Economics 466–Introduction to Econometrics–Exam II

Instructions:

Answer all questions clearly. Do not write anything irrelevant. No partial credit will be given for insufficient answers. Each question carries the point value as indicated within parentheses. There are 3 questions on this exam as well as a bonus question.

1. (45) (Regression Analysis-Housing Prices Revisited) An influential study in the late 70's tried to determine the impact that pollution had on home prices. A watered down version of their model appears below. The regressand (LMDEV or MDEV) is either the logarithm or level of the median value of owner occupied homes for a given community, where the median value is measured in \$1,000s. The regressors are: the per capita crime rate for the community (CRIME), the level of nitric oxides (NOX) in the air in the community (measured in parts per million), the ratio of students to teachers in the community (PTRATIO), and a dummy variable signifying whether or not the house is situated on the Charles river ($D_{CR} = 1$ if the house **is** on the river). Please answer each of the following questions.

   (a) (10, 5 each) Please interpret the coefficient on D_{CR} in Models (1) and (3).

   (b) (10, 5 each) What is the marginal effect of NOX on median home values in Models (1) and (2)?

   (c) (4, 2 each) At what point are median house values a decreasing function of NOX in Models (1) and (3)?

   (d) (6, 2 each) Determine the missing R^2 and $\bar{R}^2$ for the three models to four decimal places.

   (e) (5) Interpret the coefficient on NOX in model (2).

   (f) (10, 5 each) Is Model (1) or (3) better? How about Model (1) vs. Model (2)? Explain how and why you made your decision.

Dependent Variable:	LMDEV	LMDEV	MDEV
Model #:	(1)	(2)	(3)
Intercept	10.92	11.41	40.61
NOX	2.52	−3.94	84.09
NOX^2	−3.08	−2.43	−89.95
NOX·CRIME	−−	−0.18	−−
CRIME	−0.01	0.11	−0.16
PTRATIO	−0.07	−−	−1.93
D_{CR}	0.22	−−	5.52
Observations	506	506	506
R^2	0.525	−−	0.430
$\bar{R}^2$	−−	0.396	−−

2. (35, 5 each) (What's Wrong (Maybe) With This Picture?) Please state whether the following statements are correct or incorrect. In either case explain what led you to your final answer.

   (a) R^2 can be used to select between nonnested models.

   (b) Heteroscedasticity robust standard errors are bigger than regular standard errors.

   (c) I could use the numbers 0 and 32 for a dummy variable that captures the difference between men and women and the *interpretation* on the coefficient would be that same as the coefficient in the 0-1 case.

   (d) If I believe that heteroscedasticity is present I should always take natural logarithms of all the variables in my model since the natural logarithm is variance reducing.

   (e) Heteroscedasticity means that the unconditional variance of the errors is nonconstant.

   (f) The dummy variable trap is when you include a dummy variable for each group in the model (for example a dummy for men and a dummy for women)?

   (g) WLS will always provide me with unbiased estimates of the slope coefficients.

3. (20, 5 each) (Heteroscedasticity, Nice Spread!) Consider the following model:

$$y = \beta_0 + \beta_1 x + \beta_2 x^2 + \beta_3 w + \beta_4 xw + u. \tag{1}$$

   (a) What are two possible ways to test for heteroscedasticity in equation (1)?

   (b) If $\text{Var}(u \mid x, w) = \alpha_0 + \alpha_1 z + \alpha_2 z^2$ what test would you use to test for heteroscedasticity? Why?

   (c) Suppose I run the following regression

$$\hat{u} = \gamma_0 + \gamma_1 x + \gamma_2 x^2 + \gamma_3 w + \gamma_4 xw + \upsilon \tag{2}$$

   What does equation (2) allow me to test? Be Very Specific!

   (d) Why is knowing the form of the heteroscedasticity better than not knowing the form?

4. **Bonus Question** (10, 5 each) Give one criticism of each of the heteroscedasticity tests you listed in 3(a).