9

Quantitative Comparisons for Multivariate Models

SOLUTIONS

1. Correct the given statements, if they are not already correct.
   a. “The odds ratio of passing the test was 0.60 for students in School A compared to School B, meaning that students in School A were only 60% as likely to pass as those in School B.” (Or “ . . . , meaning that students in School A were 40% less likely to pass than those in School B.”)
   b. Correct as written.
   c. “Relative odds of migration for ever-married men were 0.91, reflecting lower chances of migration for ever-married than never-married men.”
   d. “The standardized beta for widows was −0.5, meaning that widows scored on average half a standard deviation lower than nonwidows.”
   e. Correct as written.
   f. “The relative risk dropped from 2.50 to 2.00 between the unadjusted and adjusted models, corresponding to a 33% reduction in excess risk.”

3. Answer these questions using the information in table 9A (Zimmerman 2003).
   a. The dependent variable is cumulative GPA, a continuous variable measured in points, with a theoretical range from 0.0 to 4.0.
   b. An OLS model is suitable because the dependent variable is continuous.
   c. The continuous independent variables are own and roommate’s verbal and math SAT scores, each divided by 100 (see row labels) in the model specification shown in table 9A. Because SAT scores can range from 200 to 800 points, this transformation (change of scale) means that each of these variables could range from 2.0 to 8.0.
   d. The categorical independent variables in the model are gender (ref. = male) and race (ref. = white American citizens, with five dummy variables, one for each of the other racial/citizenship groups [black, Hispanic, Native American, Not a U.S. citizen, Asian]).

5. The difference in GPA would be roughly 0.08 points if the student had a verbal SAT score of 720 instead of 680. Calculate this change by multiplying the coefficient for own verbal SAT (0.195) by the requested difference in SAT score (40 points, divided by 100 in accordance with the model specification). $0.195 \times 0.40 = 0.078$.

7. His predicted GPA would be 2.906 = 0.780 + [(720/100) × 0.195] + [(700/100) × 0.092] + [(680/100) × 0.027] + [(650/100) × −0.016]. No terms are needed for race or gender because they are the reference categories, which are captured in the intercept term.

9. Write sentences to convey the results in table 9B (Light 2004).
   a. "For women, the transition from single to married is associated with a predicted gain of 0.44 in log(family income)."
   b. "For women, the transition from single to married is associated with a 55% increase in family income." (Percentage change calculation: 100 × [exp(0.440) – 1] = 55%.)
   c. "For men, the transition from single to married is associated with a 3% loss in family income, but the difference is not statistically significant." (Percentage change calculation: 100 × [exp(–0.035) – 1] = 3.4%; assessment of statistical significance: *t*-statistic = –0.035/0.025 = –1.40, which is below the critical value for $p < 0.05$.)
   d. "A woman with an income of $20,000 while single is predicted to gain roughly $11,000 in family income if she marries." (Calculation: $20,000 × 0.55 = $11,054.)

11. Calculate the relative odds of first migration for the given situations using the results in table 9C (Fussell and Massey 2004).
    a. The relative odds of migrating for an ever-married man compared to a never-married man = 0.91. (Exponentiate the coefficient on ever-married; exp[–0.09] = 0.91.)
    b. The relative odds of migrating for a 30-year-old man compared to a 20-year-old man = 0.59. Use the following expression, which plugs a ten-year age difference into the linear and square terms on age: Exp[(30 × [–.003]) + (30^2 × [–0.001])]/Exp[(20 × [–.003]) + (20^2 × [–0.001])] = 0.59.
    c. The relative odds of migrating for a man with a parent who is a prior U.S. migrant compared to a man without parents who migrated there = 1.67. (Exponentiate the coefficient on "parent is a prior U.S. migrant"; exp[0.51] = 1.67.)
    d. The relative odds of migrating for a man from a community with a migration prevalence ratio (MPR) of 0–4 compared to a man from a community with an MPR of 10–14 = 0.37. (Exponentiate the coefficient on MPR = 0–4; MPR = 10–14 is the reference category; exp[–0.99] = 0.37.)
    e. The relative odds of migrating for a man from a community with a migration prevalence ratio (MPR) of 0–4 compared to one from a community with an MPR of 60 or more = 0.26. (Divide the relative odds for an MPR of 0–4 by the relative odds for an MPR of 60+ to "cancel" the 10–14 MPR reference group; 0.37/1.40 = 0.26.)

13. The odds of first migration for a 20-year-old never-married man with no children, eight years of education, 24 months of labor force participation, neither parents nor siblings who are prior migrants, from a community with an MPR of 10–14 are calculated: exp[–3.31 + (20 × [–0.003]) + (20^2 × [–0.0001]) + (8 × [–0.04]) + (24 × [–0.002])] = 0.016 or 1.6%. No terms are needed for MPR, marital status, children, or parent or sibling migrants, as those values are all in the reference category.

15. Using the results for the total sample:

a. **Table 9E. Predicted self-esteem by gender and widowhood status, CLOC sample, 1987–1994**

	Male	Female
Widow	1.62	1.72
Nonwidow	2.13	1.53

Explanation: Each of the cells includes the intercept. The "female/nonwidow" cell adds in the coefficient on the "female" dummy; the "male/widow" cell adds in the coefficient on the "widow" dummy; the "female/widow" cell adds in both of those coefficients along with the "female × widow" interaction term. (Note: Results differ from those shown in Carr [2004] because they do not include values of other variables in her model that are excluded from table 9D.)

b. Chart to present predicted self-esteem for each of the four possible combinations of gender and widowhood status (Carr 2004).

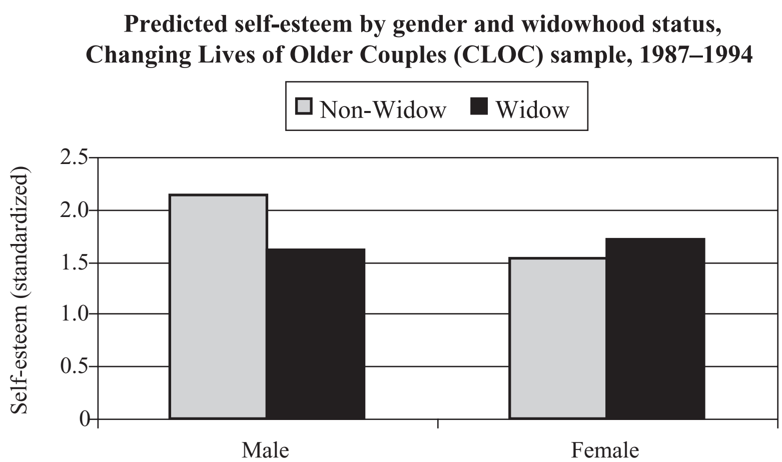

Figure 9A.

c. "As shown in table 9E, the association between widowhood and self-esteem differs by gender. Among males, self-esteem averages nearly half a standard deviation unit lower among widows than among those whose spouses are still alive at wave 2 (1.62 versus 2.13 points, respectively). Among females, however, widows have higher self-esteem than nonwidows (1.72 and 1.53, respectively)."

17. Calculate the odds ratio and relative risk with the following information.
    a. Assuming an odds ratio of 3.0 and a prevalence of the outcome (hospital admission) among the unexposed (nondiabetics) of 0.20, the corresponding relative risk of hospital admission for diabetics = $3.0/[(1–.20) + (3.0 \times .20)] = 3.0/[0.8 + 0.6] = 3.0/1.4 = 2.14$
    b. With an estimated odds ratio of 3.0 and a corresponding relative risk of 2.14, the percentage difference is calculated: $[3.00 – 2.14]/2.14 \times 100 = 40\%$. In other words, the estimated odds ratio overstates the relative risk by 40%.
    c. "Diabetics are more than twice as likely as nondiabetics to be admitted to the hospital."