i \qquad (4)$$

where: $\lambda_0 = \gamma_3 \cdot \alpha_0 + \gamma_0$; $\lambda_1 = \gamma_3 \cdot \alpha_1 + \gamma_1$; $\lambda_2 = \gamma_3 \cdot \alpha_2 + \gamma_2$; $\eta = \gamma_3 \cdot \beta + \delta$; and $v = \gamma_3 \cdot e + u$. Because *TEST* is randomly assigned, the OLS estimate of the total effect on student learning from instructor attire, λ_1, is unbiased. Given α_1 and γ_1 are also unbiased, the estimate of γ_3 in equation (2) should be unbiased when $\lambda_1 = \gamma_3 \cdot \alpha_1 + \gamma_1$. If $\lambda_1 < \gamma_3 \cdot \alpha_1 + \gamma_1$, then γ_3 is biased in a positive direction and if $\lambda_1 > \gamma_3 \cdot \alpha_1 + \gamma_1$, then γ_3 is biased in a negative direction. The estimates of equation (4) are presented in column four of Table 2. Similar to equation (2), the model specification of equation (4) explains about 20 percent of the variation in student performance. The estimated coefficient on *TEST* is $\lambda_1 = 3.013$, is statistically significant at the 0.05 level, and essentially the same as our estimate of the total effect of 3.01 calculated from the estimates of equations (1) and (2). This is reassuring as it suggests that with appropriately specified controls, the estimate of γ_3 in (2) is likely unbiased and can be used to measure the total effect on student learning from instructor attire into separate indirect and direct effects.

Instructor Bias

Our design controls for environmental factors by observing the same instructor teaching in the same classrooms during the course of the experiment. We also control for faculty-specific factors by observing the same instructor teaching the same classes during the course of the experiment, but dressed in different attire. However, it is possible that the effects of instructor business attire on student performance are being driven by the instructor implicitly or explicitly favouring the test group courses so that they are easier for students. We test for this bias with FCQ data that measures the students' opinions of the courses. The FCQ is independently administered during the penultimate week of the semester and, among other things, asks students to indicate the amount of effort they devoted to their course and how intellectually challenging the course was. The dependent variables for this robustness check are *EFFORT* (one when the student devotes zero to three hours per week to the course; two when the student devotes four to six hours; three when the student devotes seven to nine hours; four when the student devotes ten to twelve; five when the student devotes thirteen to fifteen; and six when the student devotes 16 or more hours), and *CHALLENGE* (a score from one to six of "intellectual challenge," with six indicating the highest degree of intellectual challenge).

The FCQ data comprises 193 useable observations on *EFFORT* and 209 useable observations on *CHALLENGE*, along with information on students' prior interests in the course and any written comments. The FCQ data are anonymous, cannot be linked to any other student information, and provide no demographics from which to make

Table 3: Ordered Probit Estimates of Instructor Bias and Credibility

	Instructor bias		Instructor Credibility		
Independent Variable	**Student Effort**	**Intellectual Challenge**	**Instructor Effectiveness**	**Instructor Overall**	**Course Overall**
TEST	0.048 (0.172)	-0.182 (0.172)	0.381** (0.175)	0.791*** (0.221)	0.390** (0.159)
TREND	0.057 (0.180)	0.047 (0.191)	-0.352* (0.187)	-0.740*** (0.220)	-0.391** (0.170)
FALL	0.091 (0.227)	-0.030 (0.215)	0.390* (0.101)	-1.039*** (0.273)	-0.672*** (0.188)
AM	0.071 (0.204)	0.050 (0.191)	0.101 (0.187)	-0.004 (0.1957)	0.202 (0.194)
COMMENTS	-0.009 (0.169)	0.353 (0.173)	0.011 (0.168)	-0.164 (0.184)	0.226 (0.158)
INTEREST	0.009 (0.061)	-0.008 (0.063)	0.341*** (0.077)	0.174** (0.071)	0.306*** (0.071)
Pseudo R^2	0.002	0.011	0.001	0.061	0.070
Observations	193	209	209	209	209

Note. Dependent variables are student effort (*EFFORT*), intellectual challenge of the course (*CHALLENGE*), instructor effectiveness (*EFFECTIVENESS*), instructor overall (*INSTRUCTOR*), and course overall (*COURSE*). Symbol * denotes significant at the 0.1 level, ** at the 0.05 level, and *** at the 0.01 level. Robust standard errors in parentheses.

additional comparisons. Column two of Table 3 shows the results from an ordered probit regression of *EFFORT* on *TEST*, *TREND*, and the control variables *FALL*, *AM*, *COMMENTS* (one if the student provided written comments on the course in the FCQ and zero otherwise), and *INTEREST* (a score from one to six of "prior interest," with six indicating the highest degree of prior interest in the course). Column three of Table 3 shows the results from an ordered probit regression of *CHALLENGE* on *TEST*, *TREND*, *FALL*, *AM*, *COMMENTS*, and *INTEREST*. The estimated coefficients on *TEST* in both columns are not statistically significant from zero, which suggests that students did not perceive the courses to be any harder or easier across the test and comparison groups.

Instructor Credibility

Many perceptions of an individual are formed by observations of the clothing he or she is wearing. Whether accurate or not, these perceptions provide the observer with a basis for relationship formation, communication and judgment making about the source's credibility (Morris 1977; Rosenfeld & Plax 1977; Bassett 1979; Roach 1997; Craig & Savage 2014). We argued in the previous section that the test and comparison classes are taught with the same degree of difficulty, but the business attire worn by the instructor signals professional credibility. Students respond by attending more classes and by increasing their attention in the classroom. We test the relationship between instructor credibility and attire by using 209 useable observations from the FCQ on students' opinions of "instructor effectiveness", "instructor overall" and "course overall." Column four of Table 3 shows the results from an ordered probit regression of *EFFECTIVENESS* (score from one to six of "instructor effectiveness," with six indicating the highest level of effectiveness) on *TEST*, *TREND*, *FALL*, *AM*, *COMMENTS*, and *INTEREST*. Column five of Table 3 shows the results from an ordered probit regression of *INSTRUCTOR* (score from one to six of "instructor overall," with six indicating the highest rating of the instructor) on *TEST*, *TREND*, *FALL*, *AM*, *COMMENTS*, and *INTEREST*. Column six of Table 3 shows the results from an ordered probit regression of *COURSE* (score from one to six of "course overall," with six indicating the highest rating of the instructor) on *TEST*, *TREND*, *FALL*, *AM*, *COMMENTS*, and *INTEREST*. Here, the estimated coefficients on *TEST* in all three columns are positive and statistically significantly different from zero. These results suggest that students in the test group believe the instructor to be a more credible teacher than the students in the comparison group.

6. CONCLUSIONS

This paper estimated the effects on student performance from the instructor dressing in business attire by repeating the Craig & Savage (2014) experiment. Model results show that the effect on student performance from instructor attire is both indirect and direct. The attendance for students in the test group was 2.73 percentage points higher than comparison students and this increase is associated with an improvement in their cumulative final exam score of 0.39 percentage points. Controlling for attendance, final exam scores for test group students were about 2.62 percentage points higher than comparison students. The indirect and direct effects together indicate that the total effect on student learning from instructor attire is 3.01

percentage points, which, on average, is the difference between earning a *C* and a *B*- on the final exam. The results from this evaluation also show that instructor attire does not affect female and male students differently.

There are several environmental differences between this evaluation and the original experiment. The new evaluation is conducted on a lower-division class from a smaller university, and these students are taught by a different instructor. There are also more females in this new evaluation, and the empirical model controls for time-of-day/year effects and pre-course economic ability and knowledge with the *TUCE-4*. Despite these differences, the results from the new experiment are strikingly similar to those from Craig & Savage (2014). While this suggests that the effects of instructor attire are robust to alternative environments, work on this research question is ongoing. Future work will consider a sample from several different classes and instructors, with random assignment by class-instructor to directly control for instructor quality, instructor experience and classroom environment.

APPENDIX

Table A1: References for Department/University Dress Code Sample

https://www.insidehighered.com/views/2008/02/08/jensen
http://academeblog.org/2015/02/05/student-and-faculty-dress-codes/
http://www.collegexpress.com/lists/list/colleges-with-dress-codes/418/
http://collegemisery.blogspot.com/2012/08/oral-roberts-university-dress-code-for.html
https://tenureshewrote.wordpress.com/2013/07/15/dressing-for-academia/
http://www.aamu.edu/administrativeoffices/hrservices/Documents/6.6_-_Business_Dress_and_Business_Casual_Dress_Procedure.pdf
http://portal3.oru.edu/dynmgr.dynelmt.getDoc?v_docid=1172
http://www.nea.org/home/36482.htm
https://www.medicine.wisc.edu/hr/dresscode
http://www.naplesnews.com/news/education/ave-maria-dress-code-women-employee-skirts-dresses
http://ps.columbia.edu/education/node/1940
https://hrnt.jhu.edu/working_here/curr_employees/staff_resources.cfm#Dress
http://www.alasu.edu/academics/colleges--departments/college-of-business-administration/students/dress-code/index.aspx
http://evans.uw.edu/myevans/dress-code
https://www4.uwm.edu/secu/docs/faculty/2901_Code_of_Co_ct_04_25_13.pdf
http://www.slu.edu/human-resources-home/dress-code-and-personal-appearance-guidelines
http://about.norwich.edu/wp-content/uploads/uniform-manual.pdf
https://idcenter.byu.edu/id-card-policies

Table A2: Student Characteristics of Original Experiment 2009-2012

Variable	**Description**	**Comparison Group Mean (s.e.)**	**Test Group Mean (s.e.)**	**Difference in Groups (s.e.)**
GPA	Cumulative grade point average prior to *ECON* 4697	2.877 (0.057)	2.773 (0.060)	0.103 (0.083)
PREREQ	Numerical grade for the prerequisite class *ECON* 3070	2.808 (0.093)	2.725 (0.101)	0.083 (0.138)
SAT	Score in the mathematics component of the scholastic aptitude test	616.7 (8.414)	602.7 (8.748)	14.02 (12.19)
ECON	1 if student was an economics major prior to *ECON* 4697	0.667 (0.055)	0.771 (0.046)	-0.104 (0.071)
IO_PREF	1 if student subsequently enrolled in *ECON* 4999 Antirust and Regulation	0.133 (0.040)	0.036 (0.021)	0.097** (0.044)
SOPHOMORE	1 if student was a sophomore	0.080 (0.031)	0.096 (0.032)	-0.016 (0.045)
JUNIOR	1 if student was a junior	0.347 (0.055)	0.349 (0.052)	-0.003 (0.076)
SENIOR	1 if student was a senior	0.547 (0.057)	0.554 (0.055)	-0.008 (0.079)
MALE	1 if student was male	0.840 (0.042)	0.831 (0.041)	0.009 (0.059)
WHITE	1 if student was white	0.733 (0.051)	0.735 (0.048)	-0.002 (0.070)
ATTEND	Percentage of ECON 4697 classes attended	70.97 (2.395)	78.67 (1.778)	-7.696*** (2.947)
FINAL_SCORE	Percentage score in the cumulative final exam	79.66 (1.161)	80.16 (1.062)	-0.498 (1.570)
Sample size		75	83	

Note: s.e. is standard error. Symbol ** denotes significant at the 0.05 level, and *** at the 0.01 level, For the dummy variables, "Difference in Groups" is a two sample *z* test for the equality of proportions. For the continuous variables, "Difference in Groups" is a two sample *t* test for the equality of means.

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