When to Include Interactions and Higher Powers

Interested in inference or prediction?

- If inference, look to guiding theory.
  - Theoretical reason to expect interaction effect?
  - Interested in measuring interaction effect or average effect of one variable?
  - What hypotheses would be most useful to test?
  - Can audience understand the interaction coefficients?
- If prediction, look to data to see if adding terms improves models.
  - Statistical tests can help.

Specification Tests

- With specific interaction or higher power terms, we can directly test if they improve fit of model.
  - Run *F*-test between model including terms and restricted model without them.
- **Regression specification error test (RESET):** general way to see if model may be missing interaction and higher-order terms.

RESET

- Instead of testing potential terms directly, use residuals in regression to stand in for unexplained factors.
  - Run regression with restricted model, compute residuals, $\hat{y}$.
  - Put square and cube of residuals into model as new variables; test if model fit is improved using *F*-test.
    - $y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + \delta_1 \hat{y}^2 + \delta_3 \hat{y}^3 + \text{error}$
  - If *F*-test significant, then evidence exists that higher order or interaction terms have been omitted.
- Statistical tests—we must evaluate results in context, consider sample size.
- Another concern is wide datasets with over a dozen variables.
  - Some interaction terms can appear significant due to chance.