

Homework 7: Dichotomous Categorical Predictors

EPSY 8251

Due on 12/15/2022

This goal of this assignment is to give you experience fitting and interpreting regression models with categorical predictors. For this assignment, you will again examine whether there are differences in course evaluation scores—and thus on earnings differences—between native and non-native English speaking professors. To do so, you will use the data in the `evaluations.csv` file to fit a series of regression models to predict the variation in course evaluation ratings.

Background of the Data Set

The data in `evaluations.csv` come from Hamermesh & Parker (2005) and were made available by Gelman & Hill (2007). This data were collected from student evaluations of instructors' beauty and teaching quality for several courses at the University of Texas. The teaching evaluations were conducted at the end of the semester, and the beauty judgments were made later, by six students who had not attended the classes and were not aware of the course evaluations. The variables are:

- `prof_id`: Professor ID number
- `avg_eval`: Average course rating
- `num_courses`: Number of courses for which the professor has evaluations
- `num_students`: Number of students enrolled in the professor's courses
- `perc_evaluating`: Average percentage of enrolled students who completed an evaluation
- `beauty`: Measure of the professor's beauty composed of the average score on six standardized beauty ratings
- `tenured`: Is the professor tenured? (0 = non-tenured; 1 = tenured)
- `native_english`: Is the professor a native English speaker? (0 = non-native English speaker; 1 = native English speaker)
- `age`: Professor's age (in years)
- `female`: Is the professor female? (0 = not female; 1 = female)

Instructions

Submit your responses to each of the questions below in a printed document. All graphics should be resized so that they do not take up more room than necessary and also should have an appropriate caption. This assignment is worth 100 points.

Unadjusted Group Differences Model: ANOVA

Fit a regression model using the dummy-coded `native_english` predictor to explain variation in course evaluation scores. Use the `glance()` and `tidy()` functions to examine the output.

1. Write the fitted regression equation.
2. Interpret the intercept coefficient.
3. Interpret the slope coefficient.
4. In terms of means (not betas), write the null hypothesis (using mathematical notation) associated with the t -test of the slope? Be specific.

5. Based on results of the t -test for the slope, what do you conclude about differences in evaluation scores between native and non-native English speaking professors?
6. Use the fitted regression equation to estimate (a) the mean course rating for native and (b) the mean course rating for non-native English speakers. Show your work.

Adjusted Group Differences Model: ANCOVA

Now, suppose you want to examine differences in course evaluation scores between native and non-native English speakers, but this time you want to control for differences in professors' beauty ratings and the number of courses for which the professor has evaluations. Fit this model and use the `glance()` and `tidy()` functions to examine the output.

7. Write the fitted regression equation.
8. Interpret the fitted regression coefficient for `native_english`.
9. Compare the size and direction of the difference in course evaluation scores between native and non-native English speakers in the adjusted model to those from the unadjusted model. How do they compare? Also compare the uncertainty in the estimates.
10. Write the fitted regression equation for native English speakers. (Note: This equation should only include the effects of beauty and the number of courses for which the professor has evaluations.)
11. Write the fitted regression equation for non-native English speakers. (Note: This equation should only include the effects of beauty and the number of courses for which the professor has evaluations.)
12. Compute the *adjusted* mean course rating for native and non-native English speakers (based on professors having an average beauty and an average number of courses). Show your work.