

Ch.: 7 (cont.)

$$y = \beta_0 + \beta_1 x_1 + \delta_0 x_2 + u$$

$\downarrow$   
0/1

if  $y$ : wage  
 $x_1$ : educ.  
 $x_2 \rightarrow 1$ : marr.  
 $\quad \rightarrow 0$ : not "

$$E(y | x_1, x_2) = \beta_0 + \beta_1 x_1 + \delta_0 x_2$$

$$\delta_0 = E(y | x_1, x_2=1) - E(y | x_1, x_2=0)$$

effect of  $x_2=1$  rel. to  $x_2=0$  after controlling for  $x_1$ .

Note: 2 groups denoted by single dummy

$x_3$ : 1  $\rightarrow$  not marr.  
0  $\rightarrow$  marr.

$x_2=0$  after controlling for  $x_1$ .  
base/reference group

Not reqd.  $\because x_2$  &  $x_3$   
are perfectly collinear

$x_2$	$x_3$
1	0
0	1

$\rightarrow$  dummy variable trap.

If  $y$ : log(wage)

approximate effect of  $x_2=1$ :  $100 \hat{\delta}_0$  %

exact " :  $100 [\exp(\hat{\delta}_0) - 1]$  %

e.g. if  $\hat{\delta}_0 = 0.26 \Rightarrow 26$  % (approx)

or 29.7 % (exact)

## Multiple categories

$$M \rightarrow \begin{array}{l} 1 \text{ (married)} \\ 0 \text{ (not ")} \end{array}$$

$$W \rightarrow \begin{array}{l} 1 \text{ (western region)} \\ 0 \text{ (not ")} \end{array}$$

4 groups  $\rightarrow$  choose 1 as base/reference group  
& include dummies for rest

$$y = \beta_0 + \beta_1 x_1 + \delta_0 x_2 + \delta_1 x_3 + \delta_2 x_4 + u$$

$y$ : wage

$x_1$ : educ

$\delta_0$ : effect of  $x_2=1$  rel. to base

$\delta_1$ : "  $x_3=1$  "

$x_2$ :  $M=1$  &  $W=1 \rightarrow x_2=1$  & 0 o.w.

$\delta_2$ : "  $x_4=1$  "

$x_3$ :  $M=1$  &  $W=0 \rightarrow x_3=1$

$x_4$ :  $M=0$  &  $W=1 \rightarrow x_4=1$  & 0 o.w.

base:  $M=0$  &  $W=0$

$$\hat{\delta}_0 = 2.72$$

$$\hat{\delta}_1 = 1.3$$

$$\hat{\delta}_2 = 0.02$$

. reg wage educ marrwe marrnotwe notmarrwe

Source	SS	df	MS	Number of obs	=	526
Model	1557.61913	4	389.404783	F(4, 521)	=	36.21
Residual	5602.79516	521	10.7539254	Prob > F	=	0.0000
				R-squared	=	0.2175
				Adj R-squared	=	0.2115
Total	7160.41429	525	13.6388844	Root MSE	=	3.2793

  

wage	Coefficient	Std. err.	t	P> t	[95% conf. interval]
educ	.5210957	.0518182	10.06	0.000	.4192974 .6228941
marrwe	2.718211	.5207133	5.22	0.000	1.695256 3.741167
marrnotwe	1.29973	.3227894	4.03	0.000	.6656009 1.933858
notmarrwe	.0226834	.5952741	0.04	0.970	-1.146749 1.192116
_cons	-1.582822	.6852682	-2.31	0.021	-2.929051 -.2365938

Effect of marr. & west.

rel. to base = \$2.72

" " not west. &

marr. rel. to base = \$1.3

### Interactions among dummy vars.

$$y = \beta_0 + \beta_1 x_1 + \delta_M \cdot M + \delta_W \cdot W + \delta_{MW} \cdot M \cdot W + u$$

Base / ref. group  $\Rightarrow M=0$  &  $W=0$

Effect of  $M=1$  &  $W=1$  :  $\delta_M + \delta_W + \delta_{MW}$   
rel. to base

Effect of  $M=1$  &  $W=0$  :  $\delta_M$   
rel. to base

Effect of  $M=0$  &  $W=1$  :  $\delta_W$   
rel. to base

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. reg wage educ married west marrwe
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Source	SS	df	MS	Number of obs =	526
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Residual	5602.79516	521	10.7539254	Prob > F	= 0.0000
				R-squared	= 0.2175
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Total	7160.41429	525	13.6388844	Root MSE	= 3.2793

wage	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
educ	.5210957	.0518182	10.06	0.000	.4192974	.6228941
married	1.29973	.3227894	4.03	0.000	.6656009	1.933858
west	.0226834	.5952741	0.04	0.970	-1.146749	1.192116
marrwe	1.395798	.7753837	1.80	0.072	-.1274644	2.919061
_cons	-1.582822	.6852682	-2.31	0.021	-2.929051	-.2365938

```
. reg wage educ i.married##i.west
```

Source	SS	df	MS	Number of obs =	526
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wage	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
educ	.5210957	.0518182	10.06	0.000	.4192974	.6228941
1.married	1.29973	.3227894	4.03	0.000	.6656009	1.933858
1.west	.0226834	.5952741	0.04	0.970	-1.146749	1.192116
married#west						
1 1	1.395798	.7753837	1.80	0.072	-.1274644	2.919061
_cons	-1.582822	.6852682	-2.31	0.021	-2.929051	-.2365938

$$\hat{\delta}_M = 1.3$$

$$\hat{\delta}_W = 0.02$$

$$\hat{\delta}_{MW} = 1.4$$

Effect of marr. & west = \$2.72  
(rel. to base)

Effect of marr. & not west = \$1.3  
(rel. to base)