UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Postponed exam: ECON4160 – Econometrics – Modeling and systems estimation

Date of exam: Wednesday, August 17

Time for exam: 9:00 a.m. – 12:00 noon

The problem set covers 4 pages

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

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

In an attempt to study consequences of globalization on economic performance a researcher has obtained a firm-level micro data set consisting of, among other things, information on major reorganisations in the firm, and its trade. The researcher wants to test empirically the effect of international competition on the probability that the firm undertakes major reorganisations.
A summary of the variables used in the analysis is given in the appendix. Model 1 on the next page in the appendix reports results from a PROBIT regression on this data set.
The dependent variable, REORG, is a dummy variable taking the value of one if the firm has undertaken a major reorganisation during the last five years, zero otherwise.
The variable EXPORT is a dummy variable taking the value of one if the firm is producing for the export market, zero otherwise.
The variable EMPL is the number of employees. The variables IND1-IND5 are dummy variables controlling for industry affiliation.
Model 2 reports the results from a LOGIT regression of the same model.

PART I)

i) Explain why the coefficients for EXPORT differ in size between the two models.
ii) From the coefficient in the logit model, calculate the marginal effect of increasing the number of workers by one for the average firm. Calculate the marginal effect of the number workers for a firm who has a probability of reorganisation of 0.20.
iii) Assume that firms are risk neutral profit maximisers, so that $U=\Pi$, where U is the utility level of the owner and Π is the profits of the firm. Provide an interpretation of the coefficient for EXPORT within a random utility framework. What is the difference between the two models within this framework?
iv) Suppose you had data for two different years, and you introduced a dummy variable for observations from the most recent year. How would you interpret a positively signed coefficient for this dummy variable within the random utility framework?

PART II)

Another research team challenges these results. They argue that causality goes in the opposite direction: Reorganisations improve firm performance and thus increase exports. Assume that this team has access to a continuous measure of reorganization, Y1 (eg. the number of large reorganisations the last five years), and a continuous measure of exports, Y2 (eg. the firm's export share of total sales). The following model may provide a formalisation of their idea:

1) $Y1_i = a_1 + b_1 Y2_i + X_i \gamma_1 + u1_i$
2) $Y2_i = a_2 + b_2 Y1_i + u2_i$ $\quad i=1,..,n$

where X is the vector of explanatory variables listed previously (number of employees and industry dummies) with the exception of export which is now treated as an endogenous variable and u1 and u2 are random disturbance terms.

i) Provide the order condition for identification of b_2 in equation (2).
ii) Derive expressions for the conditional expectation and variance of Y2.
iii) Explain how to calculate the indirect least square estimators (ILS) of b_2. Explain why a two stage least square estimator (2SLS) may be preferable to ILS in this case.
iv) Do you find the exclusion restrictions implicit in this model reasonable?

Assume now that export also depends on another variable Z. We have:

2') $Y2_i = a_2 + b_2 Y1_i + \gamma_2 Z_i + u2_i$

Two candidates for Z are suggested: The first is relative export prices compared to national prices (ENP) (measured at the level of very detailed industry), and the other is the number of employees in the firm (EMPL).

v) Provide assumptions necessary for ENP to be used as an instrument in the estimation of b_1. Next, provide assumptions necessary for EMPL to be used as an instrument in the estimation of b_1.
vi) Assume that you have chosen ENP as the exogenous variable to be included in equation 2'). Suggest a testing procedure that would allow you to test if Y2 is endogenous in 1). Suppose that you obtained a p-level on this test of 0.154. How would you conclude from this observation?

SUMMARY STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
REORG	4471	.4985462	.5000538	0	1
EXPORT	4471	.1391188	.3461091	0	1
EMPL	4471	146.4001	267.1253	11	3532
IND1	4471	.0205771	.1419794	0	1
IND2	4471	.2209796	.4149532	0	1
IND3	4471	.0679937	.2517633	0	1
IND4	4471	.1872064	.3901208	0	1
IND5	4471	.0641915	.2451211	0	1
IND6	4471	.1087005	.3112979	0	1
IND7	4471	.0556922	.2293521	0	1
IND8	4471	.095728	.2942508	0	1
IND9	4471	.1541042	.361089	0	1
IND10	4471	.0248267	.155614	0	1

MODEL 1 PROBIT ESTIMATES

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. probit REORG EXPORT EMPL IND1 IND3-IND10

Iteration 0:   log likelihood = -3099.0421
Iteration 1:   log likelihood = -2991.5574
Iteration 2:   log likelihood = -2989.5863
Iteration 3:   log likelihood = -2989.5828
Iteration 4:   log likelihood = -2989.5828

Probit estimates                                  Number of obs   =       4471
                                                  LR chi2(11)     =     218.92
                                                  Prob > chi2     =     0.0000
Log likelihood = -2989.5828                       Pseudo R2       =     0.0353

------------------------------------------------------------------------------
       REORG |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      EXPORT |   .2408344   .0623558     3.86   0.000     .1186193    .3630496
        EMPL |   .0008528   .0000905     9.42   0.000     .0006754    .0010301
        IND1 |  -.0208175   .1418098    -0.15   0.883    -.2987597    .2571247
        IND3 |   .0550792   .0859687     0.64   0.522    -.1134163    .2235748
        IND4 |  -.2099793   .0641222    -3.27   0.001    -.3356565   -.0843022
        IND5 |   .1212598   .0866785     1.40   0.162    -.0486269    .2911466
        IND6 |   .1207975   .0725062     1.67   0.096    -.0213121    .2629071
        IND7 |    .214035   .0941339     2.27   0.023     .0295359    .3985342
        IND8 |  -.2134604   .0781354    -2.73   0.006    -.3666031   -.0603178
        IND9 |  -.0000629   .0675508    -0.00   0.999    -.1324599    .1323342
       IND10 |   .1712208   .1285663     1.33   0.183    -.0807644    .4232061
       _cons |  -.1371542   .0493909    -2.78   0.005    -.2339586   -.0403497
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MODEL 2 LOGIT ESTIMATES

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. logit REORG EXPORT EMPL IND1 IND3-IND10

Iteration 0:   log likelihood = -3099.0421
Iteration 1:   log likelihood = -2989.7112
Iteration 2:   log likelihood =  -2983.675
Iteration 3:   log likelihood = -2983.5273
Iteration 4:   log likelihood = -2983.5272

Logit estimates                                   Number of obs   =       4471
                                                  LR chi2(11)     =     231.03
                                                  Prob > chi2     =     0.0000
Log likelihood = -2983.5272                       Pseudo R2       =     0.0373

------------------------------------------------------------------------------
       REORG |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      EXPORT |   .3704894   .1012401     3.66   0.000     .1720624    .5689165
        EMPL |    .001712   .0001897     9.02   0.000     .0013402    .0020839
        IND1 |  -.0656257   .2313324    -0.28   0.777    -.5190289    .3877776
        IND3 |   .0996077   .1375782     0.72   0.469    -.1700406    .3692561
        IND4 |  -.3098006   .1034537    -2.99   0.003    -.5125662   -.1070351
        IND5 |   .1889763   .1406087     1.34   0.179    -.0866116    .4645642
        IND6 |   .2074118   .1168798     1.77   0.076    -.0216684     .436492
        IND7 |   .3413482   .1520184     2.25   0.025     .0433976    .6392989
        IND8 |  -.3221466   .1260081    -2.56   0.011    -.5691179   -.0751753
        IND9 |   .0114397    .108739     0.11   0.916    -.2016849    .2245643
       IND10 |   .2922819   .2063021     1.42   0.157    -.1120627    .6966266
       _cons |  -.2659004   .0807361    -3.29   0.001    -.4241402   -.1076606
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