Introduction to Econometrics (4th Edition)

by

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Solutions to Odd-Numbered End-of-Chapter Exercises: Chapter 11

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11.1. (a) The *t*-statistic for the coefficient on *Experience* is 0.031/0.009 □ 3.44, which is significant at the 1% level.

(b) $z_{Matthew} = 0.712 + 0.031 \times 10 = 1.022; \Phi(1.022) = 0.847$

(c) $z_{Christopher} = 0.712 + 0.031 \times 0 = 0.712; \Phi(0.712) = 0.762$

(d) $z_{Jed} = 0.712 + 0.031 \times 80 = 3.192; \Phi(3.192) = 0.999$. This is unlikely to be accurate because the sample did not include anyone with more that 40 years of driving experience, and few with more than 30 years of experience.

11.3. (a) The *t*-statistic for the coefficient on *Experience* is $t \approx 0.006/0.002 \approx 3$, which is significant a the 1% level.

$Prob_{Matther} = 0.774 + 0.006 \times 10 = 0.836$

$Prob_{Christopher} = 0.774 + 0.006 \times 0 = 0.774$

(b) The probabilities are similar except when experience in large (> 40 years). In this case the LPM model produces nonsensical results (probabilities greater than 1.0).

11.5. (a) $\Phi(0.806 + 0.041 \times 10 + 0.174 \times 1 - 0.015 \times 1 \times 10) = 0.814$

(b) $\Phi(0.806 + 0.041 \times 2 + 0.174 \times 0 - 0.015 \times 0 \times 2) = 0.813$

(c) The *t*-stat on the interaction term is $-0.015/0.019 = -0.79$, which is insignificant at the 10% level.

11.7. (a) For a black applicant having a *P/I ratio* of 0.35, the probability that the application will be denied is

$$F(-4.13+5.37\times 0.35+1.27)=\frac{1}{1+e^{0.9805}}=0.2728=27.28\%.$$

(b) With the *P/I ratio* reduced to 0.30, the probability of being denied is $F(-4.13+5.37\times 0.30+1.27)=\frac{1}{1+e^{1.249}}=22.29\%$. The difference in denial probabilities compared to (a) is 4.99 percentage points lower.

(c) For a white applicant having a *P/I ratio* of 0.35, the probability that the application will be denied is $F(-4.13+5.37\times 0.35)=\frac{1}{1+e^{2.2505}}=9.53\%.$ If the P/I ratio is reduced to 0.30, the probability of being denied is $F(-4.13+5.37\times 0.30)=\frac{1}{1+e^{2.519}}=7.45\%.$ The difference in denial probabilities is 2.08 percentage points lower.

(d) From the results in parts (a)–(c), we can see that the marginal effect of the *P/I ratio* on the probability of mortgage denial depends on race. In the logit regression functional form, the marginal effect depends on the level of probability which in turn depends on the race of the applicant. The coefficient on *black* is statistically significant at the 1% level. The logit and probit results are similar.

11.9. (a) The coefficient on *black* is 0.084, indicating an estimated denial probability that is 8.4 percentage points higher for the black applicant.

(b) The 95% confidence interval is $0.084 \pm 1.96 \times 0.023$ □ [3.89%, 12.91%].

(c) The answer in (a) will be biased if there are omitted variables which are race-related and have impacts on mortgage denial. Such variables would have to be related with race and also be related with the probability of default on the mortgage (which in turn would lead to denial of the mortgage application). Standard measures of default probability (past credit history and employment variables) are included in the regressions shown in Table 11.2, so these omitted variables are unlikely to bias the answer in (a). Other variables such as education, marital status, and occupation may also be related the probability of default, and these variables are omitted from the regression in column. Adding these variables (see columns (4)–(6)) have little effect on the estimated effect of *black* on the probability of mortgage denial.

11. 11. (a) This is a censored or truncated regression model (note the dependent variable might be zero).

(b) This is an ordered response model.

(c) This is the discrete choice (or multiple choice) model.

(d) This is a model with count data.