UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Postponed exam: ECON4160 – Econometrics – Modeling and systems estimation

Date of exam: Friday, August 8, 2008

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

The problem set covers 6 pages (incl. cover sheet)

Resources allowed:
- All written and printed resources, as well as calculator, is allowed

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

ECON 4160: ECONOMETRICS –
MODELLING AND SYSTEMS ESTIMATION

SPRING 2008, POSTPONED EXAM

PROBLEM 1

We are interested in estimating a relationship between household per capita expenditures – in the following to be denoted as an expenditure function – and household per capita income from micro data. We have 2486 observations from South-African households in 1993-1998 for the following four variables:

```
pcexp = Per capita expenditure
pcinc = Per capita income
agehp = Age of household head
eduhp = 1 if household head has attained secondary school,
      = 0 otherwise
```

The estimation results and other printouts referred to below are obtained from PcGive and are given at the end of the problem set.

(A): We consider (`pcexp, pcinc`) as jointly endogenous variables and (`agehp, eduhp`) as exogenous. Specify the underlying econometric model and explain briefly why the coefficient estimates in equations `EQ(1)` and `EQ(2)` are inconsistent.

(B): In equations `EQ(3)`–`EQ(7)` five versions of the expenditure function which in different ways exploit the two exogenous variables as instruments. (i) Explain briefly what this means, and the meaning of the terms `'IVE'` and `'Additional instruments'` in the printouts. (ii) Explain briefly, without proofs, why the estimates are all consistent.

(C): The coefficient estimates of `pcinc` in equations `EQ(4)`, `EQ(5)` and `EQ(7)` are fairly equal, but they differ substantially from those in equations `EQ(3)` and `EQ(6)`. Could you explain this by examining the summary statistics at the start of the printouts and the results in equation `EQ(10)`?

(D): Could `agehp` have served as an instrument for `pcinc` instead of using `eduhp` in equation `EQ(5)`, and could `eduhp` have served as an instrument for `pcinc` instead of using `agehp` in equation `EQ(6)`? State briefly the reason for your answer.

(E): Let (`z28,z46,z64,z82`) be four derived variables calculated by PcGive by:

```
Algebra code for variable transformations:
    z28 = 0.2*agehp + 0.8*eduhp;
    z46 = 0.4*agehp + 0.6*eduhp;
    z64 = 0.6*agehp + 0.4*eduhp;
    z82 = 0.8*agehp + 0.2*eduhp;
```

Explain why (z28,z46,z64,z82) are all valid instruments for pcinc. Why do the estimates in EQ(8) coincide with those in EQ(7)? Would the results have been different if only one of the four transformed variables, say z82, had been used as instrument?

[**Hint:** Note that, for instance, (z28,z82) are one-to-one (non-singular) transformations of (agehp,eduhp).]

PROBLEM 2

Equations EQ(11) and EQ(12) in the printouts correspond to equations EQ(1) and EQ(7) except that pcexp is specified as regressor (right-hand side variable) and pcinc as regressand (left-hand side variable).

(A): Explain (i) why equations EQ(1) and EQ(11) have the same R^2 (R-square) and (ii) why the inverse of the OLS coefficient estimate of pcexp in equation EQ(11) is larger than the OLS coefficient estimate in equation EQ(1).

(B): Explain briefly why the inverse of the coefficient estimate of pcexp in equation EQ(12) differs from the coefficient estimate in equation EQ(7).

(C): The estimated standard error of the disturance (sigma) for equation EQ(12) exceeds that for equation EQ(11). Similarly, the estimated standard error of the disturance (sigma) for equation EQ(7) exceeds that for equation EQ(1). Could you explain this?

(D): The income variable pcinc used so far is a measure of gross income before deduction of taxes. As a measure of disposable income it is thus affected by measurement error. Assume that the relationship between disposable (after-tax) income, pcdisp, and gross income can be formalized as

$$\texttt{pcdisp} = (1-t) * \texttt{pcinc} + u,$$

where t is the mean income tax rate and u is an error. Let β^* be the coefficient of gross income pcinc in the equations estimated so far, and let β be the coefficient of disposable income pcdisp, which can be interpreted as the marginal propensity to consume. Assume that t is known, but that pcdisp is unobservable (latent). Explain how you would proceed to estimate β consistently from observations on (pcexp,pcinc) in the following two cases: (i) $\text{cov}(u, \texttt{pcinc}) = 0$; (ii) $\text{cov}(u, \texttt{pcdisp}) = 0$ and $\text{var}(u)/\text{var}(\texttt{pcdisp})$ is known. Make the additional assumptions you need to answer the equestion.

PRINTOUTS FOR PROBLEMS 1 AND 2

```
DESCRIPTIVE STATISTICS

Means
       pcinc         pcexp         agehp         eduhp
      435.68        299.70        51.710      0.038616

Standard deviations (using T-1)
       pcinc         pcexp         agehp         eduhp
      1296.9        390.03        14.445       0.19272

Correlation matrix:
                     pcinc         pcexp         agehp         eduhp
pcinc               1.0000       0.48743     -0.027758       0.21106
pcexp              0.48743        1.0000      -0.13681       0.34414
agehp            -0.027758      -0.13681        1.0000     -0.089641
eduhp              0.21106       0.34414     -0.089641        1.0000

********************************************************************

EQ(1) Modelling pcexp by OLS-CS

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
pcinc                0.146593   0.005269     27.8   0.000   0.2376
Constant              235.828      7.207     32.7   0.000   0.3012

sigma                 340.628  RSS                 288211426
R^2                  0.237587  F(1,2484) =   774.1 [0.000]**
log-likelihood       -18021.8  DW                       1.18
no. of observations      2486  no. of parameters           2

*********************************************************************

EQ(2) Modelling pcexp by OLS-CS

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
pcinc                0.130279   0.005134     25.4   0.000   0.2060
agehp                -2.77999     0.4524    -6.15   0.000   0.0150
eduhp                 492.766      34.67     14.2   0.000   0.0752
Constant              367.659      24.52     15.0   0.000   0.0830

sigma                 324.408  RSS                 261207192
R^2                  0.309022  F(3,2482) =     370 [0.000]**
log-likelihood       -17899.5  DW                       1.26
no. of observations      2486  no. of parameters           4

*********************************************************************

EQ(3) Modelling pcexp by IVE-CS

                  Coefficient  Std.Error  t-value  t-prob
pcinc          Y      1.48229     0.9840     1.51   0.132
Constant             -346.108      430.2   -0.805   0.421

sigma                 1765.73  RSS           7.74460007e+009
Reduced form sigma     386.44
no. of observations      2486  no. of parameters           2
no. endogenous variables    2  no. of instruments          2
Additional instruments:
[0] = agehp

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```

```
EQ(4) Modelling pcexp by IVE-CS

                  Coefficient  Std.Error  t-value  t-prob
pcinc          Y     0.490373    0.04112     11.9   0.000
Constant              86.0496      21.16     4.07   0.000

sigma                 561.138  RSS                782151551
Reduced form sigma     366.28
no. of observations      2486  no. of parameters          2
no. endogenous variables    2  no. of instruments         2
Additional instruments:
[0] = eduhp
*******************************************************************

EQ(5) Modelling pcexp by IVE-CS

                  Coefficient  Std.Error  t-value  t-prob
pcinc          Y     0.478539    0.04047     11.8   0.000
agehp                -2.50142     0.7676    -3.26   0.001
Constant              220.552      46.81     4.71   0.000

sigma                 547.939  RSS                745488001
Reduced form sigma     363.99
no. of observations      2486  no. of parameters          3
no. endogenous variables    2  no. of instruments         3
Additional instruments:
[0] = eduhp
*******************************************************************

EQ(6) Modelling pcexp by IVE-CS

                  Coefficient  Std.Error  t-value  t-prob
pcinc          Y      3.60572      7.703    0.468   0.640
eduhp                -4424.76 1.095e+004   -0.404   0.686
Constant             -1100.38      2935.   -0.375   0.708

sigma                 4419.15  RSS          4.84903344e+010
Reduced form sigma     363.99
no. of observations      2486  no. of parameters          3
no. endogenous variables    2  no. of instruments         3
Additional instruments:
[0] = agehp
*********************************************************************

EQ(7) Modelling pcexp by IVE-CS

                  Coefficient  Std.Error  t-value  t-prob
pcinc          Y     0.495870    0.04150     11.9   0.000
Constant              83.6546      21.36     3.92   0.000

sigma                 566.821  RSS                798074166
Reduced form sigma     363.99
no. of observations      2486  no. of parameters          2
no. endogenous variables    2  no. of instruments         3
Additional instruments:
[0] = agehp
[1] = eduhp
*********************************************************************

EQ(8) Modelling pcexp by IVE-CS

                  Coefficient  Std.Error  t-value  t-prob
pcinc          Y     0.495870    0.04150     11.9   0.000
Constant              83.6546      21.36     3.92   0.000

sigma                 566.821  RSS                798074166
Reduced form sigma     364.14
no. of observations      2486  no. of parameters          2
no. endogenous variables    2  no. of instruments         5
Additional instruments:
[0] = z28 [1] = z46
[2] = z64 [3] = z82
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EQ(9) Modelling pcexp by OLS-CS

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
agehp                -2.88420     0.5075    -5.68   0.000   0.0128
eduhp                 677.102      38.04     17.8   0.000   0.1132
Constant              422.689      27.41     15.4   0.000   0.0874

sigma                 363.994  RSS                 328976814
R^2                   0.12975  F(2,2483) =   185.1 [0.000]**
log-likelihood       -18186.3  DW                       1.07
no. of observations      2486  no. of parameters           3

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EQ(10) Modelling pcinc by OLS-CS

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
agehp               -0.799894      1.768   -0.452   0.651   0.0001
eduhp                 1414.93      132.5     10.7   0.000   0.0439
Constant              422.403      95.48     4.42   0.000   0.0078

sigma                 1268.11  RSS             3.99289903e+009
R^2                 0.0446258  F(2,2483) =   57.99 [0.000]**
log-likelihood       -21289.1  DW                       1.87
no. of observations      2486  no. of parameters           3

**********************************************************************

EQ(11) Modelling pcinc by OLS-CS

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
pcexp                 1.62072    0.05825     27.8   0.000   0.2376
Constant             -50.0424      28.65    -1.75   0.081   0.0012

sigma                  1132.6  RSS             3.18643433e+009
R^2                  0.237587  F(1,2484) =   774.1 [0.000]**
log-likelihood       -21008.7  DW                       2.05
no. of observations      2486  no. of parameters           2

**********************************************************************

EQ(12) Modelling pcinc by IVE-CS

                  Coefficient  Std.Error  t-value  t-prob
pcexp           Y     1.88557     0.1624     11.6   0.000
Constant             -129.415      53.75    -2.41   0.016

sigma                  1137.3  RSS              3.2129499e+009
Reduced form sigma     1268.1
no. of observations      2486  no. of parameters           2
no. endogenous variables    2  no. of instruments          3
Additional instruments:
[0] = agehp
[1] = eduhp
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