



School of Civil Engineering

CE 615 – Statistical and Econometric Methods II

Assignment #10 (Random Parameters Duration Models)

You are given 204 observations from a travel survey conducted in the spring of 1988, in the Seattle area (this is the same data that was used for assignment #2 and #7 in CE 614). While the purpose of the survey was to study the number of times (per week) commuters' changed their departure time on their work-to-home trip to avoid traffic congestion, we also have information on the length of time that they delay their trips to avoid congestion. The length of time commuters' delay is ideally suited to duration models.

Your task is to estimate a random parameters Weibull duration model. Please note that the software package actually estimates the parameter vector $-\beta$ instead of just β so that the effect of the covariates on the hazard is:

$$EXP(-\beta X)$$

This means that a negative parameter increases the hazard and thus decreases the duration. So the negative sign gives the effect on duration instead of on the hazard.

Following the same procedure used for random-parameter count models (assignment #9), random parameters are introduced into duration models by adding a randomly distributed term (ω_n) is introduced so that $\beta_n = \beta + \omega_n$ and explanatory variables now act on the hazard as $EXP(\beta_n X_n)$, where β now varies across n observations. As with the two random parameter models presented previously (logit and count models), a simulation-based maximum likelihood method is again used (with Halton draws again being an efficient alternative to random draws).

This means that a negative parameter in LIMDEP increases the hazard and thus decreases the duration. So the negative sign gives the effect on duration instead of on the hazard.

In your analysis include:

1. The results of your best model specification.
3. A discussion of the logical process that led you to the selection of your final specification. (e.g. Discuss the theory behind the inclusion of your selected variables). Include t -statistics and justify the sign of your variables.

Variables available for your specification are (file *tobit.dat*)

Variable Number	Explanation
x1	Household number
x2	Do you ever delay work-to-home departure to avoid traffic congestion? 1=yes, 0=no
x3	If sometimes delay, on average how many minutes do you delay?
x4	If sometimes delay, do you 1-perform additional work, 2-engage in non-work activities, or 3-do both?
x5	If sometimes delay, how many times have you delayed in the past week?
x6	Mode of transportation used work-to-home: 1-car SOV, 2-carpool, 3-vanpool, 4-bus, 5 other.
x7	Primary route (work-to-home): 1-I90, 2-I5, 3-SR520, 4-I405, 5-other
x8	Do you generally encounter traffic congestion on you work-to-home trip? 1=yes, 2=no
x9	Age in years: 1-(<25), 2-(26-30), 3-(31-35), 4-(36-40), 5-(41-45), 6-(46-50), 7-(>50)
x10	Gender: 1-male, 0-female
x11	Number of cars in household
x12	Number of children in household
x13	Annual income: 1 - less than 20000, 2 - 20000 to 29999, 3 - 30000 to 39999, 4 - 40000 to 49999, 5 - 50000 to 59999, 6 - >60000
x14	Do you have flexible work hours? 1=yes, 0=no
x15	Distance from work to home (in miles)
x16	Face LOS D or worse? 1=yes, 0=no
x17	Ratio of actual travel time to free-flow travel time
x18	Population of work zone
x19	Retail employment in work zone
x20	Service employment in work zone
x21	Size of work zone (in acres)

```
--> RESET
--> sample;1-204$
--> read;nvar=21;nobs=204;file=D:\new_laptop\CE697N-disk\tobit.dat$
--> reject;x3=0$
--> dstat;rhs=x3$
```

Descriptive Statistics

All results based on nonmissing observations.

```
=====
Variable          Mean          Std.Dev.        Minimum          Maximum          Cases
=====
-----
All observations in current sample
-----
X3                51.2916667    37.4671552     4.00000000      240.000000      96
```

```
--> create;if(x6=1)car=1$
```

```
--> create;if(x9>6)old=1$
```

```
--> dstat;rhs=car$
```

Descriptive Statistics

All results based on nonmissing observations.

```
=====
Variable          Mean          Std.Dev.        Minimum          Maximum          Cases
=====
-----
All observations in current sample
-----
CAR               .718750000    .451969375     .000000000      1.00000000      96
```

```
--> create;itime=log(x3)$
```

```
--> survival;lhs=itime;rhs=one,x10,x15,x17,x18;model=weibull
;rpm;pts=200;halton
;fcf=x10(n),x17(n),x18(n)$
```

```
+-----+
| OLS Starting values for random parameters model
| Ordinary least squares regression
| Model was estimated Sep 14, 2010 at 11:30:07AM
| LHS=LTIME Mean = 3.706844
| Standard deviation = .6997312
| WTS=none Number of observs. = 96
| Model size Parameters = 5
| Degrees of freedom = 91
| Residuals Sum of squares = 38.11339
| Standard error of e = .6471696
| Fit R-squared = .1806085
| Adjusted R-squared = .1445913
| Model test F[ 4, 91] (prob) = 5.01 (.0011)
| Diagnostic Log likelihood = -91.87654
| Restricted(b=0) = -101.4378
| Chi-sq [ 4] (prob) = 19.12 (.0007)
| Info criter. LogAmemiya Prd. Crt. = -.8195216
| Akaike Info. Criter. = -.8196159
+-----+
```

```
+-----+
| Variable | Coefficient | Standard Error | b/St.Er. | P[|Z|>z] | Mean of X |
+-----+
| Constant | 1.66327149 | .54200556 | 3.069 | .0021 |
| X15 | .04135661 | .01539192 | 2.687 | .0072 | 7.70833333
| X10 | -.13791020 | .14468253 | -.953 | .3405 | .69791667
| X17 | .75173041 | .24918005 | 3.017 | .0026 | 1.95937500
| X18 | .132663D-04 | .699274D-05 | 1.897 | .0578 | 26240.2500
```

Normal exit from iterations. Exit status=0.

```

+-----+
| Random Coefficients  WiblSurv Model
| Maximum Likelihood Estimates
| Model estimated: Sep 14, 2010 at 11:30:52AM.
| Dependent variable          LTIME
| Weighting variable          None
| Number of observations      96
| Iterations completed        41
| Log likelihood function     -88.62897
| Sample is 1 pds and         96 individuals.
| Weibull duration model
| Simulation based on 200 Halton draws
+-----+

```

Variable	Coefficient	Standard Error	b/St.Er.	P[Z >z]	Mean of X
Nonrandom parameters					
Constant	1.95225484	.10752597	18.156	.0000	
X15	.03470521	.00317378	10.935	.0000	7.70833333
Means for random parameters					
X10	-.16418077	.02963436	-5.540	.0000	.69791667
X17	.71765963	.05002343	14.346	.0000	1.95937500
X18	.119067D-04	.146496D-05	8.128	.0000	26240.2500
Diagonal elements of Cholesky matrix					
X10	.13877946	.02933724	4.730	.0000	
X17	.28136693	.02301737	12.224	.0000	
X18	.392888D-05	.490941D-06	8.003	.0000	
Below diagonal elements of Cholesky matrix					
1X17_X10	.19535399	.02396657	8.151	.0000	
1X18_X10	.463581D-06	.155596D-05	.298	.7658	
1X18_X17	.346417D-05	.163352D-05	2.121	.0339	
Scale parameter for survival distribution					
ScalParm	.19057105	.01031871	18.468	.0000	

Implied covariance matrix of random parameters

Matrix Var_Beta has 3 rows and 3 columns.

	1	2	3
1	.01926	.02711	.6433550D-07
2	.02711	.11733	.1065267D-05
3	.6433550D-07	.1065267D-05	.2765149D-10

Implied standard deviations of random parameters

Matrix S.D_Beta has 3 rows and 1 columns.

	1
1	.13878
2	.34254
3	.5258469D-05

Implied correlation matrix of random parameters

Matrix Cor_Beta has 3 rows and 3 columns.

	1	2	3
1	1.00000	.57032	.08816
2	.57032	1.00000	.59142
3	.08816	.59142	1.00000