Another example

Return to education example:

```
regress wage educ female, robust

Linear regression                               Number of obs =     526
                                                F(  2,   523) =   69.10
                                                Prob > F      =  0.0000
                                                R-squared     =  0.2588
                                                Root MSE      =  3.1855

------------------------------------------------------------------------------
             |               Robust
        wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |    .5064521   .0598956     8.46   0.000     .3887867    .6241176
      female |   -2.273362   .2702033    -8.41   0.000    -2.804179   -1.742545
       _cons |    .6228168   .7286843     0.85   0.393    -.8086909    2.054324
------------------------------------------------------------------------------

regress wage educ, robust

Linear regression                               Number of obs =     526
                                                F(  1,   524) =   78.09
                                                Prob > F      =  0.0000
                                                R-squared     =  0.1648
                                                Root MSE      =  3.3784

------------------------------------------------------------------------------
             |               Robust
        wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |    .5413593   .0612596     8.84   0.000     .4210146    .6617039
       _cons |   -.9048516   .7254795    -1.25   0.213    -2.330057    .5203539
------------------------------------------------------------------------------
```

```
correlate educ female
(obs=526)

             |     educ   female
-------------+------------------
        educ |   1.0000
      female |  -0.0850   1.0000
```

- *Can omitting Female cause an Omitted Variable Bias? Why?*
- *What other factors can cause OVB?*
- *Can Experience cause OVB?*

```
correlate educ exper
(obs=526)

             |     educ    exper
-------------+------------------
        educ |   1.0000
       exper |  -0.2995   1.0000
```

```
regress wage educ exper, robust

Linear regression                               Number of obs =     526
                                                F(  2,   523) =   50.32
                                                Prob > F      =  0.0000
                                                R-squared     =  0.2252
                                                Root MSE      =   3.257

------------------------------------------------------------------------------
             |               Robust
        wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |   .6442721   .0651869     9.88   0.000     .5162117    .7723324
       exper |   .0700954   .0109943     6.38   0.000      .048497    .0916938
       _cons |  -3.390539   .8648747    -3.92   0.000    -5.089595   -1.691484
------------------------------------------------------------------------------
```

```
reg wage educ female exper tenure,robust

  Linear regression                               Number of obs =     526
                                                  F(  4,   521) =   44.57
                                                  Prob > F      =  0.0000
                                                  R-squared     =  0.3635
                                                  Root MSE      =  2.9576

  ------------------------------------------------------------------------------
               |               Robust
          wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
          educ |   .5715048   .0612172     9.34   0.000     .4512418    .6917677
        female |  -1.810852    .254156    -7.12   0.000    -2.310149   -1.311556
         exper |   .0253959   .0098057     2.59   0.010     .0061323    .0446594
        tenure |   .1410051    .027955     5.04   0.000     .0860867    .1959234
         _cons |  -1.567939   .8259341    -1.90   0.058    -3.190509    .0546317
  ------------------------------------------------------------------------------
  test exper=tenure=0
   ( 1)  exper - tenure = 0
   ( 2)  exper = 0

         F(  2,   521) =   26.86
              Prob > F =    0.0000
```

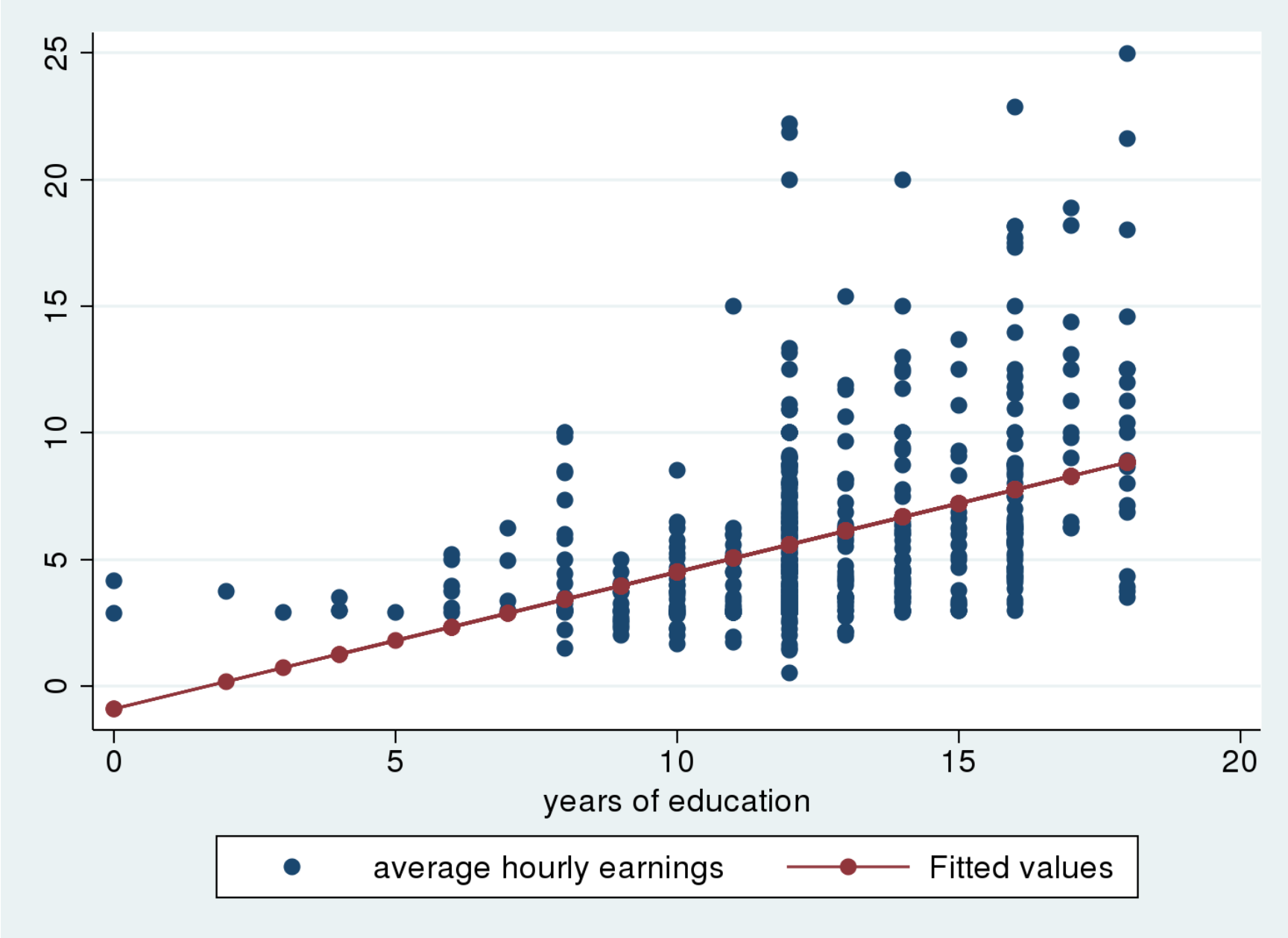
Results of Regressions of Hourly Earnings on Years of Education and Worker Characteristics

Dependent variable: Hourly earnings

Regressor	(1)	(2)	(3)	(4)	(5)
Years of education	.54** (.061)	.51** (0.06)	0.64** (0.065)	0.59** (0.061)	0.57** (0.057)
Female		-2.27** (0.27)			-1.81** (0.25)
Experience			0.07** (0.010)	0.02* (0.010)	0.025* (0.009)
Tenure				0.169** (0.029)	0.141** (0.027)
Intercept	-.90 (.72)	0.62 (0.72)	-3.39 (0.86)	-2.87 (0.80)	–1.57 (0.83)
Summary statistics					
Root MSE	3.37	3.19	3.26	3.08	2.96
$\bar{R}^2$	0.165	0.25	0.23	0.31	0.36
n	526	526	526	526	526
F-statistic testing coefficients on Tenure and Experience 0 (*p*-value)					26.86 (0.000)

The individual coefficient is statistically significant at the *5% level or **1% significance level using a two-sided test. Standard errors are given in parentheses under coefficients.

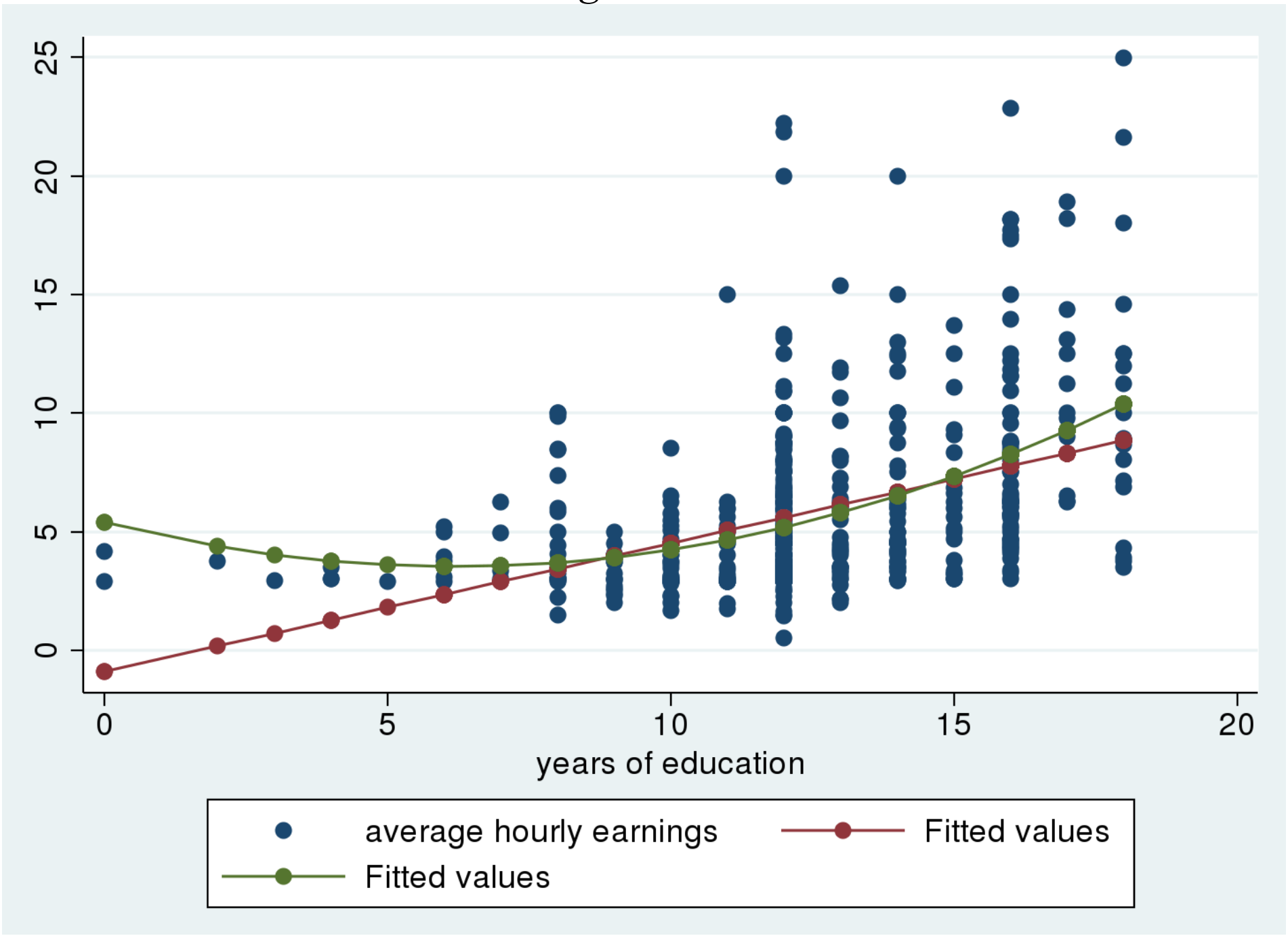
Do you think that the relation between wage and education is linear?



```
generate educsq=educ*educ

reg wage educ educsq exper tenure, robust

Linear regression                               Number of obs =     526
                                                F(  4,   521) =   38.78
                                                Prob > F      =  0.0000
                                                R-squared     =  0.3315
                                                Root MSE      =  3.0311

------------------------------------------------------------------------------
             |               Robust
        wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        educ |  -.3658928   .1893441    -1.93   0.054    -.7378645     .006079
      educsq |   .0409916   .0090113     4.55   0.000     .0232886    .0586946
       exper |   .0191522   .0101172     1.89   0.059    -.0007234    .0390278
      tenure |   .1658285    .02848     5.82   0.000     .1098789    .2217782
       _cons |   2.537227   1.062879     2.39   0.017     .4491721    4.625283
------------------------------------------------------------------------------
```

Dependence of wage on education:
-0.365Educ+0.041Educ^2
Average education is 12.56.
*Marginal effect at the average: -0.365+2*0.041*12.56=0.66*

Wage vs predicted in linear and square regressions



Results of Regressions of Hourly Earnings on Years of Education and Worker Characteristics

Dependent variable: Hourly earnings

Regressor	(1)	(2)	(3)
Years of education	0.59** (0.061)	.-0.37* (0.18)	0.41 (0.43)
Years of education^2		0.04** (0.009)	-0.045 (0.052)
Years of education^3			0.0028 (0.002)
Experience	0.02* (0.010)	0.02* (0.010)	0.02* (0.010)
Tenure	0.169** (0.029)	0.166** (0.029)	0.165** (0.028)
Intercept	-2.87* (0.80)	2.53* (1.1)	0.71 (1.14)
Summary statistics			
Root MSE	3.08	3.03	3.03
$\bar{R}^2$	0.31	0.33	0.33
n	526	526	526
F-statistic testing coefficients on educ^2 and educ^3 being 0 (*p*-value)			10.90 (0.000)

Results of Regressions of Hourly Earnings on Years of Education and Worker Characteristics

Dependent variable: ln(Hourly earnings)

Regressor	(1)	(2)	(3)
Years of education	0.092** (0.008)	.-0.032 (0.024)	-0.003 (0.06)
Years of education^2		0.005** (0.001)	0.002 (0.007)
Years of education^3			0.0001 (0.0002)
Experience	0.004* (0.001)	0.004* (0.002)	0.004* (0.002)
Tenure	0.022** (0.003)	0.022** (0.004)	0.022** (0.004)
Intercept	0.28* (0.11)	0.98** (0.15)	0.91** (0.15)
Summary statistics			
Root MSE	0.44	0.43	0.43
$\bar{R}^2$	0.31	0.34	0.34
n	526	526	526
F-statistic testing coefficients on educ^2 and educ^3 being 0 (*p*-value)			13.93 (0.000)

Graph of ln(wage) versus predicted in linear and square regressions