UNIVERSITY OF OULU

YLEISEN TENTIN TENTTILOMAKE - GENERAL EXAM FORM

Opiskelija täyttää / Student fills in

Opiskelijan nimi / Student name:	**Opiskelijanumero / Student number:**
Click here to enter text.	Click here to enter text.

Opettaja täyttää / Lecturer fills in

Opintojakson koodi / The code of the course: 721066S	
Opintojakson (tentin) nimi / The name of the course or exam: Principles of Econometrics	
Opintopistemäärä / Credit units: 6 Mikäli kyseessä on välikoe, opintopistemääräksi täytetään 0 op. 0 ECTS Credits is used for mid-term exams.	
Tiedekunta / Faculty: OyKKK / OBS	
Tentin pvm / Date of exam: 23.8.2019	**Tentin kesto tunteina / Exam in hours: 3 h**
Tentaattori(t) / Examiner(s): Sanna Huikari	**Sisäinen postiosoite / Internal address:** 6 OyKKK
Tentissä sallitut apuvälineet / The devices allowed in the exam:	
☒ Funktiolaskin / Scientific calculator ☒ Ohjelmoitava laskin / Programmable calculator ☒ Muu tentissä sallittu materiaali tai apuvälineet. Tarkenna alla. / Other material or devices, allowed in the exam. Specify below. **Two-sided hand-written A4-sheet, which must be included into the answer sheet** ☐ Tentissä ei ole sallittua käyttää apuvälineitä / The devices are not allowed in the exam	
Muut tenttiä koskevat ohjeet opiskelijalle (esimerkiksi kuinka moneen kysymyksen opiskelijan tulee vastata) / Other instructions for students e.g. how many questions he/she should answer: Click here to enter text.	

The data used in next question is based on data on course evaluations, course characteristics, and professor characteristics for 463 courses for the academic years 2000-2002 at the University of Texas at Austin.[1] One of the characteristics is an index of the professor's "beauty" as rated by a panel of six judges. In this question, you are asked to investigate how course evaluations (given by students) are related to the professor's beauty. The variables are defined in Table 1. Table 2 contains the mean values and standard deviations of continuous variables. Table 3 contains results from four estimated regressions. The dependent variable in all regressions is the course overall teaching evaluation. All estimations were made by using the heteroskedasticity-robust standard errors. (The estimated standard errors are given in Table 3 in parentheses under the values of estimated coefficients.)

Table 1. Variable definitions.

Variable	Definition
Course_eval	"Course overall" teaching evaluation score, on a scale of 1 (very unsatisfactory) to 5 (excellent)
Beauty	Rating of instructor's physical appearance by a panel of six students, averaged across the six panelists. The obtained values have been standardized so that variable has mean zero (and standard deviation 0.79).
Female	$= \begin{cases} 1 \text{ if the instructor is female} \\ 0 \text{ if the instructor is male} \end{cases}$
Minority	$= \begin{cases} 1 \text{ if the instructor is a non-White} \\ 0 \text{ if the instructor is White} \end{cases}$
NNenglish	$= \begin{cases} 1 \text{ if the instructor is not a native English speaker} \\ 0 \text{ if the instructor is a native English speaker} \end{cases}$
intro	$= \begin{cases} 1 \text{ if the course is introductory (mainly large Freshman and Sophomore courses)} \\ 0 \text{ if the course is not introductory} \end{cases}$
onecredit	$= \begin{cases} 1 \text{ if the course is a single-credit elective (yoga, aerobics, dance, etc.)} \\ 0 \text{ otherwise} \end{cases}$
age	Professor's age

Table 2. Mean values and standard deviations of continuous variables

Variable	***Mean***	***SD***
Course_eval	4	0.555
Beauty	0	0.789
age	48.4 years	9.8 years

[1] These data were provided by Professor Daniel Hamermesh of the University of Texas at Austin and were used in his paper with Amy Parker, "Beauty in the Classroom: Instructors' Pulchritude and Putative Pedagogical Productivity," Economics of Education Review, August 2005, Vol. 24, No. 4, pp. 369-376.

1. (28 p.) Use the results in *Table 3* to answer the following questions. Remember to show your work. No credit for answers if you do not show your work.

   a) (2 p.) See the scatterplot presented in Figure 1. Does there appear to be a relationship between the variables?

   b) (2 p.) Consider the results of regression (1). What is the estimated slope? Is the estimated effect of *Beauty* on *Course_eval* large or small? Explain.

   c) (3 p.) Is the estimated regression slope coefficient in regression (1) statistically significant at the 5% significance level? At the 1% significance level? What is the *p*-value (approximately) associated with coefficient's *t*-statistics?

   d) (2 p.) Professor Watson has an average value of *Beauty,* while Professor Stock's value of *Beauty* is one standard deviation above the average. Predict Professor Stock's and Watson's course evaluations based on the results in regression (1).

   e) (2 p.) Does *Beauty* explain a large fraction of the variance in evaluations across courses? Explain.

   f) (2 p.) Consider the results of regression (2), where additional variables have been included in the model. Based on these results, does the regression in (1) seem to suffer from important omitted variable bias?

   g) (2 p.) Construct and interpret the 95% confidence interval for the effect of *Beauty* on *Course_eval* in regression (2).

   h) (2 p.) Professor Smith is a black male with average beauty and is a native English speaker. He teaches a three-credit upper-division course. Predict Professor Smith's course evaluation based on regression (2).

   i) (3 p.) Consider the results of regression (3). Is there evidence that *Age* has a nonlinear effect on *Course_eval*? Is there evidence that *Age* has any effect on *Course_eval*?

   j) (2 p.) Consider the results of regression (4). Is the male-female difference in the effect of *Beauty* statistically significant?

   k) (3 p.) Professor Smith is a man. He has cosmetic surgery that increases his beauty index from one standard deviation below the average to one standard deviation above the average. What is the expected increase in his course evaluation?

   l) (3 p.) Consider the various control variables in the data set. Which do you think should be included in the regression, based on regressions (3) and (4)?

2. Assess the internal and external validity of the regressions of the results presented in Table 3 and Question 1.

Table 3. Regression results.

Regressor	(1) *Course_eval*	(2) *Course_eval*	(3) *Course_eval*	(4) *Course_eval*
Beauty	0.133 (0.032)	0.166 (0.032)	0.160 (0.030)	0.231 (0.048)
Intro	–	0.011 (0.056)	0.002 (0.056)	-0.001 (0.056)
OneCredit	–	0.635 (0.108)	0.620 (0.109)	0.657 (0.109)
Female	–	-0.173 (0.049)	-0.188 (0.052)	-0.173 (0.050)
Minority	–	-0.167 (0.067)	-0.180 (0.069)	-0.135 (0.070)
NNEnglish	–	-0.244 (0.094)	-0.243 (0.096)	-0.268 (0.093)
Age	–	–	0.020 (0.023)	–
Age^2	–	–	-0.0002 (0.0002)	–
*Female*Beauty*	–	–	–	-0.141 (0.063)
Intercept	4.00 (0.025)	4.068 (0.037)	3.677 (0.550)	4.075 (0.037)
F-statistics and associated p-values on joint hypotheses				
H_0: $Age=0$ and $Age^2=0$	–	–	0.63 (0.53)	–
SER	0.545	0.514	0.514	0.511
$\bar{R}^2$	0.034	0.144	0.142	0.151
N	463	463	463	463

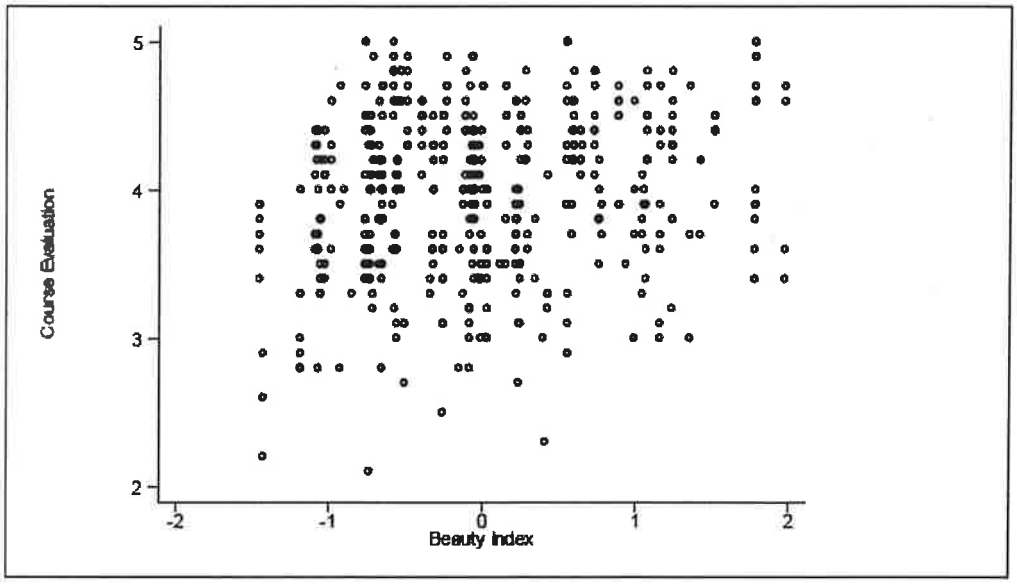

Figure 1. Scatterplot of average course evaluations on the professor's beauty.

Table 4. Large-sample critical values for the *t*-statistics from the standard normal distribution.

	Significance Level		
	10%	5%	1%
2-Sided Test (≠)			
Reject if $\|t\|$ is greater than	1.64	1.96	2.58
1-Sided Test (>)			
Reject if t is greater than	1.28	1.64	2.33
1-Sided Test (<)			
Reject if t is less than	−1.28	−1.64	−2.33

Table 5. Critical values for the *chi-squared* distribution.

	Significance Level		
Degrees of Freedom	10%	5%	1%
1	2.71	3.84	6.63
2	4.61	5.99	9.21
3	6.25	7.81	11.34
4	7.78	9.49	13.28
5	9.24	11.07	15.09
6	10.64	12.59	16.81
7	12.02	14.07	18.48