Precept 3: Survival Analysis and Proportional Hazards

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1 Equations

1.1 Proportional Hazards

With a baseline hazard of $h(x, 0)$ and an individual hazard of $h(x, i)$

$$h(x, i) = h(x, 0) \cdot e^{B_1 Z(1,i) + B_2 Z(2,i) \ldots}$$

And remember:

$$e^{B_1 Z(1,i) + B_2 Z(2,i) \ldots} = e^{B_1 Z(1,i)} \cdot e^{B_2 Z(2,i)}$$

1.2 Proportion Hazards and Partial Likelihoods

This example comes form Wachter section 8.5. Women are the baseline hazard and men have a proportional hazrd.

Women	$h(x, i) = h(x, 0)$
Men	$h(x, i) = e^{\beta} \cdot h(x, 0)$

We are given data on 5 people who lived record life spans:

Name	Sex	Date of Birth	Date of Death	Lifespan
Calment	F	21/2/1875	4/4/1997	122
Meilleur	F	29/7/1880	16/4/1998	117
Mortensen	M	16/7/1882	25/4/1998	115
Hughes	F	1/7/1877	17/3/1993	115
Jennings	F	12/11/1884	20/11/1999	115

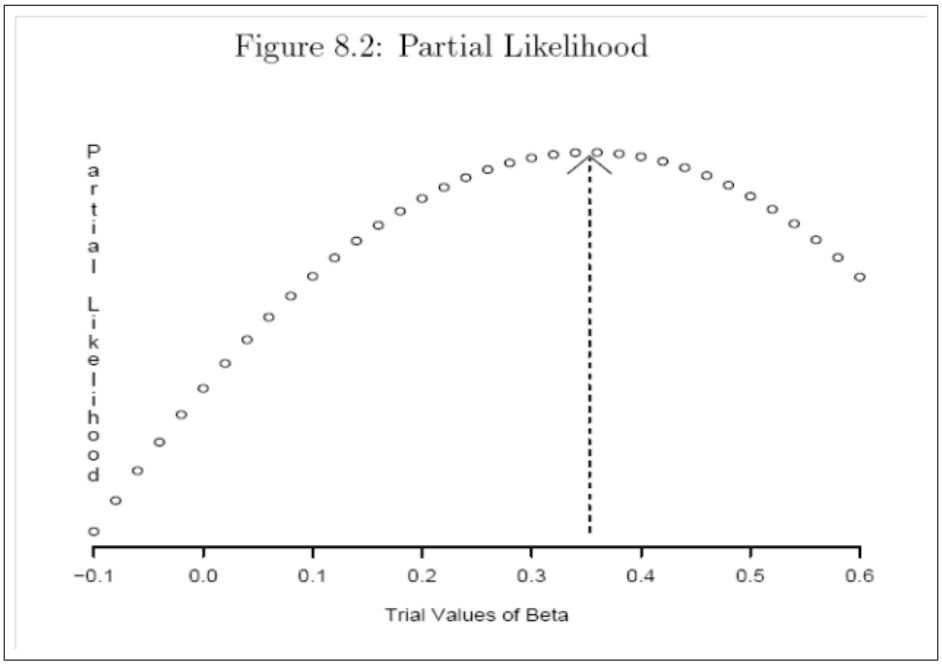
The model says that the chance of Mrs. Jennings dying first is:

$$\frac{h(x, 0)}{h(x, 0) + h(x, 0) + e^{\beta} h(x, 0) + h(x, 0) + h(x, 0)} = \frac{1}{4 + e^{\beta}}$$

"We look for the value of the parameter β which maximzes the partial likelihood, that is, which makes the observed order of deaths as likely as possible under the model." (Wacther pg. 204)

In this example, plug in trial values for β and choose the on that gives the highest value for the partial likelihood:

$$\lambda = \frac{1}{4+e^{\beta}} \cdot \frac{1}{3+e^{\beta}} \cdot \frac{e^{\beta}}{2+e^{\beta}} \cdot \frac{1}{2} \cdot \frac{1}{1}$$



2 Stata

2.1 st commands

Command	Description
stset	Declare data to be survival-time data
stdescribe	Describe survival-time data
stsum	Summarize survival-time data
stsplit	Split time-span records
stjoin	Join time-span records
sts	Generate, graph, list, and test the survivor and CH functions
stcox	Fit Cox proportional hazards model
streg	Fit parametric survival models
stcurve	Plot survivor, hazard, cumulative hazard, or CI function
stphplot	Graphically assess the Cox proportional-hazards assumption

2.2 stset

stset: declares date to be survival-time data.
The syntax is:

```
stset timevar [if] [weight] [,single_option]
```

2.3 stcox

stcox: Cox proportional hazards model
The syntax is:

```
stcox varlist [if] [in] [, options]
```

2.4 sts graph

sts graph: Graph the survivor and cumulative hazard functions
The syntax is:

```
sts graph [if] [in] [, options]
```

Options include:

survival	graph Kaplan-Meier survivor function (default)
failure	graph Kaplan-Meier failure function
cumhaz	graph Nelson-Aalen cumulative hazard function
hazard	graph smoothed hazard estimate
by(varlist)	calculate separately on different groups of varlist
strata(varlist)	stratify on different groups of varlist
ci	shows pointwise confidence bands

2.5 stphplot

stphplot: Tests of proportional hazards assumptopm
The syntax for checking the proportional hazard assumption using log-log plot of survival is:

```
stphplot [if], {by(varname) | strata(varname)} [stphplot_options]
```

The syntax for checking the proportional hazard assumption using Schoenfeld residuals:

```
estat phtest [, phtest_options]
```

2.6 xi

xi: Interaction expansion
xi expands terms containing categorical variables into indicator (also called dummy) variable sets by creating new variables
The syntax is:

```
xi: any_stata_command
```