

Interaction Models

EPsy 8251

Assignment #10

You will use the data set *FCI-2014.csv* to examine whether a set of predictors predicts variation in FCI. In this assignment, the natural logarithm of the variable `fci` will be used as the outcome. Please 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 all should have an appropriate caption. Any equations should be appropriately typeset within the document. There are 15 points possible for the assignment (each question is worth one point unless otherwise noted).

PREPARING THE DATA

There are no points for anything in this section. However, this preparation is necessary to complete the remainder of the assignment.

- Compute the natural logarithm of FCI as a new variable (i.e., another column in the data). Name it `Lfci`.
- Compute the current age of each stadium as a new variable (i.e., another column in the data). Name it `ageStadium`.

FITTING MODELS

Fit the following regression models using R. There are no points for anything in this section. You will use the output from the fitted models to answer the questions in the assignment.

Model 1: $\text{Lfci} \sim \text{ageStadium} + \text{ageStadium}^2 + \text{COL}$

Model 2: $\text{Lfci} \sim \text{ageStadium} + \text{ageStadium}^2 + \text{COL} + \text{league}$

Model 3: $\text{Lfci} \sim \text{ageStadium} + \text{ageStadium}^2 + \text{COL} + \text{league} + \text{ageStadium}:\text{league}$

Model 4: $\text{Lfci} \sim \text{ageStadium} + \text{ageStadium}^2 + \text{COL} + \text{league} + \text{ageStadium}:\text{league} + \text{ageStadium}^2:\text{league}$

Model 5: $\text{Lfci} \sim \text{ageStadium} + \text{ageStadium}^2 + \text{COL} + \text{league} + \text{ageStadium}:\text{COL}$

Model 6: $\text{Lfci} \sim \text{ageStadium} + \text{ageStadium}^2 + \text{COL} + \text{league} + \text{ageStadium}:\text{COL} + \text{ageStadium}^2:\text{COL}$

MAIN-EFFECT OF LEAGUE

1. Write the null-hypothesis associated with the ΔF -test to compare Model 1 and Model 2.
2. Report the results from the ΔF -test.
3. What does this indicate about whether league is an important predictor of variation in FCI (log) above and beyond the linear and quadratic effects of stadium age, and the effect of cost-of-living?
4. Carry out the analysis to examine all of the pairwise league comparisons, controlling for the linear and quadratic effects of stadium age, and the effect of cost-of-living. Report the estimated differences, the unadjusted p -values for those differences, and the Benjamani–Hochberg adjusted p -values for the differences in a table. Be sure your table has an appropriate caption. (2pts.)

5. Write 2–3 sentences explaining what the results of these analyses suggest about differences in the FCI (log) between leagues after controlling for the linear and quadratic effects of stadium age, and the effect of cost-of-living? (2pts.)

INTERACTION EFFECT BETWEEN LEAGUE AND STADIUM AGE

6. Report the results from the ΔF -test that compares Model 2, Model 3, and Model 4. (Hint: Use three models in the `anova()` function rather than two.)
7. What does this indicate about whether league interacts with stadium age? Explain.
8. Create a plot of the fitted regression equations for Model 4. In this plot, show the effect of stadium age on the x -axis and the effect of league through different lines. Control out any other effects.
9. Use the plot to explain the effect of league on FCI. (Be careful since there are interactions.)

INTERACTION EFFECT BETWEEN STADIUM AGE AND COST-OF-LIVING

10. Report the results from the ΔF -test that compares Model 2, Model 5, and Model 6. (Hint: Use three models in the `anova()` function rather than two.)
11. What does this indicate about whether stadium age interacts with cost-of-living? Explain.
12. Create a plot of the fitted regression equations for Model 6. In this plot, show the effect of stadium on the x -axis and the effect of league and cost-of-living through different lines. Control out any other effects.
13. Use the plot to explain the effect of stadium age on FCI. (Be careful since there are interactions.)