

**UNIVERSITY OF OSLO**  
**DEPARTMENT OF ECONOMICS**

Exam: ECON3150/4150 – INTRODUCTORY ECONOMETRICS, SPRING 2004

Date of exam: Friday, May 21, 2004

Time for exam: 2:30 p.m. – 5:30 p.m.

The problem set covers 3 pages

Resources allowed:

- All written and printed resources, as well as calculator are allowed

The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

We are concerned with analysing the demand for beverages in a sample of households. Our sample reports observations on 4 variables: the quantity of beverages demanded ( $QB$ ), the price of beverages ( $PB$ ), a price index of the remaining goods and services on the households' budgets ( $PR$ ), and finally the households income ( $INC$ ). We are not certain of what will be the appropriate specification of this demand so we will try different forms. We start with the log-log functional form:

$$(1) \ln(QB_i) = \beta_0 + \beta_1 \ln(PB_i) + \beta_2 \ln(PR_i) + \beta_3 \ln(INC_i) + \varepsilon_i \quad i = 1, 2, \dots, 30$$

where  $\varepsilon_i$  denotes a random disturbance.

**Question A.** Discuss briefly this specification of the demand for beverages.

The results of this regression applied to the data-set are shown in Output 1.

**Question B.** Give your comments to the empirical results of this specification. Explain also how the numbers in the column with heading t-prob are calculated.

Standard consumer demand theory tells us that if prices and income increase by the same proportion we should expect no change in the quantity demanded. The consumers are said to have no money illusion.

**Question C.** Show that the assumption of no money illusion applied to the demand function (1) implies the restriction:

$$(2) \beta_1 + \beta_2 + \beta_3 = 0$$

**Question D.** Use results and information you can find in Output 1 to test the hypothesis:

$H_0 : \beta_1 + \beta_2 + \beta_3 = 0$  against  $H_a : \beta_1 + \beta_2 + \beta_3 \neq 0$   
with significance level  $\alpha = 0.05$ .

We are now told that the log-log functional form (2) has certain theoretical drawbacks. In addition to (2) we thus wish to analyse two forms which are linear in the relative price and the real income.

$$(3) \quad QB_i = \beta_0 + \beta_1 + \beta_2(PR_i/PB_i) + \beta_3(INC_i/PB_i) + u_i$$

$$(4) \quad QB_i = \beta_0(1/PB_i) + \beta_1 + \beta_2(PR_i/PB_i) + \beta_3(INC_i/PB_i) + v_i$$

where  $u_i$  and  $v_i$  denote random disturbances.

The results of the regressions (3) and (4) are shown in Output 2.

**Question E.** Which of the two equations (3) or (4) do you think is appropriate for testing the assumption of no money illusion? State the reason for your choice and explain how you would test this hypothesis.

**Question F.** Assume that the number of household members ( $N_i$ ) have been wrongly excluded from the regressions (3) and (4). Choose one of these regressions for further study, and explain formally how this misspecification effects the OLS estimates of the  $\beta$ 's when:

- (i)  $N_i$  is uncorrelated with the explanatory variables already used in the equation.
- (ii)  $N_i$  is correlated with the explanatory variables already used in the equation.

#### OUTPUT 1

Q( 1) Modelling LnQB by OLS-CS (using table8-3.xls)

	Coefficient	Std.Error	t-value	t-prob
Constant	-2.38863	3.658	-0.653	0.519
LnPB	-1.12951	0.2152	-5.25	0.000
LnPR	0.194921	0.07857	2.48	0.020
LnINC	0.733374	0.3741	1.96	0.061
sigma	0.0600689	RSS	0.0938152246	
R^2	0.817824	F(3,26) =	38.91 [0.000]**	
no. of observations	30	no. of parameters	4	
mean(LnQB)	4.01853	var(LnQB)	0.0171657	

Covariance matrix (symmetric) of estimated parameters:

$$\begin{aligned} \text{Var}(\hat{\beta}_0) &= 13.378 & \text{Cov}(\hat{\beta}_0, \hat{\beta}_1) &= 0.72430 & \text{Cov}(\hat{\beta}_0, \hat{\beta}_2) &= 0.13600 & \text{Cov}(\hat{\beta}_0, \hat{\beta}_3) &= -1.3680 \\ \dots\dots\dots & & \text{Var}(\hat{\beta}_1) &= 0.046299 & \text{Cov}(\hat{\beta}_1, \hat{\beta}_2) &= 0.0029052 & \text{Cov}(\hat{\beta}_1, \hat{\beta}_3) &= -0.074731 \end{aligned}$$

.....                      .....                       $Var(\hat{\beta}_2) = 0.0061731$                        $Cov(\hat{\beta}_2, \hat{\beta}_3) = -0.013523$   
 .....                      .....                      .....                       $Var(\hat{\beta}_3) = 0.13994$

OUTPUT 2

Q( 2) Modelling QB by OLS-CS (using table8-3.xls)

The estimation sample is: 1 to 30

	Coefficient	Std.Error	t-value	t-prob
Constant	-21.3758	6.387	-3.35	0.002
RPRICE	24.4448	9.527	2.57	0.016
RINCOME	0.00626855	0.0006333	9.90	0.000
sigma	3.19379	RSS	275.408276	
R <sup>2</sup>	0.846176	F(2,27) =	74.26 [0.000]**	
no. of observations	30	no. of parameters	3	
mean(QB)	56.1133	var(QB)	59.6805	

EQ( 3) Modelling QB by OLS-CS (using table8-3.xls)

The estimation sample is: 1 to 30

	Coefficient	Std.Error	t-value	t-prob
Constant	-7.76332	12.11	-0.641	0.527
INVPRICE	31.8066	24.17	1.32	0.200
RPRICE	29.3002	10.10	2.90	0.007
RINCOME	0.00381513	0.001967	1.94	0.063
sigma	3.15141	RSS	258.215341	
R <sup>2</sup>	0.855779	F(3,26) =	51.43 [0.000]**	
no. of observations	30	no. of parameters	4	
mean(QB)	56.1133	var(QB)	59.6805	