Answers to
Empirical Exercises for Chapter 7

These tables contain the results from several regressions that are referenced in the answers. The dependent variable is ln(*AHE*).

1998 Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	0.0216** (0.0021)		0.162*** (0.047)	0.151** (0.064)	0.155** (0.063)	0.147** (0.074)	0.132 (0.082)
Age^2			–0.0024** (0.0008)	–0.0022* (0.0010)	–0.0023* (0.0011)	–0.0021 (0.0012)	–0.0019 (0.0014)
ln(*Age*)		0.642** (0.061)					
Female×*Age*				0.025 (0.094)		0.020 (0.095)	0.061 (0.128)
Female×Age^2				–0.0005 (0.0016)		–0.0004 (0.0016)	–0.0011 (0.0022)
Bachelor×*Age*					0.014 (0.095)	0.015 (0.096)	0.055 (0.132)
Bachelor×Age^2					–0.0002 (0.0016)	–0.0002 (0.0016)	–0.0008 (0.0022)
Female×*Bachelor*×*Age*							–0.089 (0.192)
Female×*Bachelor*×Age^2							0.0014 (0.0032)
Female	–0.218** (0.016)	–0.218** (0.016)	–0.218** (0.016)	–0.531 (1.400)	–0.218** (0.016)	–0.453 (1.401)	–1.081 (1.882)
Bachelor	0.347** (0.016)	0.347** (0.016)	0.345** (0.016)	0.346** (0.016)	0.095 (1.400)	0.074 (1.412)	–0.541 (1.940)
Female×*Bachelor*	0.084** (0.023)	0.084** (0.023)	0.085** (0.023)	0.084** (0.023)	0.086** (0.023)	0.085** (0.235)	1.451 (2.823)
Intercept	1.798** (0.062)	0.264 (0.207)	–0.255 (0.694)	–0.131 (0.943)	–0.139 (0.926)	–0.039 (1.087)	0.190 (1.200)
***F*-statistic and *p*-values on joint hypotheses**							
(a) *F*-statistic on terms involving *Age*			59.01 (0.00)	29.58 (0.00)	29.74 (0.00)	19.87 (0.00)	14.96 (0.00)
(b) Interaction terms with *Age* and Age^2			0.32 (0.72)	0.44 (0.64)	0.32 (0.72)	0.43 (0.79)	0.35 (0.91)
(c) Interaction terms *Female*×*Bachelor*×*Age* and *Female*×*Bachelor*×Age^2							0.23 (0.79)
SER	0.445	0.445	0.445	0.445	0.445	0.445	0.445
$\overline{R}^2$	.1840	.1843	.1850	.1849	.1848	.1847	.1845

Significant at the *5% and **1% significance level.

1992 Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	0.0267** (0.0018)		0.150** (0.041)	0.122* (0.056)	0.118* (0.053)	0.092 (0.064)	0.102 (0.0007182)
Age^2			–0.0021** (0.0007)	–0.0015 (0.0009)	–0.0016 (0.0008)	–0.0011 (0.0011)	–0.0012 (0.0012)
ln(*Age*)		0.792** (0.52)					
Female×*Age*				0.071 (0.081)		0.059 (0.081)	0.033 (0.106)
Female×Age^2				–0.0015 (0.0014)		–0.0013 (0.0014)	–0.0009 (0.0018)
Bachelor×*Age*					0.072 (0.082)	0.081 (0.083)	0.054 (0.114)
Bachelor×Age^2					–0.0010 (0.0014)	–0.0012 (0.0014)	–0.0008 (0.0019)
Female×*Bachelor*×*Age*							0.058 (0.165)
Female×*Bachelor*×Age^2							–0.0009 (0.0027)
Female	–0.201** (0.013)	–0.201** (0.013)	–0.201** (0.013)	–1.026 (1.190)	–0.200** (0.013)	–0.832 (1.189)	–0.407 (1.556)
Bachelor	0.338** (0.014)	0.338** (0.014)	0.338** (0.014)	0.339** (0.014)	–0.876 (1.210)	–1.027 (1.210)	–0.578 (1.671)
Female×*Bachelor*	0.085** (0.020)	0.085** (0.020)	0.084** (0.020)	0.078** (0.020)	0.086** (0.020)	0.080** (0.020)	–0.880 (2.413)
Intercept	1.640** (0.053)	–0.249 (0.175)	–0.163 (0.597)	0.154 (0.819)	0.363 (0.778)	0.659 (0.946)	0.494 (1.048)
***F*-statistic and *p*-values on joint hypotheses**							
(a) *F*-statistic on terms involving *Age*			121.92 (0.00)	63.86 (0.00)	66.02 (0.00)	46.19 (0.00)	34.78 (0.00)
(b) Interaction terms with *Age* and Age^2			0.32 (0.72)	9.00 (0.00)	4.98 (0.72)	7.41 (0.79)	5.10 (0.00)
(c) Interaction terms *Female*×*Bachelor*×*Age* and *Female*×*Bachelor*×Age^2							0.58 (0.56)
SER	0.430	0.430	0.430	0.430	0.430	0.430	0.430
$\overline{R}^2$	.1886	.1890	.1895	.1911	.1902	.1921	.1920

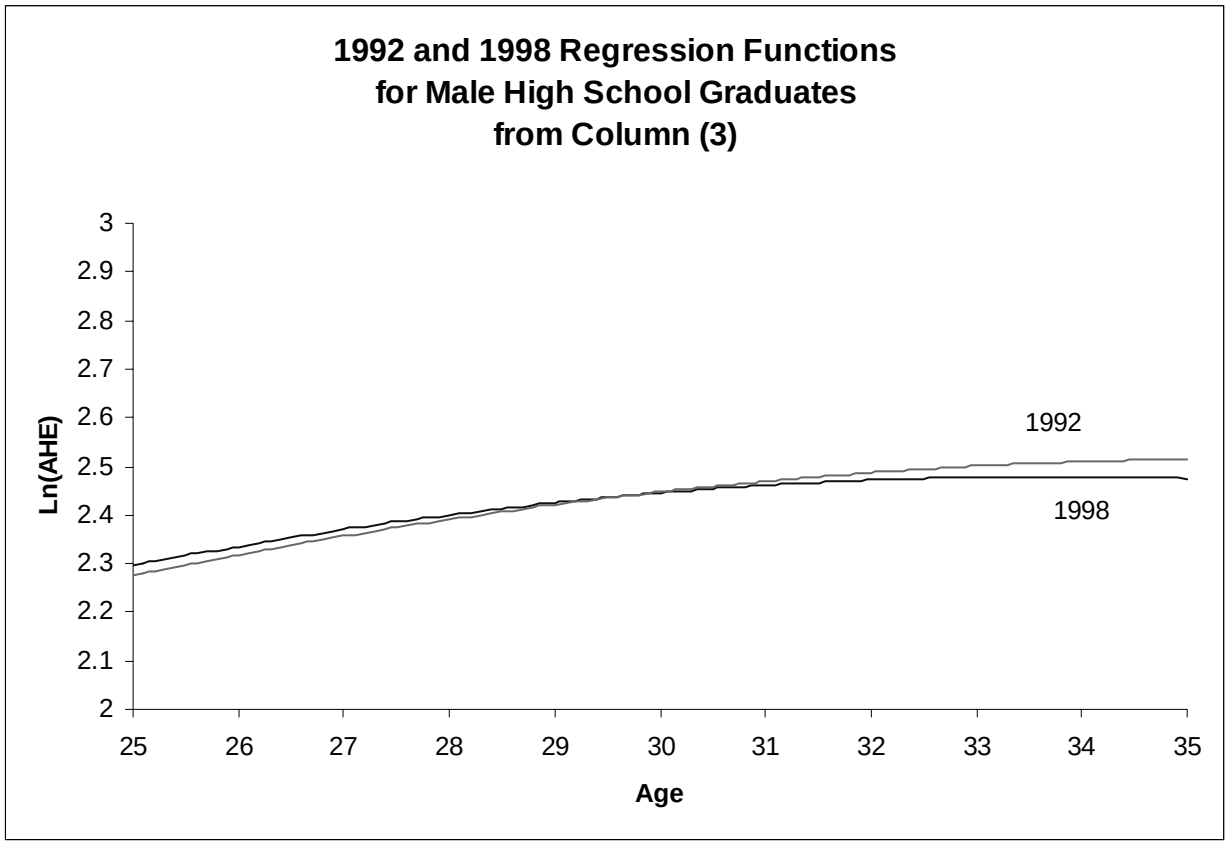
Significant at the *5% and **1% significance level.

1. *Using the data for 1998, summarize the relationship between age and earnings after controlling for gender and education. (This is the same as the final question in the empirical exercises for Chapter 6. If you have not completed the Chapter 6 exercises, you should. Doing so will allow you to give a complete answer to this question.)*

The estimated regressions suggest that earnings increase as workers age from 25-35, the range of age studied in this sample. Regression (3), which includes *Age* and Age^2, is the best fitting regression considered. Because Age^2 enters the regression, this a nonlinear regression, and the slope of the regression relating *Age* and ln(*AHE*) depends on the value of *Age*. The binary variables *Female* and *Bachelor* enter the regression significantly, as does the interaction term *Female*×*Bachelor*. Regressions (4)-(7) suggest that the effect of *Age* on ln(*AHE*) does not depend on *Female*, *Bachelor*, or the interaction of *Female* and *Bachelor*. That is, the slope of the regression function relating *Age* and ln(*AHE*) is the same for males and females, and for college and high school graduates.

2. *Use the data from 1992 to evaluate the external validity of your answer to (1). (To adjust for inflation between 1992 and 1998, you should multiply the 1992 earnings by (163/140.3), which is the ratio of the value of the Consumer Price Index (CPI) in 1998 to its value in 1992.)*

The regression results reported in column (3) for 1992 are similar to the results for 1998. The two regression functions for high school males are shown below. They are quite similar.



However, the results of columns (4)-(7) of the 1992 table suggest that the slope of the regression function relating *Age* to ln(*AHE*) is different for men and women, and for college and high school graduates. This was not the case for the 1998 data. The next page contains graphs of the 1992 and 1998 estimated regression functions taken from column (6) of the tables.

In 1998 the slopes of the regression functions for men and women are very similar to one another, as are the slopes of estimated regression for high school and college graduates. This is not the case in 1992. In 1992, the gap between male and female earnings increases as workers age. The gap between college and high school graduates also widens as workers age.


1992 Regression Functions
from Column (6)
Ln(AHE)
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
Male, BA
Female, BA
Male, HS
Female, HS
25
26
27
28
29
30
31
32
33
34
35
Age


1998 Regression Functions
from Column (6)
Ln(AHE)
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
Male, BA
Female, BA
Male, HS
Female, HS
25
26
27
28
29
30
31
32
33
34
35
Age