Advanced Econometrics

Take-Home Exam #1, WS 2012/13
December 20th, 2012 – January 10th, 2013 (16:00h)

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This exam contains 1 question which is worth ten (10) points.

Your solution should include answers (summary tables/figures and interpretations), as well as your Gauss code. Please hand in the answers as a hard copy in Fabian Krüger's office (F309), and send your Gauss code to `Fabian.Krueger@uni-konstanz.de` in a file named after your student ID number.[1] Please document your answers and work steps in a way that makes it easy to understand what you did and why. Presentation of the results is part of grading.

The hard copy **and** the Gauss code have to be delivered until January 10th, 2013, 16:00h. Solutions delivered after the deadline will not be graded. Do not forget to state your student ID number.

Policy with regard to academic dishonesty:

The grade for your take home exam will be a part of your overall grade of your course. Students who wish to work together on assignment material may do so. However, each student must formulate and hand in their work independently.

Please note that plagiarism is a serious offence! It can be avoided by simply citing the original source of ideas or material that are not your own. Any attempt to plagiarize will be marked with zero (0) points for all take home exams in this course.

Good Luck!

[1] For example, "588497.gss".

Problem 1

The data set `th1.dat` is a subset of the data used by McCall (1996), who analyzes how different labor market institutions affect unemployment duration. The complete data set is available online at http://cameron.econ.ucdavis.edu/mmabook/mmaprograms.html. The data is part of the US current population survey (CPS) and covers individuals who became unemployed between 1986 and 1992. For simplicity, we drop individuals who were still unemployed at the end of the sample period. `th1.dat` thus contains $n = 1073$ observations on the following variables:

Column	Variable	Description
1	UNDUR	Unemployment duration (time between becoming unemployed and finding a new full-time job), in two-week intervals.
2	UI	1 if person received unemployment benefits, 0 if not
3	RR	Replacement rate (amount of unemployment benefits, divided by wage before unemployment)
4	RRUI	RR × UI
5	DR	Disregard rate (maximal amount which can be earned while receiving unemployment benefits, divided by wage before unemployment)
6	DRUI	DR × UI
7	LWAGE	Log weekly wage in last job before unemployment

To analyze what drives unemployment durations, you use the following exponential model:

$$
\begin{aligned}
f(Y_i|X_i) &= \begin{cases} \lambda_i \exp\left(-\lambda_i Y_i\right) & Y_i > 0 \\ 0 & \text{else.} \end{cases} \\
\lambda_i &= \exp(X_i'\beta), \\
\beta &= \begin{bmatrix} \beta_1 & \beta_2 & \beta_3 & \beta_4 & \beta_5 & \beta_6 & \beta_7 \end{bmatrix}', \\
Y_i = \text{UNDUR}_i, \qquad & X_i = \begin{bmatrix} 1 & \text{UI}_i & \text{RR}_i & \text{RRUI}_i & \text{DR}_i & \text{DRUI}_i & \text{LWAGE}_i \end{bmatrix}'.
\end{aligned}
$$

The observations $i = 1, \ldots, n$ are assumed to be independent. Note that $\mathrm{E}\left[Y_i|\, X_i\right] = 1/\lambda_i$ and $\mathrm{V}\left[Y_i|\, X_i\right] = 1/\lambda_i^2$.

a) Derive the log likelihood function, score, Hessian and information matrix of the model. 1 P

b) Report descriptive statistics for the present data set. 0.5 P

c) Write a `GAUSS` procedure for the log likelihood function of the exponential regression model. The procedure must have the following structure. Inputs: Candidate estimate for β; data set. Output: $n \times 1$ vector, log likelihood function for each individual in the sample. 1 P

d) Use the `maxlik` command as well as your procedure to obtain the Maximum Likelihood estimate of the parameter vector β, $\hat{\beta}_{ML}$. Use a vector of zeros as starting values for your likelihood maximization problem, and the sandwich estimator of the variance-covariance (VCV) matrix of $\hat{\beta}_{ML}$, i.e. set `_max_covpar = 3`. Report standard errors, t-statistics and p-values for all relevant parameter estimates. Interpret your results. 3 P

Hints:

- Don't forget to include an intercept.
- The command `_max_parnames` documented in the `maxlik` manual may be useful to keep track of the variables.

e) Consider a representative person with characteristics $\tilde{X}_i$. You want to test the null hypothesis that $\mathrm{E}\left[Y_i|\,\tilde{X}_i\right] = \frac{1}{\lambda_i} = \exp(-\tilde{X}_i'\beta) = z$, where z is a strictly positive number.

- Derive a formula for the Wald test statistic of this null hypothesis. 1 P
- Write a `Gauss` procedure with the following structure. Inputs: $\tilde{X}_i$, $k \times 1$ vector of characteristics; $\hat{\beta}$, $k \times 1$ estimated parameter vector; $\hat{\Sigma}_{\hat{\beta}}$, $k \times k$ estimated variance-covariance matrix of $\hat{\beta}$; z, strictly positive number. Output: Wald test statistic for the null hypothesis described above. 1 P
- Suppose a person receives unemployment benefits, with a replacement rate of 50 percent and a disregard rate of 10 percent. Furthermore, assume that the log of the last weekly wage of that person is 5.5. Use your procedure from the last step, as well as your estimation results, to test the null hypothesis that the expected unemployment duration for this person is six periods. Use a 5 percent significance level. Write down the value of your Wald test statistic, the critical value, and your test decision. 1 P

f) Compute the derivative

$$\mathrm{PE}(X_i) = \frac{\partial \mathrm{E}\left[Y_i|\,X_i\right]}{\partial \mathrm{LWAGE}_i}.$$

How can $\mathrm{PE}(X_i)$ be interpreted? 0.5 P

g) Compute the estimated partial effect, $\widehat{\mathrm{PE}}(X_i)$, for each of the n individuals in the sample. Plot a histogram of the n values and provide some summary statistics. 1 P

Reference

McCall, Brian P. (1996): "Unemployment Insurance Rules, Joblessness, and Part-Time Work", *Econometrica* 64(3), 647-682.