Exercises Econometrics: Set 1-Correction

Computer exercises:

1) Use the data in SLEEP75.RAW from Biddle and Hamermesh (1990) to study whether there is a tradeoff between the time spent sleeping per week and the time spent in paid work. We could use either variable as the dependent variable.

For concreteness, estimate the model $sleep = \beta_0 + \beta_1 totwork + u$, where $sleep$ is minutes spent sleeping at night per week and $totwork$ is total minutes worked during the week.

(i) Report your results in equation form along with the number of observations and $R^2$. What does the intercept in this equation mean?

(ii) If $totwork$ increases by 2 hours, by how much is $sleep$ estimated to fall? Do you find this to be a large effect?

(ii) If someone works two more hours per week then $\Delta totwork = 120$ (because $totwork$ is measured in minutes), and so $\Delta sleep = -0.151(120) = -18.12$ minutes. This is only a few minutes a night. If someone were to work one more hour on each of five working days, $\Delta sleep = -0.151(300) = -45.3$ minutes, or about five minutes a night.

\[
sleep = 3.586.4 - 0.151 \cdot totwork
\]

\[n = 706, \quad R^2 = .103.\]
(iii) Let \( \text{totwrk}_hr \) be the total hours worked during the week. Without using the computer, what will be the coefficient of this variable in a regression of sleep on \( \text{totwrk}_hr \)?

\[
\text{totwrk}_hr = \text{totwrk}/60
\]

We can re-write the model equation using this new variable:

\[
\text{sleep} = \beta_0 + \beta_1 (\text{totwork}_hr \times 60) + u
\]

\[
\text{sleep} = \beta_0 + 60 \beta_1 \text{totwork}_hr + u
\]

\[
\text{sleep} = \beta_0 + \beta'_1 \text{totwork}_hr + u \quad \text{where} \quad \beta'_1 = 60 \beta_1.
\]

So \( \beta'_1 = 60 \beta_1 = -0.15 \times 60 = -9 \).

Increasing the number of total hours worked per week by one leads to a decrease of 9 minutes of sleep per week.

2) A more realistic version of this model is: \( \text{sleep} = \beta_0 + \beta_1 \text{totwork} + \beta_2 \text{educ} + \beta_3 \text{age} + u \), where \( \text{sleep} \) and \( \text{totwork} \) (total work) are measured in minutes per week and \( \text{educ} \) and \( \text{age} \) are measured in years.

(i) If adults trade off sleep for work, what is the sign of \( \beta_1 \)?

If adults trade off sleep for work, more work implies less sleep (other things equal), so \( \beta_1 < 0 \).

(ii) What signs do you think \( \beta_2 \) and \( \beta_3 \) will have?

The signs of \( \beta_2 \) and \( \beta_3 \) are not obvious. One could argue that more educated people like to get more out of life, and so, other things equal, they sleep less (\( \beta_2 < 0 \)). The relationship between sleeping and age is more complicated than this model suggests, and economists are not in the best position to judge such things.

(iii) Using the data in SLEEP75.RAW, estimate the equation above. Write down the equation with the found coefficients, the \( R^2 \), and the number of observations.

```
. reg sleep totwrk educ age
```

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<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs =</th>
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<tr>
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<td>702</td>
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<td>705</td>
<td>197503.313</td>
<td>Adj R-squared =</td>
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</tbody>
</table>

| sleep | Coef. | Std. Err. | t | P>|t| | (95% Conf. Interval) |
|--------|-------|-----------|---|-----|---------------------|
| totwrk | -1.4837734 | 0.1669935 | -8.89 | 0.000 | -1.8111487 | -1.155982 |
| educ   | -11.33831 | 5.884575 | -1.89 | 0.059 | -22.68729 | -0.146805 |
| age    | 5.199885 | 1.445717 | 3.52 | 0.029 | 6.385613 | 5.018331 |
| _cons  | 3638.245 | 122.2751 | 30.40 | 0.000 | 3417.81 | 3858.681 |

Using the data in SLEEP75.RAW, the estimated equation is

\[
\text{sleep} = 3638.25 - .148 \text{totwrk} - 11.13 \text{educ} + 2.20 \text{age}
\]

\[ n = 706, R^2 = .113. \]
(iv) If someone works five more hours per week, by how many minutes is sleep predicted to fall? Is this a large tradeoff? Compare these results with the results you had in the first exercise.

\[ \text{sleep} = \beta_0 + \beta_{\text{totwork}} + \beta_{\text{educ}} + \beta_{\text{age}} + u \]

Everything else held equal, if \( \Delta \text{totwork} = 5 \times 60 = 300 \), then

\[ \Delta \text{sleep} = \beta_1 \times \Delta \text{totwork} = -0.148 \times 300 = -44.4. \]

So working 5 more hours per week leads to sleeping 44.4 minutes less per week, which does not seem to be a large trade-off: for a week, 44.4 minutes less spent sleeping is not an overwhelming change. These results are very close from those obtained when we did not control for education and age, probably because of the low correlation between \( \text{educ}, \text{age} \) and \( \text{totwrk} \).

(v) Discuss the sign and magnitude of the estimated coefficient on \( \text{educ} \).

More education implies less predicted time sleeping, but the effect is quite small. If we assume the difference between college and high school is four years, the college graduate sleeps about 45 minutes less per week, other things equal.

(vi) Would you say \( \text{totwrk}, \text{educ}, \text{and age} \) explain much of the variation in sleep? What other factors might affect the time spent sleeping? Are these likely to be correlated with \( \text{totwrk} \)?

Not surprisingly, the three explanatory variables explain only about 11.3% of the variation in sleep. One important factor in the error term is general health. Another is marital status, and whether the person has children. Health (however we measure that), marital status, and number and ages of children would generally be correlated with \( \text{totwrk} \). (For example, less healthy people would tend to work less.)

Exercise without computer:

3) The median starting salary for new law school graduates is determined by

\[ \log(\text{salary}) = \beta_0 + \beta_{\text{LSAT}} + \beta_{\text{GPA}} + \beta_{\log(\text{libvol})} + \beta_{\log(\text{cost})} + \beta_{\text{rank}} + u, \]

where \( \text{LSAT} \) is median LSAT score for the graduating class, \( \text{GPA} \) is the median college GPA for the class, \( \text{libvol} \) is the number of volumes in the law school library, \( \text{cost} \) is the annual cost of attending law school, and \( \text{rank} \) is a law school ranking (with \( \text{rank} = 1 \) being the best).

(i) Explain why we expect \( \beta_5 \leq 0 \).

A larger rank for a law school means that the school has less prestige; this lowers starting salaries. For example, a rank of 100 means there are 99 schools thought to be better.

(ii) What signs do you expect for the other slope parameters? Justify your answers.

\( \beta_1 > 0, \beta_2 > 0 \). Both \( \text{LSAT} \) and \( \text{GPA} \) are measures of the quality of the entering class. No matter whether better students attend law school, we expect them to earn more, on average. \( \beta_3, \beta_4 > 0 \). The number of volumes in the law library and the tuition cost are both measures of the school quality. (Cost is less obvious than library volumes, but should reflect quality of the faculty, physical plant, and so on.)
(iii) Using the data in LAWSCH85.RAW, the estimated equation is:

\[
\log(\text{salary}) = 8.34 + 0.0047\, \text{LSAT} + 0.248\, \text{GPA} + 0.095\log(\text{libvol}) + 0.038\log(\cos t) - 0.0033\, \text{rank} + u,
\]

\[n = 136, R^2 = 0.842.\]

What is the predicted ceteris paribus difference in salary for schools with a median GPA different by one point? (Report your answer as a percent.)

This is just the coefficient on GPA, multiplied by 100: 24.8%.

(iv) Interpret the coefficient on the variable \(\log(\text{libvol})\).

This is an elasticity: a one percent increase in library volumes implies a .095\% increase in predicted median starting salary, other things equal.

(v) Would you say it is better to attend a higher ranked law school? How much is a difference in ranking of 20 worth in terms of predicted starting salary?

It is definitely better to attend a law school with a lower rank. If law school A has a ranking 20 less than law school B, the predicted difference in starting salary is 100(0.0033)(20) = 6.6\% higher for law school A.