Name: _____ Spring 2017

EC200 Econometrics and Applications

Unit 1 Quiz

You have 50 minutes to complete this quiz. There are 30 total points.

1. *(14 points)* Biddle and Hammermesh (1990) study whether hours worked affects sleep. One simple way to recreate the spirit of their results is to regress total *minutes* of sleep per week (*sleep*) on total *minutes* of worked per week (*totwork*), controlling for years of education (*educ*), as shown below:

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.
.
. regress sleep totwrk educ
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Source	SS	df	MS		Number of obs =	706
					F(2, 703) =	43.64
Model	15377580.9	2	7688790.43		Prob > F =	0.0000
Residual	123862255	703	176190.974		R-squared =	0.1104
					Adj R-squared =	0.1079
Total	139239836	705	197503.313		Root MSE =	419.75

sleep	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
totwrk	-.1494518	.0166941	-8.95	0.000	-.182228	-.1166756
educ	-13.50385	5.680014	-2.38	0.018	-24.65567	-2.352025
_cons	3756.215	81.28699	46.21	0.000	3596.621	3915.809

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(a) Write the population model that underlies this OLS regression. *[2 points]*

(b) Interpret $\widehat{\beta}_{totwrk}$, the coefficient on minutes of weekly work. *[2 points]*

(c) One sample member, Susan, has 12 years of schooling, works exactly 15 hours per week (900 minutes), and sleeps exactly 7 hours per night (2940 minutes). What is her predicted minutes of sleep per week? What is her residual? *[2 points]*

(d) Irene says that because Susan's actual sleep differs from the model's prediction, the model is biased. Explain why you do or do not agree with her. *[2 points]*

(e) Set up a hypothesis test of whether years of education affect sleep. Report the null hypothesis, alternative hypothesis, test statistic, and decision. Can you reject the null hypothesis at the 5% level? At the 1% level? *[3 points]*

Null hypothesis:

Alternative hypothesis:

Test statistic:

Decision at 5% level?

Decision at 1% level?

(f) Suppose you estimate the same model, but you use the log of minutes worked, $log(totwrk)$. Interpret the new coefficient on $log(totwrk)$. Does this model or the first one have a better fit? How do you know? *[3 points]*

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.
.
. regress sleep ltotwrk educ
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Source	SS	df	MS		
Model	11885378.7	2	5942689.35	Number of obs	= 676
Residual	119074876	673	176931.465	F(2, 673)	= 33.59
				Prob > F	= 0.0000
Total	130960254	675	194015.192	R-squared	= 0.0908
				Adj R-squared	= 0.0881
				Root MSE	= 420.63

sleep	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ltotwrk	-232.5504	29.24841	-7.95	0.000	-289.9795	-175.1213
educ	-11.67324	5.889974	-1.98	0.048	-23.23818	-.1083065
_cons	5172.248	235.0862	22.00	0.000	4710.657	5633.839

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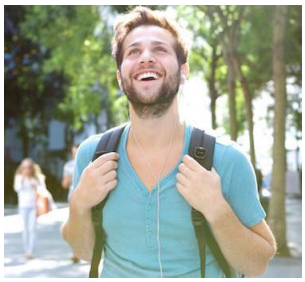
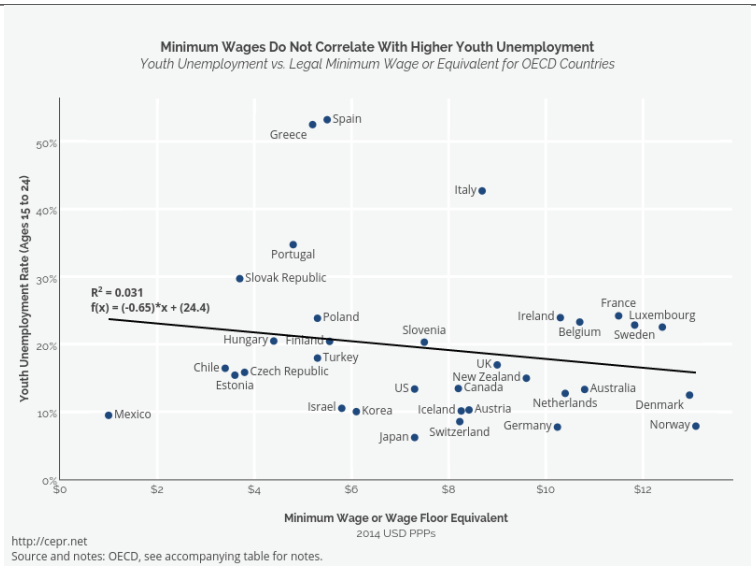
Interpretation:

Better fit? How do you know?

2. *[10 points]* Economics major Charles (who has never taken EC200) is studying the relationship between minimum wages and unemployment for his EC011 project. He finds a cool chart on the internet (see chart) and concludes that minimum wages do not affect youth unemployment.



Charles



Charles's Chart

The line on Charles's chart represents a the results of an OLS regression, where x is minimum wage and $f(x) = y =$ youth unemployment rate.

(a) Suppose that the t-statistic for $\widehat{\beta}$, the coefficient on minimum wages, is 1.24. Construct a 95% confidence interval for β_1, the slope coefficient on minimum wages.
[3 points]

(b) Give two specific examples to help Charles understand why this chart may not demonstrate a *causal* relationship between minimum wages and youth unemployment. *[4 points]*

1.

2.

(c) You want to help Charles, and you have data on the inflation rate ($inflation$), mean annual temperature ($temp$), and the share of the population under 25 ($pop25$). Should you include all three in the population model to reduce omitted variable bias? Explain your reasoning and any assumptions you make in order to draw your conclusions. *[3 points]*

3. *[6 points]* Consider the following population model: $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + u$. Suppose that $E[u|x_1, x_2, x_3] = 0$ and $Var(u|x_1, x_2, x_3) = \sigma^2_{x_2}$ (that is, the variance of the error term depends on x_2.)

   (a) Given this information, can OLS estimates of $\widehat{\beta_2}$ be BLUE? If yes, list any additional assumptions you would need. If no, explain why not. *[2 points]*

   (b) Given this information, can OLS estimates of $\widehat{\beta_2}$ be unbiased? If yes, list any additional assumptions you would need. If no, explain why not. *[2 points]*

   (c) Given this information, can OLS estimates of the *variance* of $\widehat{\beta_2}$ be unbiased? If yes, list any additional assumptions you would need. If no, explain why not. *[2 points]*