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3rd Tutorial to
Econometric Methods and Applications WS 2017/18

Exercise 13 [2.5%]

Exercise 6.5 Stock & Watson: Introduction to Econometrics (Third Edition, p.248)

Data were collected from a random sample of 220 home sales from a community in 2003. Let *Price* denote the selling price (in 1000 \$), *BDR* denote the number of bedrooms, *Bath* denote the number of bathrooms, *Hsize* denote the size of the house (in square feet), *Lsize* denote the lot size (in square feet), *Age* denote the age of the house (in years), and *Poor* denote a binary variable that is equal to 1 if the condition of the house is reported as "poor". An estimated regression yields

$$\begin{aligned}\widehat{Price} &= 119.2 + 0.485 \cdot BDR + 23.4 \cdot Bath + 0.156 \cdot Hsize + 0.002 \cdot Lsize \\ &\quad + 0.090 \cdot Age - 48.8 \cdot Poor \\ \overline{R}^2 &= 0.72 \\ SER &= 41.5\end{aligned}$$

(a) Suppose that a homeowner converts part of an existing family room in her house into a new bathroom. What is the expected increase in the value of the house?

(b) Suppose that a homeowner adds a new bathroom to her house, which increases the size of the house by 100 square feet. What is the expected increase in the value of the house?

(c) What is the loss in value if a homeowner lets his house run down so that its condition becomes "poor"?

(d) Compute the R^2 for the regression.

Exercise 14 [2.5%]

With the linear model

$$\texttt{wage}_i = \beta_0 + \beta_1 \texttt{educ}_i + \beta_2 \texttt{exper}_i + \beta_3 \texttt{female}_i + \beta_4 \texttt{married}_i + u_i, i \in \{1, \ldots, n\},$$

wages (`wage`) are regressed on years of education (`educ`), years of professional experience (`exper`), a dummy variable for gender (`female`) and a dummy for marital status (`married`).

(a) The estimation results are (assuming homoskedastic errors):

```
Call:
lm(formula = wage ~ educ + exper + female + married)


Residuals:
    Min      1Q  Median      3Q     Max
-6.4057 -1.9042 -0.5982  1.1454 14.6545


Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.79066    0.75121  -2.384   0.0175 *
educ         0.58332    0.05166  11.292  < 2e-16 ***
exper        0.05567    0.01106   5.035 6.59e-07 ***
female      -2.06710    0.27221  -7.594 1.45e-13 ***
married      0.66024    0.29685   2.224   0.0266 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.066 on 521 degrees of freedom
Multiple R-squared:  0.3158,Adjusted R-squared:  0.3105
F-statistic: 60.12 on 4 and 521 DF,  p-value: < 2.2e-16
```

What wages are predicted by the model for

(i) female singles

(ii) male singles

(iii) married women

(iv) married men

with 15 years of professional experience and 12 years of education?
What is the effect of being married on wages?

(b) After introducing an interaction term for the two dummy variables ('`I(female * married)`', for married women taking the value 1 and being 0 otherwise), the model was re-estimated:

```
Call:
lm(formula = wage ~ educ + exper + female + married + I(female *
    married))

Residuals:
    Min      1Q  Median      3Q     Max
-6.8255 -1.7078 -0.5796  1.0495 14.2206

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)         -2.65518    0.75492  -3.517 0.000474 ***
educ                 0.57811    0.05053  11.441  < 2e-16 ***
exper                0.05322    0.01082   4.918 1.18e-06 ***
female              -0.42373    0.42423  -0.999 0.318346
married              2.08000    0.40707   5.110 4.54e-07 ***
```

```
I(female * married) -2.70735    0.54416  -4.975 8.87e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.999 on 520 degrees of freedom
Multiple R-squared:  0.3469,Adjusted R-squared:  0.3406
F-statistic: 55.24 on 5 and 520 DF,  p-value: < 2.2e-16
```

What wages are predicted by the model for

(i) female singles

(ii) male singles

(iii) married women

(iv) married men

with 15 years of professional experience and 12 years of education?
What is the effect of being married on wages for males and females, resp.?

(c) After introducing a further interaction effect ('`I(female * exper)`', being equal to 0 for men and giving the years of professional experience for women), the estimation result was:

```
Call:
lm(formula = wage ~ educ + exper + female + married + I(female *
    married) + I(female * exper))

Residuals:
    Min      1Q  Median      3Q     Max
-7.3283 -1.6474 -0.5308  1.0442 14.1439

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)         -3.15376    0.77453  -4.072 5.39e-05 ***
educ                 0.59431    0.05063  11.739  < 2e-16 ***
exper                0.08080    0.01506   5.363 1.23e-07 ***
female               0.19589    0.48380   0.405 0.685718
married              1.79901    0.41881   4.296 2.08e-05 ***
I(female * married) -2.22990    0.57107  -3.905 0.000107 ***
I(female * exper)   -0.05335    0.02039  -2.616 0.009154 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.982 on 519 degrees of freedom
Multiple R-squared:  0.3554,Adjusted R-squared:  0.3479
F-statistic: 47.69 on 6 and 519 DF,  p-value: < 2.2e-16
```

What is the effect of an additional year of professional experience for men and women, resp.? Also give an interpretation for the regression coefficient for '`I(female * exper)`'.