STOCKHOLM UNIVERSITY
Department of Statistics
Econometrics I, Regression analysis, ST223G
Autumn semester 2019

Written Re-examination in Econometrics I

Date	2020-01-13
Hour:	9.00-14.00
Examiner:	Jörgen Säve-Söderbergh
Allowed tools:	1) Textbook: Wooldridge, J.M. *Introductory Econometrics: A Modern Approach*, Cengage. 2) Pocket calculator 3) Notes written in the text book are allowed.

- Note that no formula sheet is provided.
- Passing rate: 50% of overall total, which is 100 points. For detailed grading criteria, see the course description.
- The maximum number of points for each problem is stated after each question. If not indicated otherwise, to obtain the maximum number of points on each problem, detailed and clear solutions are required. Answers may be given in English or Swedish.

Good luck!

We will use the following data material in this exam. We have information on the following variables

- X_1 = current taxes(local, school and county)/1000
- X_2 = number of bathrooms
- X_3 = lot size/1000 (square feet)
- X_4 = living space/1000 (square feet)
- X_5 = number of garage spaces
- X_6 = number of rooms
- X_7 = number of bed rooms
- X_8 = age of house (years)
- X_9 = number of fireplaces
- Y = actual sale price/1000 (dollars)

on $n = 24$ sold houses in Pennsylvania during the 1970s.

1. We fit a multiple regression model relating the selling price to all nine regressors using R:

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Call:
lm(formula = Y ~ X1 + X2 + X3 + X4 + X5 + X6 + X7 + X8 + X9,
data = dat1)

Residuals:
Min      1Q Median      3Q     Max
-3.720 -1.956 -0.045  1.627  4.253

Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) 14.92765    5.91285   2.525   0.0243
X1           1.92472    1.02990   1.869   0.0827
X2           7.00053    4.30037   1.628   0.1258
X3           0.14918    0.49039   0.304   0.7654
X4           2.72281    4.35955   0.625   0.5423
X5           2.00668    1.37351   1.461   0.1661
X6          -0.41012    2.37854  -0.172   0.8656
X7          -1.40324    3.39554  -0.413   0.6857
X8          -0.03715    0.06672  -0.557   0.5865
X9           1.55945    1.93750   0.805   0.4343
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Residual standard error: 2.949 on 14 degrees of freedom
Multiple R-squared:  0.8531,Adjusted R-squared:  0.7587
F-statistic: 9.037 on 9 and 14 DF,  p-value: 0.000185
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(a) Test for significance of regression. What statement can you make about the contribution of each individual regressor to the model. Use 5% significance level. (10 p)

(b) What is the contribution of lot size and living space to the fit, given that all the other regressors are in the model? Use 5% significance level. *Hint* $R_r^2 = 0.8464$ (10 p)

2. The following equations were estimated using the above data. The first equation is for houses with fireplaces and the second for houses without fireplaces

$$\hat{Y} = 64.9970 - 39.4931X2 + 7.6578X3 - 0.7553X8$$

where $n = 6, R^2 = 0.9839$ and $SSR = 2.74194$.

$$\hat{Y} = 15.5566 + 14.4781X2 + 0.9598X3 - 0.1062X8$$

where $n = 18, R^2 = 0.6757$ and $SSR = 195.2586$.

The third equation combine houses with and without fireplaces.

$$\hat{Y} = 17.37162 + 13.44330X2 + 0.90053X3 - 0.11457X8 + 1.66460X9$$

where $n = 24, R^2 = 0.7146$ and $SSR = 236.5995$.

Compute the usual Chow test for testing the null hypothesis that the regression equations are the same for houses with a fireplace and for houses without a fireplace. (30 p)

3. Assume that you have decided that the model

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$$

fits your data material. A collegue asks you to test the null hypothesis $H_0 : 2\beta_1 + 4\beta_2 = 12$. Show her how this can be done.

Hint: Define $\theta_1 = \beta_1 + 4\beta_2 - 12$ and write a regression equation involving β_0, θ_1 and β_2 that allows you to directly obtain $\hat{\theta}_1$ and its standard error. (30 p)

4. Five years ago we observed the number of employees (x) at 217 companies. You are investigating the relationship between the number of employees five years ago and the proportion of companies that no longer exist $\Lambda(x)$. A logit regression on this data delivered the following estimates $\hat{\beta}_0 = 2$ (standard error 0.09) and $\hat{\beta}_1 = -0.02$ (standard error 0.0004).

   (a) Draw the estimated logit curve. *Hint*: Make a table of the values of $\Lambda(x)$ and sketch the curve. (10 p)

   (b) Which proportion of the companies that had 100 employees are no longer present on the market today according to the model? (5 p)

   (c) Which proportion of the companies that had 10 employees are no longer present on the market today according to the model? (5 p)