Decomposing discrete time multistate models

Tim Riffe

5-3-2020

Discrete time multistate models

Demography (2017) 54:2101–2123
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CrossMark

Working Life Expectancy at Age 50 in the United States and the Impact of the Great Recession

Christian Dudel[1]

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Abstract A key c
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is known about th
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Great Recession in
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Eur J Population (2018) 34:769–791
https://doi.org/10.1007/s10680-017-9458-9

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The Length of Working Life in Spain: Levels, Recent Trends, and the Impact of the Financial Crisis

Christian Dudel[1] · María Andrée López Gómez[2,3,4,5] · Fernando G. Benavides[3,4,5] · Mikko Myrskylä[1,6,7]

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Soc Indic Res (2019) 142:283–303
https://doi.org/10.1007/s11205-018-1910-7

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The Legacy of the Great Recession in Italy: A Wider Geographical, Gender, and Generational Gap in Working Life Expectancy

Angelo Lorenti[1]

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Abstract Under th
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Working and Disability Expectancies at old ages: the role of childhood circumstances and education

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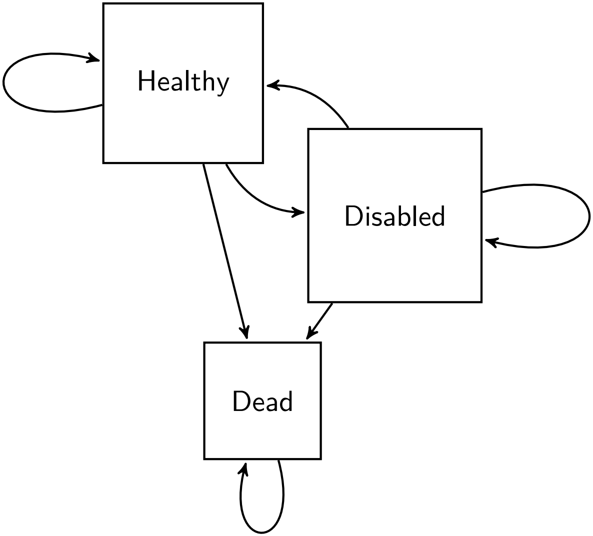
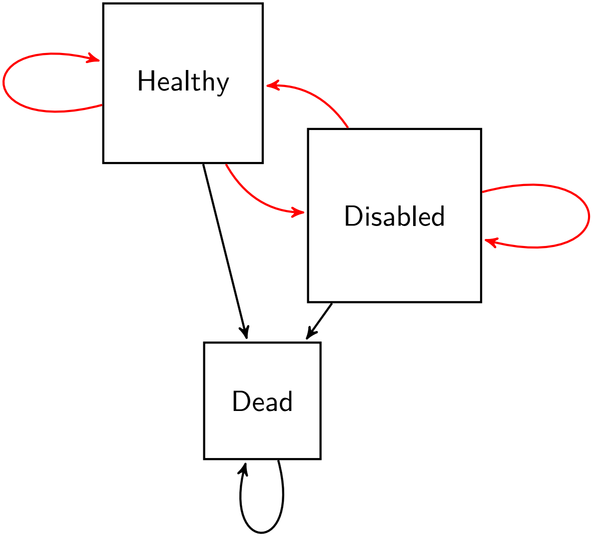
A typical model



A typical model



Generalizing the objective

$$\xi = f(\theta)$$

Generalizing the objective

$$\xi = f(\theta)$$

where ξ can be any synthetic quantity calculated using θ.

- often ξ is an expectancy

Decomposition

Kitagawa, Arriaga, stepwise algorithm, Oaxaca-Blinder, CF, Horiuchi, LTRE, SVD, SSE, and many many more

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Decomposition

Method	order indep.	exact sum	interpretable
Stepwise		X	X
Horiuchi	X	X	X
LTRE	X	X†	X

Decomposition

Method	order indep.	exact sum	interpretable
Stepwise		X	X
Horiuchi	X	X	X
LTRE	X	X†	X

They're all good enough for what we're doing

† requires a modification

The setup

$$\Delta\xi = \xi^2 - \xi^1$$

The setup

$$\Delta\xi = \xi^2 - \xi^1$$

$$= f(\theta^2) - f(\theta^1)$$

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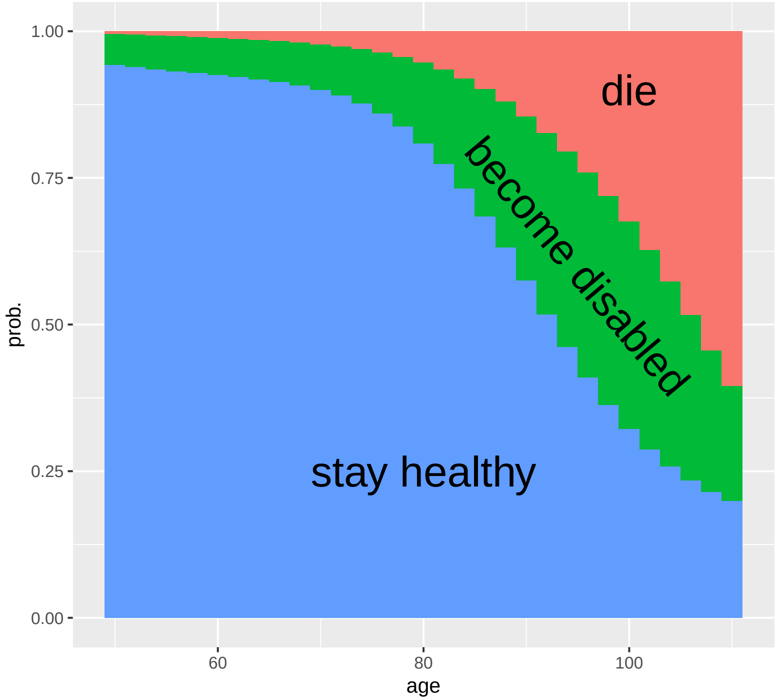
$$\Delta\xi = \xi^2 - \xi^1$$

$$= f(\theta^2) - f(\theta^1)$$

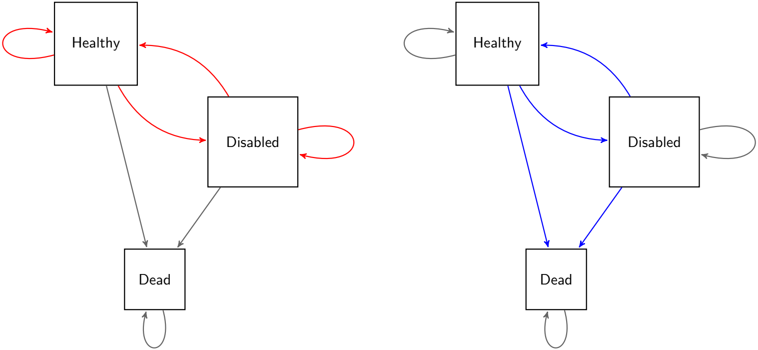
$$\Delta\xi = \sum \mathbf{c}_i$$

$$\mathbf{c} = \mathcal{D}(f, \theta^2, \theta^1)$$

Let's talk about θ



1.00
0.75
0.50
0.25
0.00
prob.
60
80
100
age
die
become disabled
stay healthy


Healthy
Disabled
Dead
Healthy
Disabled
Dead

Observation

$$\xi = f(\theta) = f(\theta)$$

Observation

$$\xi = f(\theta) = f(\theta)$$

$$\Delta\xi = \xi^2 - \xi^1 = \xi^2 - \xi^1$$

Observation

$$\xi = f(\theta) = f(\theta)$$

$$\Delta\xi = \xi^2 - \xi^1 = \xi^2 - \xi^1$$

$$\mathcal{D}(f, \theta^2, \theta^1) \neq \mathcal{D}(f, \theta^2, \theta^1)$$

$$\sum \mathbf{c}^i = \sum \mathbf{c}^i$$

but

$$\mathbf{c}^i \neq \mathbf{c}^i$$

Example

DFLE increased from 30.75 in 2006 to 32.33 in 2014. That's 1.58 years

(HRS, women with secondary education)

Example

Same result whether we *omit*:

- self-transitions
- mortality transitions
- health transitions

Example

But very different stories if we decompose:

Resid.	DF-DF	DF-Dis.	DF mort	Dis.-DF	Dis.-Dis.	Dis. mort
(self)		-0.01	1.32	-0.28		0.54
(dead)	1.28	0.04		-1.86	2.13	
(other)	0.21		1.10		-0.41	0.67

Thank you intermission

A new property

We would like a solution that gives consistent interpretable results

A new property

We would like a solution that gives consistent interpretable results

Solution

A new property

We would like a solution that gives consistent interpretable results

Solution

Make θ consist in conditional probabilities

Specifics

For standard calcs we use (two of)

$[p^{stay}, p^{switch}, p^{die}]$

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For standard calcs we use (two of)

$[p^{stay}, p^{switch}, p^{die}]$

Transform this into two multiplicative probabilities

$[p^{stay}|survive, p^{survive}]$

Complementarity (or *symmetry*?)

DF mort	Dis. mort	DF-Dis.	Dis.-DF
1.29	0.58	0.02	-0.31

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Transitions can be framed in terms of mortality or survival, in terms of staying in the state of transfering out of it. Results **identical**

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Transitions can be framed in terms of mortality or survival, in terms of staying in the state of transfering out of it. Results **identical**

Really, IDENTICAL

Small things

- Best to logit or similar before decomposing ($f(\theta)$ just needs to undo it)
- Probably extends to larger state spaces
- Accounting for initial conditions not treated here

Things to consider

- Recheck LTRE work in lit
- Low programming overhead on top of MS modeling
- MS papers probably should do this