

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

Exam: **ECON3150/4150 – Introductory Econometrics**

Date of exam: Wednesday, June 1, 2011

**Grades are given: June 15, 2011**

Time for exam: 09:00 a.m. – 12:00 noon

The problem set covers 4 pages (incl. cover sheet)

Resources allowed:

- No resources allowed

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

**Please do not forget the periodic course evaluation for  
ECON3150/4150, which you will find on the website for the  
course. The deadline is June 13.**

# ECON 3150/4150: INTRODUCTORY ECONOMETRICS

## PROBLEM SET, EXAM SPRING 2011

We want to analyze how household consumption and savings depends on income and its composition, and to examine some hypotheses about the form of the relationship. We have observations from 50 households on the variables (data from the U.S.A., measured in 10000 Dollars):

- c = Annual consumption
- s = Annual saving
- r = Annual income
- rmean = Mean income over the last 10 years
- rexc = Excess income, defined as Annual income minus Mean income

The observations are computed so that they satisfy exactly the relationships

$$r = c + s$$

$$r = rmean + rexc$$

All the tables below are from slightly edited Stata printouts.

**Question 1:** The means, standard deviations, min and max values are:

```
-----+-----
Variable |      Obs      Mean    Std.Dev.    Min      Max
-----+-----
      c |         50    7.1667    1.3049    4.6246   10.2885
      s |         50    0.3951    0.1003    0.1812    0.6117
      r |         50    7.5618    1.2944    4.9197   10.6234
    rmean |         50    6.7393    0.5063    5.6080    8.0904
    rexc  |         50    0.8225    1.0440   -1.1402    2.5330
*****
```

The correlation coefficients of the variables are

```
-----+-----
      |      c      s      r    rmean    rexc
-----+-----
      c |  1.0000
      s | -0.1432  1.0000
      r |  0.9971 -0.0669  1.0000
    rmean |  0.6121  0.3246  0.6422  1.0000
    rexc  |  0.9393 -0.2404  0.9283  0.3112  1.0000
*****
```

**(1.a):** The standard deviations of  $r$  and  $rexc$  are much larger than that of  $rmean$ . Can you explain why this is reasonable?

**(1.b):** Regressing consumption on income  $r$  and regressing saving on income  $r$ , we get the result in the tables below. The estimated marginal propensities to consume and to save (i.e. the two slope coefficients) add to 1 exactly. Can you, by utilizing that  $c+s=r$ , show that this result follows from the application of the OLS method. (Hint: Formulate the underlying regression models.) The two estimated equations can therefore be said to 'tell the same story', as the estimated intercepts are equal with opposite signs, and the Root MSEs and the Std.Err.s are equal.

**(1.c):** The  $R^2$  (R-squared), however, differ widely. Could you explain this finding?

```

Number of obs =      50
F( 1, 48) = 8109.03
Prob > F      = 0.0000
R-squared     = 0.9941
Root MSE     = .10114
-----+-----
      c |      Coef.   Std. Err.      t    P>|t|
-----+-----
      r |   1.005185   .0111625    90.05   0.000
      _cons |  -.434277   .0856116    -5.07   0.000
-----+-----
*****

Number of obs =      50
F( 1, 48) = 0.22
Prob > F      = 0.6444
R-squared     = 0.0045
Root MSE     = .10114
-----+-----
      s |      Coef.   Std. Err.      t    P>|t|
-----+-----
      r |  -.005185   .0111625    -0.46   0.644
      _cons |   .434277   .0856116     5.07   0.000
-----+-----
*****

```

**Question 2:** The composition of income  $r$  into ‘regular income’ and ‘irregular income’, may, according to some economic theory, be expected to affect consumption. Let us, for simplicity, in our data set, associate the former component with  $rmean$  and the latter with  $rexc$ . An estimation result based on this idea is given below.

```

Number of obs =      50
F( 2, 47) = 5169.44
Prob > F      = 0.0000
R-squared     = 0.9955
Root MSE     = .08963
-----+-----
      c |      Coef.   Std. Err.      t    P>|t|
-----+-----
      rmean |   .9123745   .0266101    34.29   0.000
      rexc  |   1.036325   .0129056    80.30   0.000
      _cons |   .1655914   .1767737     0.94   0.354
-----+-----
*****

```

**(2.a):** Construct a 95% confidence interval for the marginal propensity to consume of  $rexc$ . Explain precisely, in words, the interpretation of this interval.

**(2.b):** Test the null hypothesis that the marginal propensity to consume of  $rmean$  is one, against the hypothesis that it is less than one and formulate your conclusion.

**(2.c):** Test the null hypothesis that the marginal propensities to consume of  $rmean$  and  $rexc$  are equal against the hypothesis that they are different. The estimated covariance of the two coefficient estimates is  $-0.00010688$  (the estimate of the corresponding correlation coefficient is  $-0.3112$ ).

**Question 3:** Another theory maintains that the marginal propensity to consume may depend on the income level. To examine this hypothesis we use the simple income measure  $r$  and extend the set of regressors by including quadratic and cubic terms,  $r2=r^2$  and  $r3=r^3$ . The results from two regressions are given in the following two tables, supplemented by the correlation matrix of the three regressors at the bottom:

```

Number of obs =      50
F( 2, 47) = 4056.76
Prob > F      = 0.0000
R-squared     = 0.9942
Root MSE     = .10112
-----+-----
      c |      Coef.   Std. Err.      t    P>|t|
-----+-----
      r  |   .8927904   .1118173     7.98   0.000
      r2  |   .0074335   .0073583     1.01   0.318
      _cons |  -.0216255   .4173522    -0.05   0.959
-----+-----
*****

Number of obs =      50
F( 3, 46) = 2660.08
Prob > F      = 0.0000
R-squared     = 0.9943
Root MSE     = .10196
-----+-----
      c |      Coef.   Std. Err.      t    P>|t|
-----+-----
      r  |   .5303655   .769732     0.69   0.494
      r2  |   .0553329   .1009065     0.55   0.586
      r3  |  -.0020628   .0043337    -0.48   0.636
      _cons |   .8701224   1.920182     0.45   0.653
-----+-----
*****

```

	r	r2	r3
r	1.0000		
r2	0.9950	1.0000	
r3	0.9803	0.9951	1.0000

\*\*\*\*\*

**(3.a):** Does the hypothesis that the marginal propensity to consume is income dependent find support in the data? State the reason for your answer.

**(3.b):** In the second regression, with both the quadratic and the cubic terms included as regressors, all regressors come out with small t-values. Does this mean that income ‘drops out as an explanatory variable’ for consumption? Try, as part of your answer, to interpret the results  $F(3,46) = 2660.08$  and  $\text{Prob} > F = 0.0000$  in the printout and explain what the arguments 3 and 46 mean.

**Question 4:** It has been objected against the above analysis that the disturbance variance may not be constant (heteroskedasticity). To examine this we go back to the model in **Question 1** and let  $\text{ehat2} = \hat{e}_i^2$  be the squared OLS residual from the first estimation. Regressing  $\text{ehat2}$  on  $r$  gives the results in the first table below. Repeating the analysis, after having first transformed  $r$  and  $c$  to logarithms, denoted as  $\text{logr}$  and  $\text{logc}$ , respectively, gives the results in the second table below.  $\text{elohat2}$  is the corresponding squared OLS residual, which is regressed on  $\text{logr}$ .

**(4.a):** Which conclusion can you draw from this?

**(4.b):** If there is sign of heteroskedasticity, would this destroy the property that the OLS estimators of the regression coefficients are unbiased? Explain briefly.

ehat2	Coef.	Std. Err.	t	P> t
r	-.001635	.0013795	-1.19	0.242
_cons	.0221834	.0105804	2.10	0.041

\*\*\*\*\*

elohat2	Coef.	Std. Err.	t	P> t
logr	-.0006372	.0002425	-2.63	0.011
_cons	.0015007	.0004887	3.07	0.004

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