BOSTON COLLEGE
Department of Economics

EC 228 01
Econometric Methods
Fall 2008
Prof. Baum

Final Examination
16 December 2008

Time 2.5 hours maximum. Answer all questions. Total of 140 points. Partial credit given for partial answers.

1. (35 pts) **Briefly** explain each term. Use examples to illustrate your explanation.

   a. first-order Markov model
   b. Breusch–Godfrey test
   c. instrumental variable
   d. dynamic model
   e. RESET test
   f. *ceteris paribus* in the context of multiple regression
   g. adjusted R^2

2. (20 pts) Write a brief essay describing how Generalized Least Squares (GLS) may be used to deal with non-*i.i.d.* errors in the contexts of (a) pure heteroskedasticity and (b) pure autocorrelation (serial correlation).

3. (20 pts) Suppose our model of y is $y_i = \gamma + v_i$, and we have a sample of size N.

   a. Write out the least squares (OLS) criterion for the estimation of this model.
   b. Using this criterion, derive the least squares estimator of $\hat{\gamma}$ as that value minimizing the criterion. First order conditions are sufficient.

4. (20 pts) The following regression results were obtained from models explaining U.S. corporations' CEO salaries. The dependent variable is log(salary), and 177 observations are available. Standard errors are given in parentheses.

Table 1: default

Regressor	(1)	(2)	(3)
log(sales)	0.224	0.158	0.188
	(0.027)	(0.040)	(0.040)
log(mktval)		0.112	0.100
		(0.050)	0.049)
profmarg		-0.0023	-0.0022
		(0.0022)	(0.0021)
ceoTen			0.0171
			(0.0055)
comTen			-0.0092
			(0.0033)
constant	4.94	4.62	4.57
	(0.20)	(0.25)	(0.025)
R^2	0.281	0.304	0.353

mktval is market value of the company. profmarg is profit as a percentage of sales. ceoTen is the number of years the CEO has held that position, while comTen is the number of years s/he has been with the company.

a. Comment on the effect of profmarg on CEO salary.

b. Does market value of the firm have a significant effect? Explain.

c. Interpret the coefficients on ceoTen and comTen. Are the variables statistically significant?

d. How do you interpret the result that longer tenure with the company, *ceteris paribus*, is associated with a lower salary?

5. (20 pts) We have 26 annual time-series observations from 1940–1965 for the following variables from the U.S. coal mining industry:

F = fatal injuries per million man-hours worked

NF = nonfatal injuries per million man-hours worked

TML = percentage of output mechanically loaded (vs. manually loaded)

TOPM = output per man-hour, tons

TI = technology index

SMPM = average number of miners per mine

STPM = average output per mine, tons

R = dummy variable for Federal Coal Mine Safety Act, 1953–1965 = 1

We hypothesize that the rate of fatal injury is linearly related to mechanical loading, the size of mines (larger mines should be safer, as small mines were exempt from many federal safety regulations) and the presence of tighter safety regulations. The regression results were (standard errors in parentheses):

$$\hat{F}_t = 3.6909 - 0.00256 TML_t - 0.0169 SMPM_t + 0.0643 R_t$$
$$\phantom{\hat{F}_t = } (0.406) \quad (0.004) \qquad\quad (0.004) \qquad\qquad (0.091)$$
$$R^2 = 0.725 \quad SSE = 0.216 \quad F(3, 22) = 19.362$$

a) Is this a significant regression? Interpret the coefficients' signs and significance. In particular, did the Federal Coal Mine Safety Act have a significant effect on the likelihood of fatal accidents?

Perhaps the proper way to model the effects of regulation involves the interaction between technology, size and regulation. Such a model yields:

$$\hat{F}_t = 3.3531 - 0.00235 TML_t + 0.003 TML_t \bullet R_t - 0.0133 SMPM_t - 0.0043 SMPM_t \bullet R_t$$
$$\phantom{\hat{F}_t = } (0.593) \quad (0.005) \qquad\quad (0.003) \qquad\qquad (0.006) \qquad\qquad (0.006)$$
$$R^2 = 0.734 \quad SSE = 0.210 \quad F(4, 21) = 14.45$$

b) Interpret the coefficients' signs and significance. How would you calculate the effect of size on the fatality rate during the 1953–1965 period?

c) What test must be conducted in the context of this model to test whether regulation significantly reduced the fatality rate?

d) Can we use the SSEs or R^2 values from these two regression models to formally test which model provides the better explanation of the fatality rate?

6. (25 pts) True, False, Explain. Indicate clearly whether each of the following statements is **true** or **false**, and **explain** your answer. **No credit** without explanation.

a. Inclusion of too many lagged values in a time-series regression leads to biased and inefficient estimates.

b. Regression residuals always have a mean of zero in an OLS regression model.

c. Ratio variables (return on assets, GDP per capita) are often used to mitigate the effects of heteroskedasticity.

d. The order condition for identification states that we must have at least one excluded exogenous variable for every included endogenous variable.

e. If the error process follows a random walk ($u_t = u_{t-1} + \epsilon_t$), the regression should be estimated in first differences.

Happy Holidays!