Questions and Exercises - Tutorial #4

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Nonlinear Regression Functions

1. Sketch a regression function that is increasing (has a positive slope) and is steep for small values of X but less steep for large values of X. Explain how you would specify a nonlinear regression to model this shape. Can you think of an economic relationship with a shape like this? *(Exercise 8.1, Review the Concepts, Stock and Watson).*

2. Summary of Functional Forms Involving Logarithms *(Wooldridge, p.39)*

Model	Dependent Variable	Independent Variable	Interpretation of β_1
level-level	y	x	$\Delta y = \beta_1 \Delta x$
level-log	y	$\log(x)$	$\Delta y = (\beta_1/100)\%\Delta x$
log-level	$\log(y)$	x	$\%\Delta y = (100\beta_1)\Delta x$
log-log	$\log(y)$	$\log(x)$	$\%\Delta y = \beta_1 \%\Delta x$

3. A standard "money demand" function used by macroeconomists has the form : $ln(m) = \beta_0 + \beta_1 ln(GDP) + \beta_2 R$, where m is the quantity of (real) money, GDP is the value of (real) gross domestic product, and R is the value of nominal interest rate measured in percent per year. Suppose that $\beta_1 = 4.45$ and $\beta_2 = -0.09$. What is the expected change in m if GDP increases by 10%? What is the expected change in m if the interest rate increases from 1% to 6%? *(Exercise 8.3, Review the Concepts, Stock and Watson).*

4. You have estimated a linear regression model relating y to x. your professor says, "I think that the relationship between y and x is nonlinear." how would you test the adequacy of your linear regression?" *(Exercise 8.4, Review the Concepts, Stock and Watson).*

5. *(Exercise 8.2, Stock and Watson)* Suppose that a researcher collects data on houses that have sold in a particular neighborhood over the past year and obtains regression results in the table below .

   - Using the results in column (1), what is the expected change in price of building a 500-square-foot addition to a house? Construct a 95% confidence interval for the percentage change in price;
   - Comparing columns (1) and (2), is it better to use $Size$ or $ln(Size)$ to explain house prices?
   - Using column (2), what is the estimated effect of pool on price? (Make sure you get the units right.) Construct a 95% confidence interval for this effect.
   - The regression in column (3) adds the number of bedrooms to the regression. How large is the estimated effect of an additional bedroom? Is the effect statistically significant? Why do you think the estimated effect is so small? (*Hint*: What other variables are being held constant?)
   - Is the quadratic term $ln(Size)^2$ important?

Dependent variable: ln(*Price*)

Regressor	(1)	(2)	(3)	(4)	(5)
Size	0.00042				
	(0.000038)				
ln(*Size*)		0.69	0.68	0.57	0.69
		(0.054)	(0.087)	(2.03)	(0.055)
ln(*Size*)^2				0.0078	
				(0.14)	
Bedrooms			0.0036		
			(0.037)		
Pool	0.082	0.071	0.071	0.071	0.071
	(0.032)	(0.034)	(0.034)	(0.035)	(0.035)
View	0.037	0.027	0.026	0.027	0.027
	(0.029)	(0.028)	(0.026)	(0.029)	(0.030)
Pool × *View*					0.0022
					(0.10)
Condition	0.13	0.12	0.12	0.12	0.12
	(0.045)	(0.035)	(0.035)	(0.036)	(0.035)
Intercept	10.97	6.60	6.63	7.02	6.60
	(0.069)	(0.39)	(0.53)	(7.50)	(0.40)
Summary Statistics					
SER	0.102	0.098	0.099	0.099	0.099
$\bar{R}^2$	0.72	0.74	0.73	0.73	0.73