

# Random Effects Regression

Test name: Random Effects Regression

Dataset: D:/DATA ANALYSIS/H Regression Tests and Models/Random Effects Regression/dataset.csv

Rows in original dataset: 649

Long-format rows used: 1947

Student clusters: 649

Repeated outcome columns: G1, G2, G3

Numeric predictors: studytime, failures, absences, age, Medu

Categorical predictors: school, sex, address

Formula:  $\text{grade\_score} \sim \text{grade\_period} + \text{studytime} + \text{failures} + \text{absences} + \text{age} + \text{Medu} + \text{school} + \text{sex} + \text{address}$

Random structure: random intercept for student\_id.

Random intercept variance: 5.235427

Residual variance: 1.187727

Intraclass correlation (ICC): 0.815087

Likelihood-ratio p-value: 1.67632e-58

Interpretation: fixed effects are average effects holding other variables constant.

Random intercepts estimate persistent student-specific deviations from the overall intercept.

ICC is the proportion of total variance attributable to between-student differences.

Decision guide:  $p < 0.05$  indicates stronger evidence for a fixed-effect predictor.

Charts generated: 10



# Likelihood-ratio test

|                                                          | comparison | likelihood_ratio_chi_square | df | p_value     |
|----------------------------------------------------------|------------|-----------------------------|----|-------------|
| Full random-effects model vs null random-intercept model |            | 299.8452                    | 10 | 1.67632e-58 |
| decision_alpha_0_05                                      |            |                             |    |             |
| Full model improves fit                                  |            |                             |    |             |

## Fixed effects

| model                     | term                          | coefficient | standard_error | df   | t_value    | p_value      | ci95_lower  |
|---------------------------|-------------------------------|-------------|----------------|------|------------|--------------|-------------|
| Full random-effects model | (Intercept)                   | 9.98545076  | 1.40884063     | 1296 | 7.0877078  | 2.233339e-12 | 7.22159267  |
| Full random-effects model | grade_periodG2                | 0.17103236  | 0.06067101     | 1296 | 2.8190130  | 4.890439e-03 | 0.05200821  |
| Full random-effects model | grade_periodG3                | 0.50693374  | 0.06067101     | 1296 | 8.3554529  | 1.658325e-16 | 0.38790960  |
| Full random-effects model | studytime                     | 0.46031314  | 0.11898292     | 640  | 3.8687328  | 1.206031e-04 | 0.22666905  |
| Full random-effects model | failures                      | -1.51887748 | 0.17115837     | 640  | -8.8741058 | 7.018355e-18 | -1.85497733 |
| Full random-effects model | absences                      | -0.06567316 | 0.02102027     | 640  | -3.1242779 | 1.862980e-03 | -0.10695018 |
| Full random-effects model | age                           | 0.03928809  | 0.08217923     | 640  | 0.4780781  | 6.327579e-01 | -0.12208543 |
| Full random-effects model | Medu                          | 0.36896057  | 0.08759749     | 640  | 4.2119991  | 2.894522e-05 | 0.19694733  |
| Full random-effects model | schoolMS                      | -1.27085682 | 0.22079037     | 640  | -5.7559432 | 1.337064e-08 | -1.70441791 |
| Full random-effects model | sexM                          | -0.57878327 | 0.19769569     | 640  | -2.9276473 | 3.536680e-03 | -0.96699386 |
| Full random-effects model | addressU                      | 0.28195760  | 0.21874759     | 640  | 1.2889632  | 1.978766e-01 | -0.14759213 |
| ci95_upper                | decision_alpha_0_05           |             |                |      |            |              |             |
| 12.74930884               | Statistically significant     |             |                |      |            |              |             |
| 0.29005650                | Statistically significant     |             |                |      |            |              |             |
| 0.62595789                | Statistically significant     |             |                |      |            |              |             |
| 0.69395724                | Statistically significant     |             |                |      |            |              |             |
| -1.18277763               | Statistically significant     |             |                |      |            |              |             |
| -0.02439613               | Statistically significant     |             |                |      |            |              |             |
| 0.20066161                | Not statistically significant |             |                |      |            |              |             |
| 0.54097380                | Statistically significant     |             |                |      |            |              |             |
| -0.83729573               | Statistically significant     |             |                |      |            |              |             |
| -0.19057267               | Statistically significant     |             |                |      |            |              |             |
| 0.71150734                | Not statistically significant |             |                |      |            |              |             |

# Variance components

| component                    | value     |
|------------------------------|-----------|
| Random intercept variance    | 5.2354270 |
| Residual variance            | 1.1877270 |
| Total variance               | 6.4231540 |
| Intraclass correlation (ICC) | 0.8150866 |

# Random intercepts

| student_id | random_intercept |
|------------|------------------|
| 1          | -5.57912554      |
| 2          | -1.84656268      |
| 3          | 0.33010412       |
| 4          | 0.05624643       |
| 5          | -0.75879989      |
| 6          | -0.19739252      |
| 7          | 0.43221164       |
| 8          | -1.32613319      |
| 9          | 3.22470127       |
| 10         | -0.18418180      |
| 11         | 0.60630950       |
| 12         | -1.42700092      |





















