Computer Exercise 3 Solutions

Exercise 1 1. *If spread is zero, there is no favorite, and the probability that the team we (arbitrarily) label the favorite should have a 50% chance of winning.*

2. *If spread is zero, we have $\Phi(\beta_0 + \beta_1 spread) = \Phi(\beta_0)$. If there is no favorite, $P(favwin = 1|spread = 0) = 0.5 = \Phi(\beta_0)$. Hence, we should expect $\beta_0 = 0$.*

3. *The linear probability model estimated by OLS gives*

$$\begin{aligned} favwin &= \underset{\substack{(.028)\\ [.032]}}{.577} + \underset{\substack{(.0023)\\ [.0019]}}{.0194} spread, \\ n &= 553,\ R^2 = .111, \end{aligned} \tag{1}$$

where the usual standard errors are in $(\cdot)$ and the heteroskedasticity-robust standard errors are in $[\cdot]$. Using the usual standard error, the t statistic for $H_0 : \beta_0 = .5$ is $\frac{.577-.5}{.028} \approx 2.73$, which leads to rejecting H_0 against a two-sided alternative at the 1% level (critical value≈ 2.58). Using the robust standard error reduces the significance but nevertheless leads to strong rejection of H_0 at the 2% level against a two-sided alternative: $t = \frac{.577-.5}{.032} \approx 2.43$ (critical value ≈ 2.33).

4. *As we expect, spread is very statistically significant using either usual or robust standard error. If spread is 10, the estimated probability that the favored team wins is $.577 + .0194 \times 10 = .771$.*

5. *Note that this is the analog of testing whether the intercept is $.5$ in the LPM when there is no favored team and the spread captures all the information about the game.The z statistic for testing $H_0 : \beta_0 = 0$ is only about $-.101$ with p-value around 92%, so we do not reject H_0.*

6. *When $spread = 10$ the predicted response probability from the estimated probit model is $\Phi(-.0106 + .0925 \times 10) = \Phi(.9144) \approx .820$. This is somewhat above the estimate for the LPM.*

7. *The McFadden R-square for the unrestricted model is $.132$ while $.129$ for the restricted model. There is a slight improvement,*

8. *When $favhome$, $fav25$, and $und25$ are added to the probit model, the value of the log likelihood becomes* -262.64. *Therefore, the likelihood ratio statistic is* $2[-262.64-(-263.56)] = 2(263.56-262.64) = 1.84$. *The p-value from the* $\chi^2(3)$ *distribution is about* .61, *so $favhome$, $fav25$, and $und25$ are jointly very insignificant. The Wald test statistic and the p-value are similar to those of the LR test. Once spread is controlled for, these other factors have no additional power for predicting the outcome.*