第 14 章例题写法

例 1

Methods and Assumption Checks

As the response variable, Frequency, is a count, we have fitted a generalised linear model with a Poisson response distribution. We have two explanatory variables: Magnitude (Numeric) and Location (Categoric). The scatterplot of magnitude vs frequency shows an exponentially decreasing trend for both locations. A Poisson model with interaction between magnitude and location was fitted. It shows that the interaction between magnitude and location is highly significant ($P\text{-}value \approx 0$).

All model assumptions were satisfied. We can trust the results from this model ($P\text{-}value = 0.46$).

Our final model is

$$\log(\mu_i) = \beta_0 + \beta_1 \times Locn.WA_i + \beta_2 \times Magnitude_i + \beta_3 \times Locn.WA_i \times Magnitude_i,$$

where μ_i is the mean number of earthquakes in California with magnitude i and $Frequency_i$ (the number of earthquakes with magnitude i) has a Poisson distribution with mean μ_i. Also, $Locn.Wa$ is 1 if the earthquake with magnitude i was in Washington and 0 otherwise.

Executive Summary

The research question is to quantify the rate of decrease in earthquake frequency (with increasing magnitude) in both California and Washington states, and to assess whether these rates are the same.

The rate of decline in the frequency of earthquakes (with increasing magnitude) is more rapid in Washington than California.

In Washington, there is a 94.0 to 95.0% drop in the expected number of earthquakes for a one unit increase in their magnitude on the Richter scale.

In California, the decrease is between 90.0 to 90.8%.

例 2

Methods and Assumption Checks

As the response variable, `Freq`, is a count, we have fitted a generalised linear model with a Poisson response distribution. We have two expanatory factors: `Locn` and `Reserve`. The interaction plot suggests that the multiplicative difference between expected snapper counts at the two locations may be the same. Hence, a Poisson model with interaction between reserve and location was fitted. The interaction term was not significant ($P\text{-}value = 0.65$) and the model was refitted with this term removed.

All assumptions were satisfied. We can trust the results from the Poisson model ($P\text{-}value = 0.46$).

Our final model is

$$\log(\mu_i) = \beta_0 + \beta_1 \times Locn.Leigh_i + \beta_2 \times Reserve.Yes_i,$$

where μ_i is the mean number of snapper counts in a non-reserve area in Hahei and $Freq_i$ (the number of snapper counts in a non-reserve area in Hahei) has a Poisson distribution with mean μ_i. Also, $Locn.Leigh_i$ and $Reserve.Yes_i$ are dummy variables which take the value 1 if the observation is from Leigh and if the observation is from a marine reserve respectively, otherwise they are 0.

Executive Summary

It was of interest to explore the relative count of snapper with regard to location and reservation status.

We conclude that the expected count of snapper is between 3 and 21 times as high in marine reserves than in the area just outside of the reserve.

Moreover, the Leigh location has higher expected snapper counts than Hahei, - they are between 1.7 and 5.4 times as high at Leigh.