**MIDTERM EXAMINATION INDEX 22**

| **FINANCIAL ECONOMETRICS** | | | |
|---|---|---|---|
| Head of Department of Mathematics | Lecturer | **Student ID:**<br><br>**Name:** | Date:<br><br>April 2020 |

**INSTRUCTIONS:**

1. This is a group assignment. Please remember to write down your team member names and exam paper index.
2. You are not allowed to copy from each other.
3. You should not send out this exam paper file. If you send out this exam paper file, some points will be deducted (*I can easily find out since the exam index is unique for each team*).

You should submit the pdf file on Blackboard before Saturday 25 April at 13:00. The pdf file can be prepared with Word, or scanned from a handwritten paper.

**Question 1.** (*10 points*) What 5 assumptions are usually made about the unobservable error terms in the Classical Linear Regression Model? Briefly explain the meaning of each.

**Question 2.** (*15 points*) Which of the following models can be estimated using Ordinary Least Squares, where x,y,z are the variables and $\alpha, \beta, \gamma$ are the parameters to be estimated?

$$a) y_t = e^{\alpha} x_t^{\beta} e^{u_t}$$

$$b) y_t = \alpha^2 + \beta\gamma x_t + u_t$$

$$c) \ln(y_t) = \alpha + \frac{\beta}{\ln(x_t)} + u_t$$

$$d) y_t = \alpha + \beta x_t z_t + u_t$$

**Question 3.** (*20 points*) In an estimated simple regression model, based on 34 observations, the estimated slope parameter is 0.310 and the estimated standard error is 0.082.

a) Test the null hypothesis that the slope is positive against the alternative that it is negative at the 5% level of significance.

b) Test the null hypothesis that the estimated slope is 0.5, against the alternative that it is not, at the 5% level of significance.

**Question 4.** (*15 points*) For this question, you are given the following data

$$(X'X)^{-1} = \begin{bmatrix} 1.3 & 2.1 & -1.4 \\ 2.1 & 0.8 & 1.9 \\ -1.4 & 1.9 & 3.4 \end{bmatrix} \quad , \quad (X'y) = \begin{bmatrix} -1.6 \\ 2.9 \\ 0.8 \end{bmatrix} \quad ,$$

$$s^2 = 0.86 \quad , \quad T = 103$$

The regression equation is $y_t = \beta_1 + \beta_2 X_{2t} + \beta_3 X_{3t} + u_t$

a) What are the values for $(\hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3)$?

b) What are the Standard Errors of $(\hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3)$?

**Question 5** *(20 points) using the formula to estimate the coefficients in a simple linear regression model using OLS. The dependent variable is nominal GDP or real GDP.*

Table 3.8 gives data on gross domestic product (GDP) for the United States for the years 1959–1997.

**a.** Plot the GDP data in current and constant (i.e., 1992) dollars against time.

**b.** Letting $Y$ denote GDP and $X$ time (measured chronologically starting with 1 for 1959, 2 for 1960, through 39 for 1997), see if the following model fits the GDP data:

$$Y_t = \beta_1 + \beta_2 X_t + u_t$$

Estimate this model for both current and constant-dollar GDP.

**c.** How would you interpret $\beta_2$?

**d.** If there is a difference between $\beta_2$ estimated for current-dollar GDP and that estimated for constant-dollar GDP, what explains the difference?

**TABLE 3.8** NOMINAL AND REAL GDP, UNITED STATES, 1959–1997

| Year | NGDP | RGDP | Year | NGDP | RGDP |
|---|---|---|---|---|---|
| 1959 | 507.2000 | 2210.200 | 1979 | 2557.500 | 4630.600 |
| 1960 | 526.6000 | 2262.900 | 1980 | 2784.200 | 4615.000 |
| 1961 | 544.8000 | 2314.300 | 1981 | 3115.900 | 4720.700 |
| 1962 | 585.2000 | 2454.800 | 1982 | 3242.100 | 4620.300 |
| 1963 | 617.4000 | 2559.400 | 1983 | 3514.500 | 4803.700 |
| 1964 | 663.0000 | 2708.400 | 1984 | 3902.400 | 5140.100 |
| 1965 | 719.1000 | 2881.100 | 1985 | 4180.700 | 5323.500 |
| 1966 | 787.7000 | 3069.200 | 1986 | 4422.200 | 5487.700 |
| 1967 | 833.6000 | 3147.200 | 1987 | 4692.300 | 5649.500 |
| 1968 | 910.6000 | 3293.900 | 1988 | 5049.600 | 5865.200 |
| 1969 | 982.2000 | 3393.600 | 1989 | 5438.700 | 6062.000 |
| 1970 | 1035.600 | 3397.600 | 1990 | 5743.800 | 6136.300 |
| 1971 | 1125.400 | 3510.000 | 1991 | 5916.700 | 6079.400 |
| 1972 | 1237.300 | 3702.300 | 1992 | 6244.400 | 6244.400 |
| 1973 | 1382.600 | 3916.300 | 1993 | 6558.100 | 6389.600 |
| 1974 | 1496.900 | 3891.200 | 1994 | 6947.000 | 6610.700 |
| 1975 | 1630.600 | 3873.900 | 1995 | 7269.600 | 6761.700 |
| 1976 | 1819.000 | 4082.900 | 1996 | 7661.600 | 6994.800 |
| 1977 | 2026.900 | 4273.600 | 1997 | 8110.900 | 7269.800 |
| 1978 | 2291.400 | 4503.000 | | | |

*Note:* NGDP = nominal GDP (current dollars in billions).
RGDP = real GDP (1992 billions of dollars).
*Source: Economic Report of the President,* 1999, Tables B-1 and B-2, pp. 326–328.

**Question 6.** *(20 points)*

From a sample of 209 firms, Wooldridge obtained the following regression results*:

$$\widehat{\log(\text{salary})} = \underset{(0.32)}{4.32} + \underset{(0.035)}{0.280}\log(\text{sales}) + \underset{(0.0041)}{0.0174}\,\text{roe} + \underset{(0.00054)}{0.00024}\,\text{ros}$$

$$R^2 = 0.283$$

where salary = salary of CEO
sales = annual firm sales
roe = return on equity in percent
ros = return on firm's stock

and where figures in the parentheses are the estimated standard errors.

**a.** Interpret the preceding regression taking into account any prior expectations that you may have about the signs of the various coefficients.

**b.** Which of the coefficients are *individually* statistically significant at the 5 percent level?

**c.** What is the overall significance of the regression? Which test do you use? And why?