PDF

dummydu...

$$y = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 (D_1 \times D_2) + \epsilon$$

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

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

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

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.
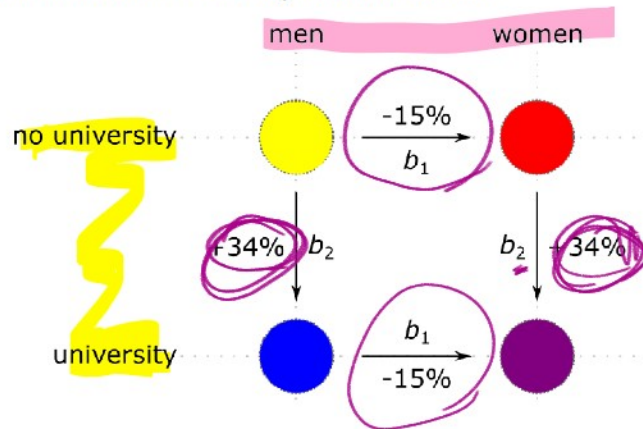
$$\log(wage) = \beta_0 + \beta_1 female + \beta_2 university + \beta_3 (\overset{1}{female \times university}) + \beta_4 age + \epsilon$$

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 women, and the difference between these two differences is β_3 (4.5%). See Figure 8.11.

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

men   women

no university -17%
                     b_1

                  $+32\%$ b_2 b_2+b_3 $+32\%$ 36.5%
                                                    $+4.5\%$

university b_1+b_3
                    -17%
                    $+4.5\%$

                    -12.5%

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