Ch9-2

Monday, March 17, 2025 11:27 AM

dummydu...

Two dummy variables without an interaction

As an example, we will use a version of the CPS data:

```
dat <- read.csv("https://rtgodwin.com/data/twodummies.csv")
```

In this example, the `university` variable is a **dummy** variable which equals to 1 if the individual has a university (BA) degree, and 0 otherwise. The other dummy variable in the data is `female`.

Variable	Description
`wage`	hourly wage of the worker
`female`	= 1 if the individual is female
	= 0 if male
`university`	= 1 if the individual has a university degree
	= 0 if no university degree
`age`	the age of the worker in years

$$\log(wage) = \beta_0 + \beta_1 female + \beta_2 university + \beta_3 age + \epsilon$$

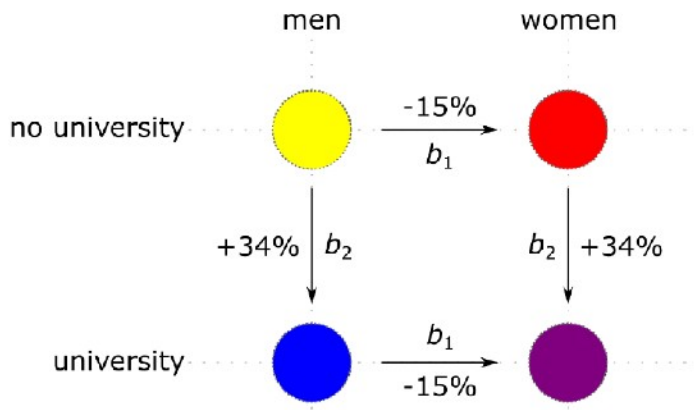
Estimate this in R:

```
summary(lm(log(wage) ~ female + university + age, data = dat))
```

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.016700   0.043388   46.48   <2e-16 ***
female      -0.152178   0.008503  -17.90   <2e-16 ***
university   0.337940   0.008409   40.19   <2e-16 ***
age          0.026435   0.001439   18.37   <2e-16 ***
```

The interpretation of the results is that women make 15% less than men, and that a university degree increases wage by 34%. However, this model does not allow for the possibility that education has a different effect for women than it does for men. There is a difference between men and women, and there is a difference for a university degree, but there is no difference in the effect of university for men vs. women. See Figure 8.10.

Figure 8.10: University makes a difference, and gender makes a difference, but there is not a separate difference for university educated women.



$$\log(wage) = \beta_0 + \beta_1 female + \beta_2 university + \beta_3(female \times university) + \beta_4 age + \epsilon$$

where β_3 is the additional percentage increase in wages for women with an education, versus men with an education. In R, we can do this by:

```
summary(lm(log(ahe) ~ female + bachelor + I(female * bachelor) + age,
           data = cps))
```

```
                        Estimate Std. Error t value Pr(>|t|)
(Intercept)              2.01896    0.04338  46.541  < 2e-16 ***
female                  -0.17347    0.01173 -14.791  < 2e-16 ***
university               0.31895    0.01107  28.809  < 2e-16 ***
I(female * university)   0.04489    0.01704   2.635  0.00842 **
age                      0.02662    0.00144  18.479  < 2e-16 ***
```

It is estimated that women make 17% less than men, that men with a degree make 32% more than men without a degree, and that women with a degree make (32% + 4.5% ≈ 36%) more than women without a degree. There is a difference for men, a difference for

It is estimated that women make 17% less than men, that men with a degree make 32% more than men without a degree, and that women with a degree make (32% + 4.5% ≈ 36%) more than women without a degree. There is a difference for men, a difference for women, and the difference between these two differences is β_3 (4.5%). See Figure 8.11.

Figure 8.11: University makes a difference, and gender makes a difference, but there is not a separate difference for university educated women.