

**Economics 203B**  
**Winter 2000**  
**Midterm Examination**  
**Ekaterini Kyriazidou**

You have 1 hour and 20 minutes to do the following problems. Write carefully and clearly. Try to answer ALL questions as partial credit will be given. GOOD LUCK!

**PROBLEM 1 (16 points):**

A four-variable regression using quarterly data from 1958 to 1976 inclusive gave an estimated equation:

$$\hat{Y} = 2.20 + 0.104X_2 - 3.48X_3 + 0.34X_4$$

The explained sum of squares was 109.6 and the error sum of squares 18.48. When the equation was re-estimated with three seasonal dummies added to the specification, the explained sum of squares rose to 114.8.

- (a) (8 points) Test for the presence of seasonality.  
 (b) (8 points) Two further regressions based on the original specification were run for the subperiods 1958-I to 1968-IV and 1969-I to 1976-IV, yielding error sum of squares of 9.32 and 7.46, respectively. Test for the constancy of the relationship over the two subperiods.

**PROBLEM 2 (40 points):**

A regression of real investment (in trillions of dollars) on a constant, a time trend (1,2,3,...), real GNP (in trillions of dollars), interest rate (in percentage points) and inflation rate (in percentage points, computed as the percentage change in the CPI - Consumer Price Index) using annual time series data from 1968-1982 produces the following results:

Regression results for an investment equation

Sum of squared residuals  $45 \times 10^{-5}$

Variable	t	Coefficient	Standard Error	
Constant	4.63	-0.5091	0.0551	0.11
Time	4.15	-0.0166	0.0019	0.004
Real GNP	6.09	0.6704	0.0550	0.11
Interest Rate	× 1.15	-0.0023	0.0012	0.002
Inflation Rate	× 0.03	$-9 \times 10^{-5}$	0.0013	0.0036

	<u>Estimated Covariance matrix</u>				
Constant	Time	Real GNP	Interest	Inflation	
0.00304					
0.00014	$39 \times 10^{-7}$				
-0.00304	-0.0001	0.0030			
$56 \times 10^{-7}$	$-29 \times 10^{-8}$	$-73 \times 10^{-7}$	$15 \times 10^{-7}$		
$-32 \times 10^{-7}$	$-26 \times 10^{-9}$	$-23 \times 10^{-7}$	$-75 \times 10^{-8}$	$18 \times 10^{-7}$	

(a) (10 points) Interpret the results of the above regression. Which of the coefficients are statistically significant at the 5% level of significance?

(b) (10 points) Are the data consistent with the hypothesis that a \$1 billion increase in real GNP will be associated with an equal increase in investment?

(c) (10 points) Compute a forecast for real investment in 1983 assuming forecasts of \$3100 billion for nominal GNP, 212 for the CPI which implies an inflation rate of 2.12%, and 10% for the interest rate.

(d) (10 points) Describe in as much detail as possible how you would construct a 95% confidence interval for your forecast of part (c).

HINT: Pay attention to the units in which each of the variables is expressed.

### PROBLEM 3 (30 points):

You have the position of political analyst at a local TV station. In view of upcoming congressional elections, you are asked to comment on the results from the 1996 elections. You have data on the percentage of votes received by Democratic candidates among all votes cast for House of Representatives candidates for each one of the 50 states. In addition, for each one of the states you have data on the unemployment rate, and you know whether Bill Clinton appeared there to campaign for congressional candidates.

a. (15 points) You believe that the percentage of votes received by Democratic candidates in each state may be explained by the state's unemployment rate, by whether Bill Clinton campaigned in that state, and by the state's location in the country in four different regions: Northeast, South, Midwest, and West. Write down a regression model for the determination of the percentage of democratic votes per state that expresses these beliefs. Interpret the coefficient estimates of the model which you would obtain if you would actually use your data to estimate the regression model. Describe how you would test for the following hypotheses using the estimated coefficients and their estimated covariance matrix:

(i) Clinton's campaigning didn't matter.

(ii) The entire country voted uniformly: there are no regional differences.

(iii) The Northeast and the Midwest (the "frostbelt") voted uniformly.

(iv) The frostbelt voted uniformly, the "sunbelt" (the South and the West) voted uniformly, but the frostbelt and the sunbelt did not necessarily vote uniformly.

Make sure you give all necessary details for carrying on the tests (detailed description of the test statistics, critical values, "rules" for testing)

b. (15 points) In addition you may think that the effect of Clinton's campaign may be different depending on whether the state is in the Northeast, South, Midwest, or West. Write down a

regression model for the determination of the percentage of democratic votes per state that also captures this effect. Interpret the coefficient estimates of the model which you would obtain if you would actually use your data to estimate the regression model. Describe how you would test for the hypothesis that Clinton's appearance had the same effect in all regions. Give two formulations for the test statistic you would use to test this hypothesis.

**PROBLEM 4 (14 points):**

- (a) (7 points) Obtain the Restricted Least Squares estimator for the  $k$ -variate CR model  $Y = X\beta + \epsilon$  under the restriction that  $\Gamma\beta = \gamma_0$  where  $\Gamma$  is  $p \times k$  matrix of constants of full row rank.
- (b) (7 points) Use the estimator of part(a) to obtain the relationship between the  $F$  statistic used for testing the hypothesis that  $\Gamma\beta = \gamma_0$  and the sum of squared residuals of the restricted and the unrestricted regression.