Homework #4 Answers

1a.

The R^2 tells us that 31.6% of the variation in the log wage is explained by the education, experience, and tenure. However, it does not imply a causal relationship.

1b.

First, state the null and alternative hypotheses:

$$\begin{aligned} H_0 &: \beta_{Educ} = 0 \\ H_A &: \beta_{Educ} \neq 0 \end{aligned}$$

Next, construct the t-statistic for this estimate:

$$\begin{aligned} t_{stat} &= \frac{0.092 - 0}{0.007} \\ &= 13.14286 \end{aligned}$$

Next, find the two-sided critical value for the 5% significance level (95% confidence level).

$$t_{crit} = 1.96$$

Clearly, since $|t_{stat}| = 13.14286 > 1.96$, we can reject the null hypothesis in favor of the alternative. The effect of education on the wage is significantly different from zero. Precisely, a one year increase in education yields a 9.2% increase in the wage.

1c.

Since wage is in logs, and experience is in levels, the hypothesis that an additional year of experience increases my wage by .5% translates into the following null and alternative

$$\begin{aligned} H_0 &: \beta_{Exper} = .005 \\ H_A &: \beta_{Exper} \neq .005 \end{aligned}$$

Thus, we can show that

$$|t_{stat}| = \left| \frac{0.0041 - 0.005}{0.0017} \right| = 0.529 < t_{crit} = 1.64$$

Thus, we cannot reject the hypothesis that a one year increase in experience decreases wages by .5%.

1d.

Omitted variables are those that affect the outcome, but are correlated with the included variables. Ability is a good example. Ability may be positively correlated with experience, tenure, and education level. The key is that it is correlated with one of these variables AND correlated with the dependent variable.

2a.

The intercept tells us nothing. The precise interpretation is that a school with zero teacher compensation, no students, and no staff should expect an average math score of 2.274.

2b.

The confidence interval is written (generally) as:

$$\widehat{\beta}_{totcomp} - t_{crit} * se\left(\widehat{\beta}_{tot\_comp}\right) < \beta_{totcomp} < \widehat{\beta}_{totcomp} + t_{crit} * se\left(\widehat{\beta}_{tot\_comp}\right)$$

At the 95% confidence level, t_{crit} is 1.96. Thus, the confidence interval is:

$$\begin{aligned} 0.00046 - 1.96 * 0.00010 &< \beta_{totcomp} < 0.00046 + 1.96 * 0.00010 \\ 0.000264 &< \beta_{totcomp} < 0.000656 \end{aligned}$$

Since zero is not contained in the confidence interval, we can conclude that *totcomp* is a significant determinant of math scores. However, one must be careful since average student income is an omitted variable. If higher income kids are more likely to get higher grades, and higher income areas hire better teachers, it may not be compensation which is influencing math scores.

2c.

To calculate the P-Value, write your null and alternative hypotheses

$$\begin{aligned} H_0 &: \beta_{staff} = 0 \\ H_A &: \beta_{staff} \neq 0 \end{aligned}$$

Then calculate the T statistic.

$$t_{stat} = \frac{0.048 - 0}{0.04} = 1.2$$

Next, calculate the probability that a randomly selected value from the t distribution satisfies the following:

$$\begin{aligned} \Pr(|T| &> 1.2) = \Pr(T > 1.2) + \Pr(T < -1.2) \\ &= 2 * (1 - \Pr(T < 1.2)) \\ &= 2 * (1 - 0.8849) \\ &= 0.2302 \end{aligned}$$

Thus, the p-value is 0.23. This implies that there is a 23% chance of falsely rejecting the null hypothesis. This is not low enough to reject the null hypothesis at conventional levels.