Broken Heart with R

A study on the survival chance of widows

Orsolya Rétallér

University of Groningen
Department of Economics, Econometrics and Finance

29 June 2015

rijksuniversiteit groningen

Dependence time frame (Hougaard, 2000)

Short-term dependence
"In some cases, the risk of an event is particularly high shortly after a previous event, whereas the increase in risk fades away over time."

Long-term dependence
"In this time frame the whole history is important."

Dependence time frame (Hougaard, 2000)

If two lives are dependent:

$$\mu_2(t, t_1) \neq \lambda_2(t)$$

where

- $\lambda_2(t)$ is the hazard of death of member 2 before member 1's death
- $\mu_2(t, t_1)$ is the hazard of death of member 2 after member 1's death at time t_1

Dependence time frame (Hougaard, 2000)

Under positive dependence

$$\mu_2(t, t_1) > \lambda_2(t)$$

- the dependence is of short-term nature if $\mu_2(t, t_1)$ is increasing as function of t_1 for any fixed value of t,
- the dependence is of long-term nature if $\mu_2(t, t_1)$ is constant or decreasing as function of t_1 for any fixed value of t.

The Database

Some facts

- 14,947 contracts in force with a large Canadian insurer
- Period of observation: 29 December 1988 to 31 December 1993
- Contracts are held by couples
- Important variables for the analysis: birth and death dates

Some problems

- Some couples hold more than one contract
- Couples are of same sex

After filtering the data 12,197 couples remained in the database

The Problem with Widows...

The number of widows in the database is rather low

- The number of male widows: 382 (alive: 281, dead: 101)
- The number of female widows: 1190 (alive: 1097, dead: 93)

Focus will be more on female widows, due to lack of data.

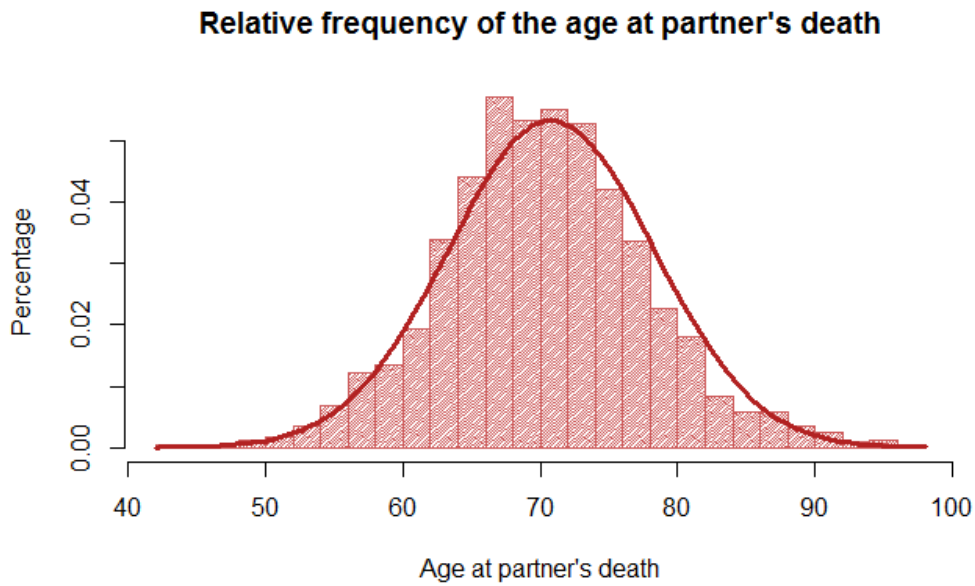
Widows are a select group

- If someone outlived their spouse, that implies higher life-expectancy.

Widows' mortality will be compared to those, who are alive at a particular age, and not to the whole population.

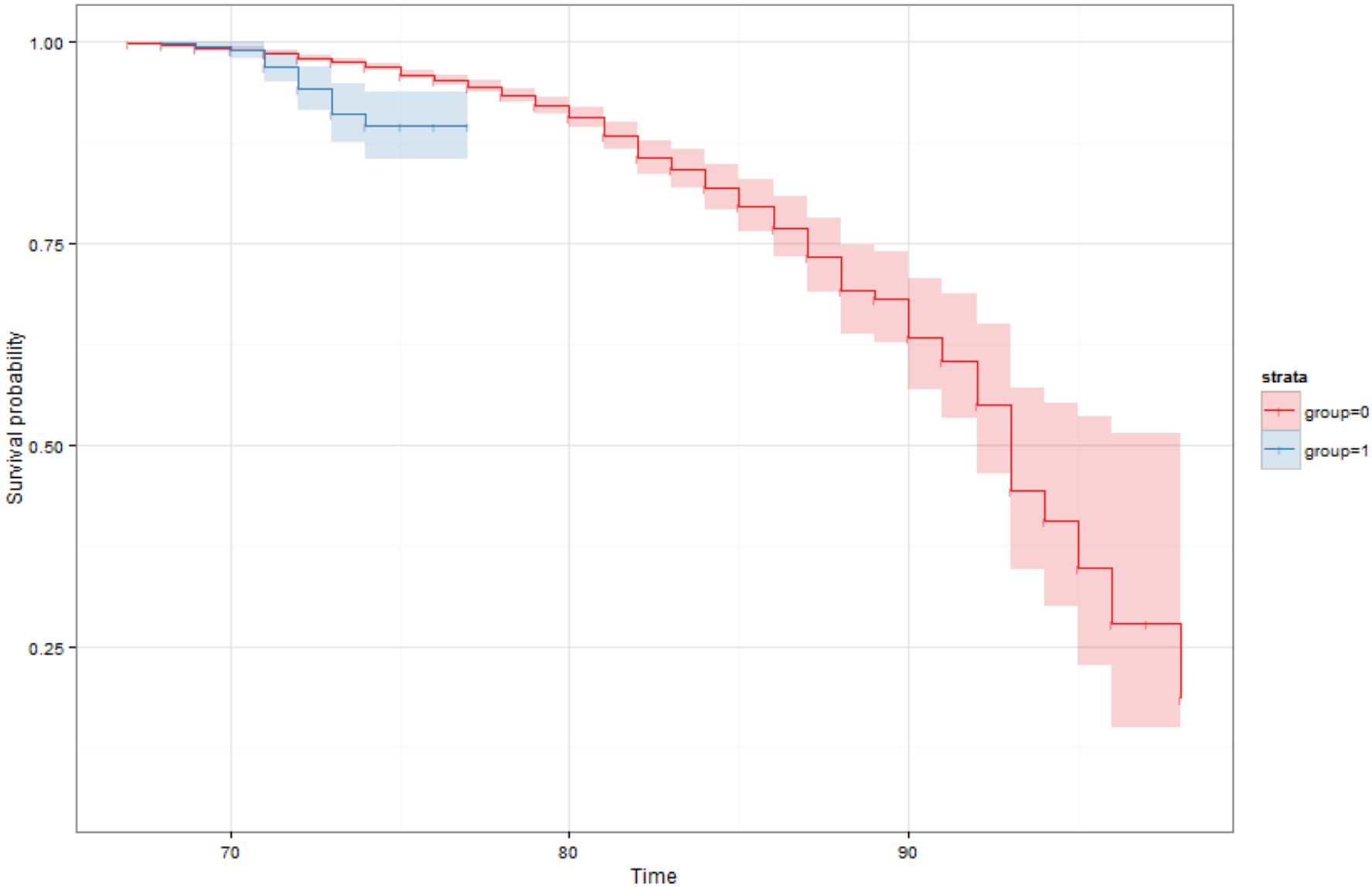
The Problem with Widows...

Widows don't become widows at the same time

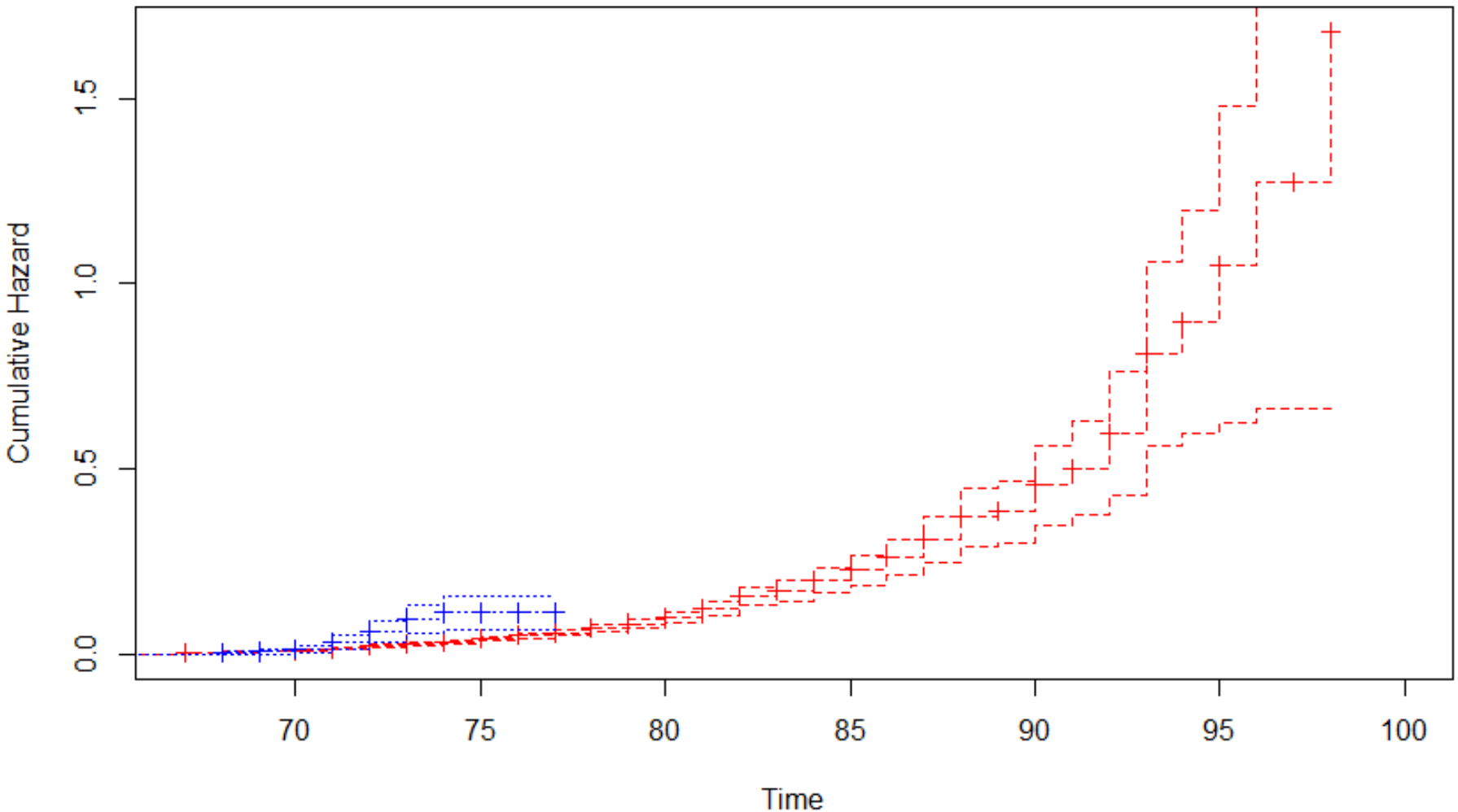


Focus will be on a specific age group: ages of 67-72 (alive: 369, dead: 25).

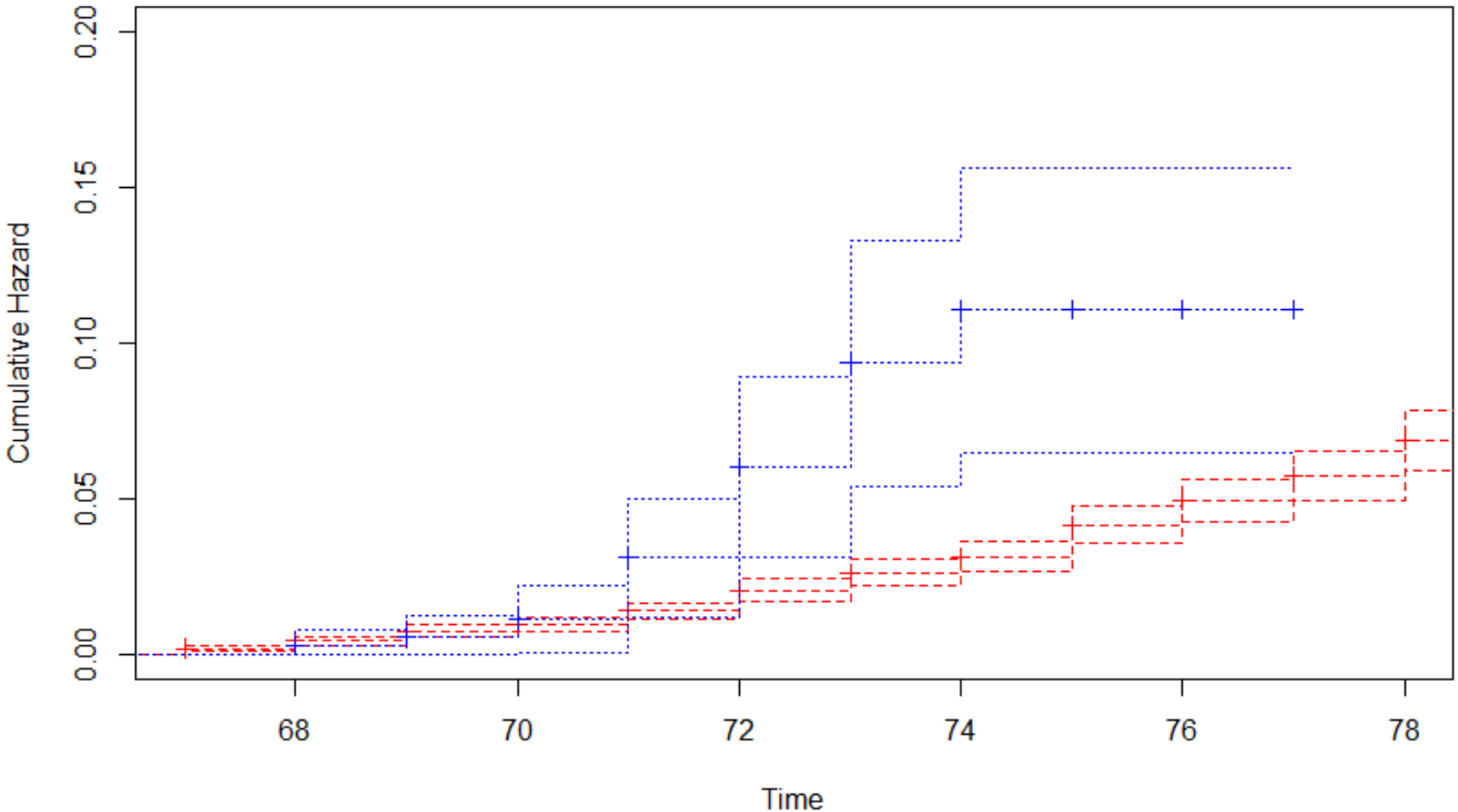
Kaplan-Meier survival functions



Kaplan-Meier cumulative hazard functions



Kaplan-Meier cumulative hazard functions



Kaplan-Meier models

Short-term dependency seems to be verified:
The loss of a woman's husband increases her mortality in short-term.

p-values of long-rank tests for different age-groups:

Age-group	67-68	67-69	67-70	67-71	67-72	67-73	67-74
p-value	0.8810	0.5410	0.0002	0.0000	0.000	0.0001	0.0001

Age-group	67-75	67-76	67-77	67-78	67-79	67-80	67-81
p-value	0.0004	0.0001	0.0000	0.0002	0.0024	0.0012	0.0030

After a while the effect seem to vanish.

How to handle widowhood in the long-term?

Being a widow is not a constant covariate.

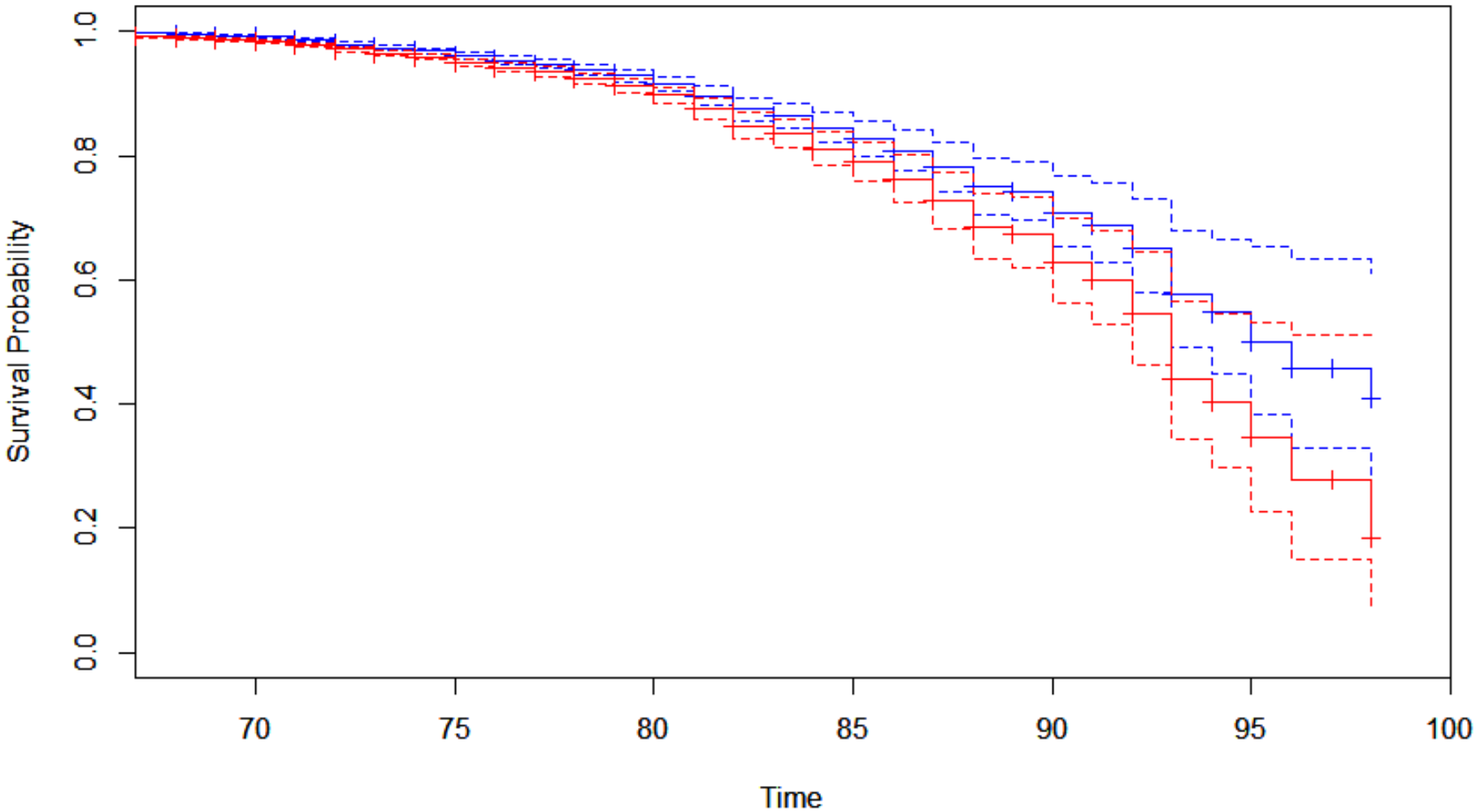
- Some become a widow earlier, some later
- Some never become a widow
- Eventually becoming a widow implies that one belongs to a select group - it is not a good idea to simply split the database into widows and not widows

A possible solution: episode-splitting

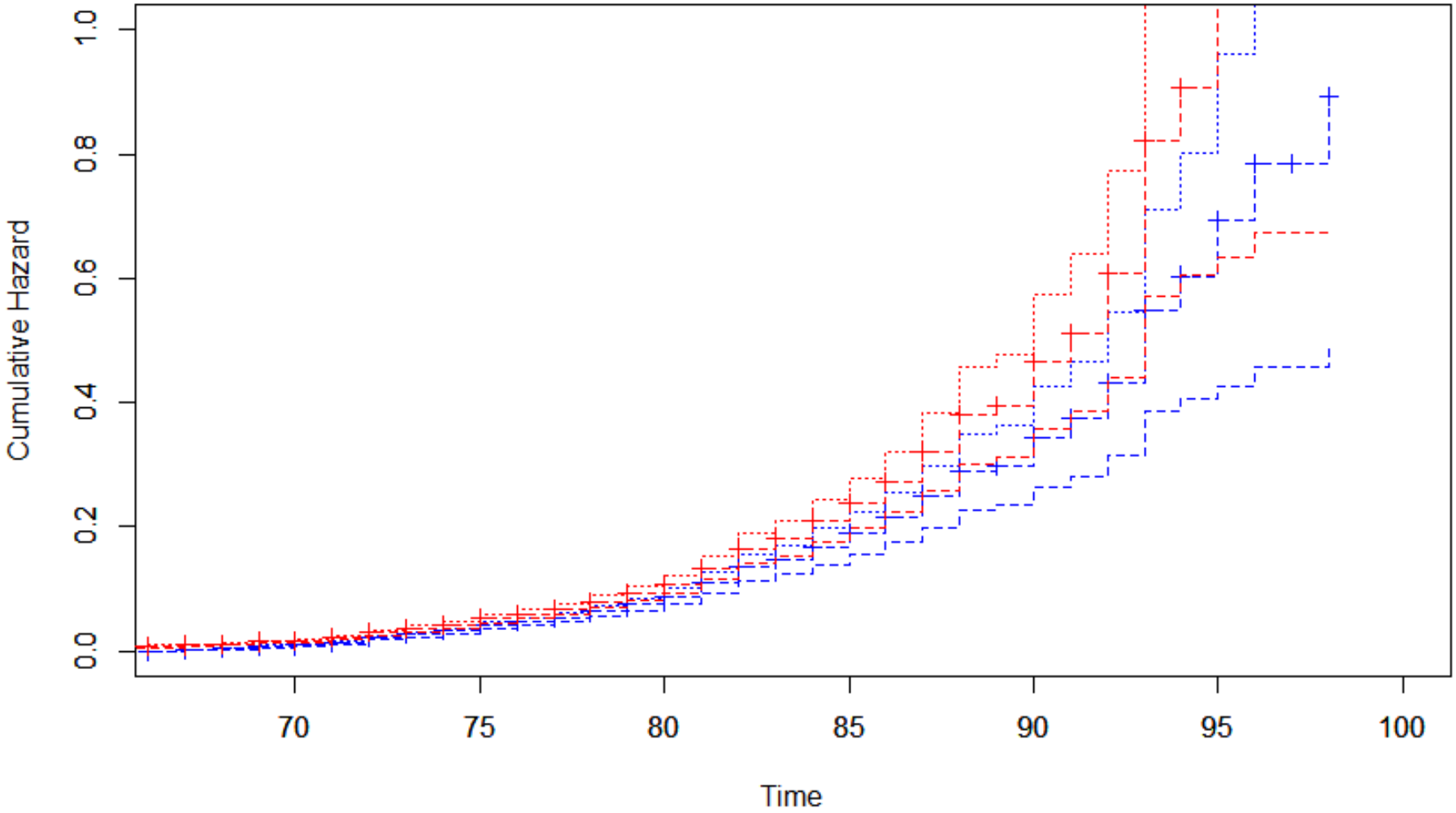
The general idea:

Each person will be represented in the dataset as many times as many years they live. The variable "widow" can then vary over time for each person.

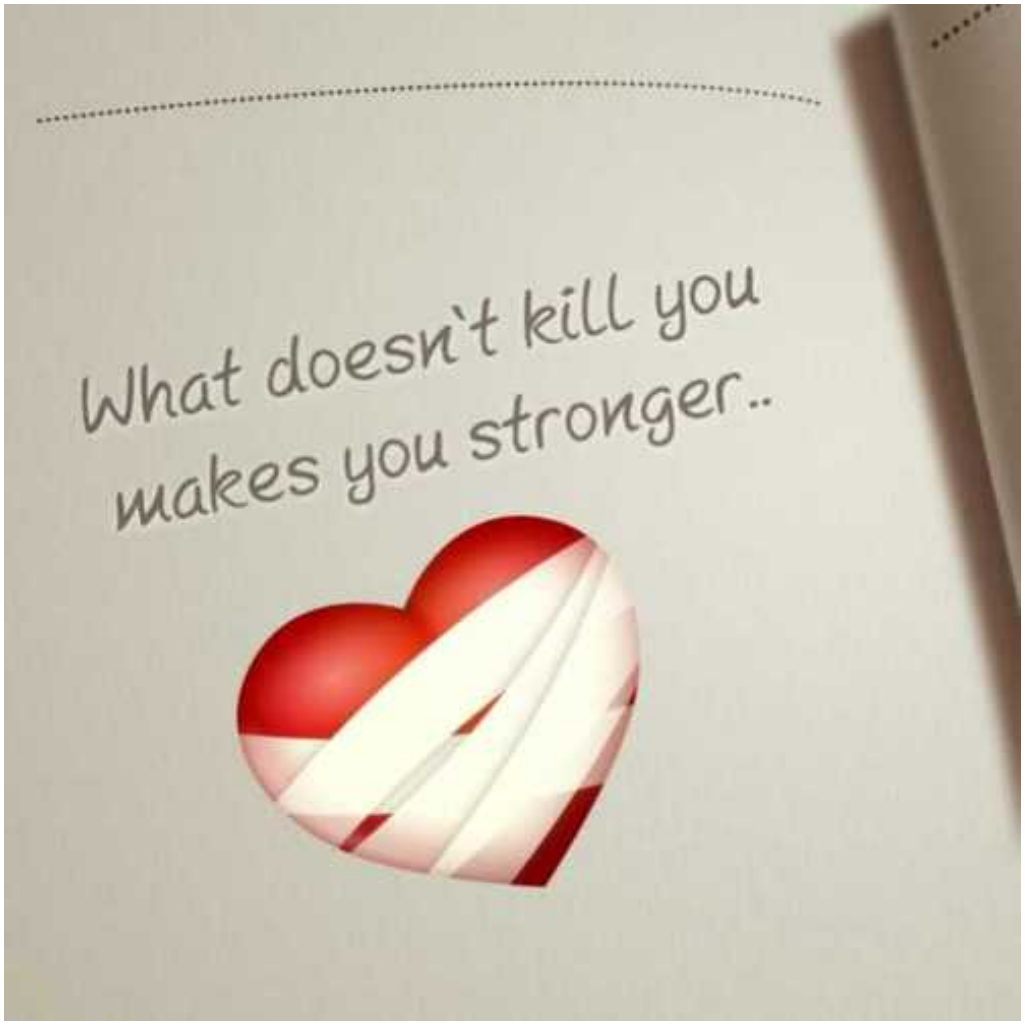
Cox's survival function with episode splitting



Cox's cumulative hazard function with episode splitting



Conclusion



Broken Heart in R

Thank you for your attention!

Orsolya Rétallér

University of Groningen

Department of Economics, Econometrics and Finance

29 June 2015

rijksuniversiteit groningen