Economics 471: Econometrics

University of Alabama

Department of Economics, Finance and Legal Studies

Fall 2015

Final Exam

The exam consists of four questions on five pages. Each question is of equal value.

1. Answer the following questions about the Gauss-Markov assumptions:

   (a) State each of the six Gauss-Markov assumptions.

   (b) Which assumption(s) guarantee(s) unbiasedness?

   (c) Which assumption(s) guarantee(s) that OLS is the best linear unbiased estimator?

   (d) Which assumption(s) guarantee(s) that OLS is the minimum variance unbiased estimator?

2. Consider the multiple variable regression model

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + u,$$

where the x variables are measured in unrelated units (for example, one is in pounds and another is in feet). In order to compare the relative impact of each regressor on y, we use the standardized regression model

$$z_y = b_0 + b_1 z_1 + b_2 z_2 + b_3 z_3 + e,$$

where

$$z_y = \frac{y - \overline{y}}{\sigma_y},$$

where $\overline{y}$ is the mean of y and σ_y is its standard deviation. Similarly,

$$z_l = \frac{x_l - \overline{x}_l}{\sigma_{x_l}}$$

where $\overline{x}_l$ is the mean of x_l and σ_{x_l} is its standard deviation, for $l = 1$, 2, and 3.

(a) Show that z_1 has an expected value equal to zero.

(b) Show that z_1 has a variance equal to one.

(c) Derive the standardized regression model starting from the multiple variable regression model.

(d) What is the interpretation of b_1?

(e) What is the expected value and variance of e? Show your work.

3. Suppose I am interested in examining how many children people think is the "ideal" number to have in their families. Does this vary by religion? To answer this question, I created dummy variables for religion: $Catholic$, $Jewish$, $None$, $OtherReligion$ and $Protestant$.

   (a) In the following regression model $IdealChildren = \alpha + \delta_1 Catholic + \delta_2 Jewish + \delta_3 None + \delta_4 OtherReligion + u$. What is the "reference" or base category?

   (b) In the following regression model $IdealChildren = \alpha + \delta_1 Catholic + u$. What is the "reference" or base category?

   (c) What, specifically, does δ_1 measure in part (a)? In part (b)? What does α measure in part (a)? In part (b)?

   (d)

	Coefficient	Std Err	t-statistic	p-value
$Constant$	2.775	.049	56.482	.000
$Catholic$	.134	.090	1.489	.137
$Jewish$	.405	.233	1.737	.083
$None$	-.150	.120	-1.249	.212
$OtherReligion$	-.08544	.180	-.476	.634

   Consider the above table. Calculate the intercept for each of the five religions.

   (e) Should you conclude the Protestants and Catholics are different with respect to the ideal number of children in a family? Why or why note?

   (f) Should you conclude that people with no religion are different from Jews with respect to the ideal number of children in a family?

4. Consider two estimation strategies for the relationship between student test scores and hours of homework assigned daily: linear ($y = \alpha + \beta x + u$) and quadratic ($y = \alpha + \beta x + \gamma x^2 + \varepsilon$). Note that the test scores can range from 0 to 100. Use the EViews output tables and the critical values table below to answer the following questions:

   (a) What is the partial effect of a one hour increase in homework per day on test scores for each model.

   (b) What value of homework will give the maximum predicted test score in the linear model?

   (c) What value of homework will give the maximum predicted test score in the quadratic model?

   (d) Test the null that the model is linear.

   (e) Test the validity of the regression in each model.

   (f) Using any three of the model selection criteria discussed in class, pick the model that represents the data best.

Dependent Variable: TESTSCORES
Method: Least Squares
Date: 11/12/08 Time: 16:56
Sample: 1 3733
Included observations: 3733
TESTSCORES = C(1) + C(2)*HOMEWORK

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	49.83785	0.298027	167.2257	0.0000
C(2)	4.011346	0.393603	10.19134	0.0000

R-squared	0.027084	Mean dependent var	52.43538
Adjusted R-squared	0.026823	S.D. dependent var	9.566599
S.E. of regression	9.437423	Akaike info criterion	7.327779
Sum squared resid	332301.3	Schwarz criterion	7.331114
Log likelihood	-13675.30	Durbin-Watson stat	1.704769

Dependent Variable: TESTSCORES
Method: Least Squares
Date: 11/12/08 Time: 16:57
Sample: 1 3733
Included observations: 3733
TESTSCORES = C(1) + C(2)*HOMEWORK + C(3)*(HOMEWORK^2)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	47.23240	0.412152	114.5994	0.0000
C(2)	9.532628	0.723923	13.16802	0.0000
C(3)	-1.691596	0.186972	-9.047310	0.0000

R-squared	0.047976	Mean dependent var	52.43538
Adjusted R-squared	0.047465	S.D. dependent var	9.566599
S.E. of regression	9.336797	Akaike info criterion	7.306607
Sum squared resid	325165.7	Schwarz criterion	7.311610
Log likelihood	-13634.78	Durbin-Watson stat	1.689612