Mortality Shift & Compression Decomposition – Two Applications

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Rationale:

- for a econometrics course
- the paper by Bergeron-Boucher et al., (2015) in Demographic Research

These are the extensions

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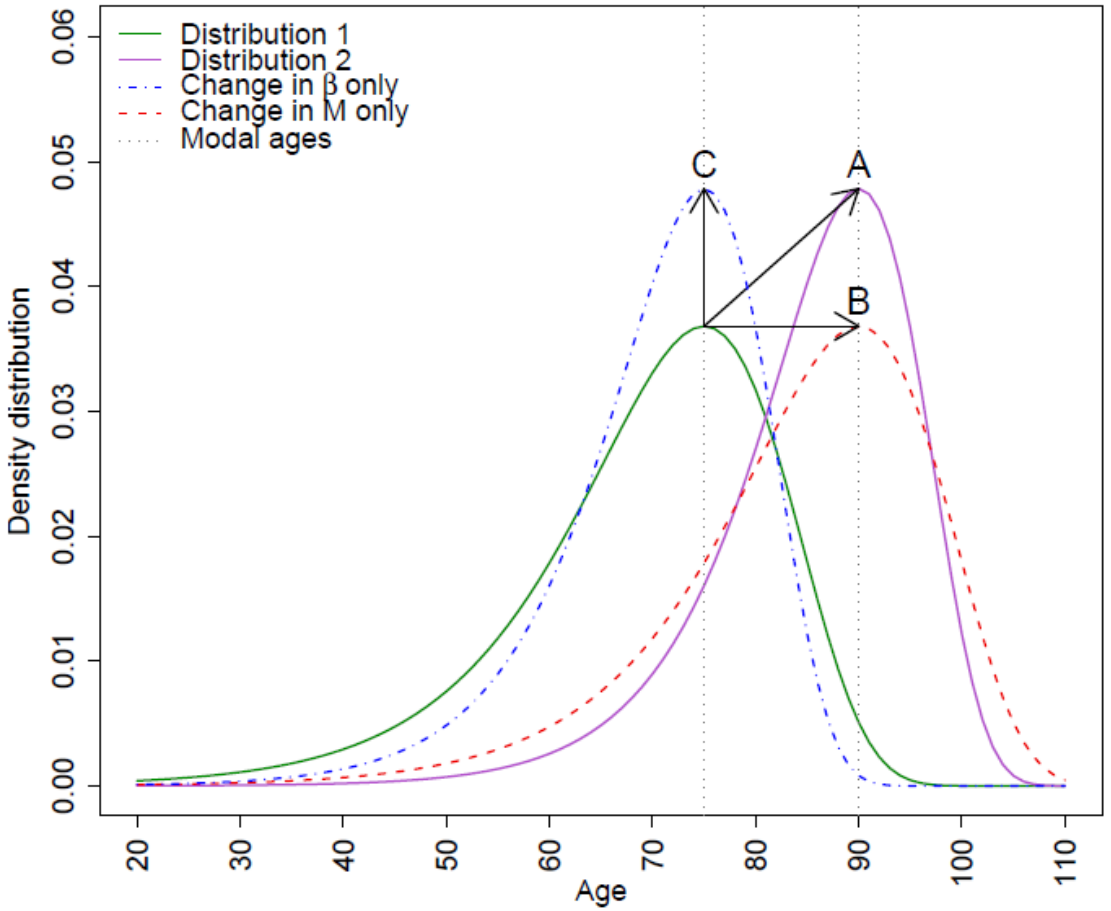
Methodology



- M modal age at death.
- β mortality intensity, or variation $(\frac{1}{\beta})$.
- Others

Bergeron-Boucher et al., (2015)
Basellini et al., (2019)

Methodology

Changes in Life expectancy

$$\dot{e}_{0,t} = \int_0^{\omega} \dot{l}_{a,t}\, da = -\int_0^{\omega} l_{a,t} \int_0^{a} \dot{\mu}_{x,t}\, d_x\, d_a,$$

Methodology

Mortality modelling

$$\mu_{x,t} = c_t + \beta_t e^{\beta_t (x - M_t)},$$

$$\mu_{x,t} = \alpha_t \, e^{-b_t x} + c_t + \beta_t e^{\beta_t (x - M_t)},$$

Methodology

$$\dot{e}_{0,t} = \int_0^{\omega} i_{a,t}\, da = -\int_0^{\omega} l_{a,t} \int_0^{a} \dot{\mu}_{x,t}\, d_x\, d_a,$$

$$\dot{e}_{0,\mathrm{t}} = \sum_i \Delta_i = \Delta_M + \Delta_\beta + \cdots$$

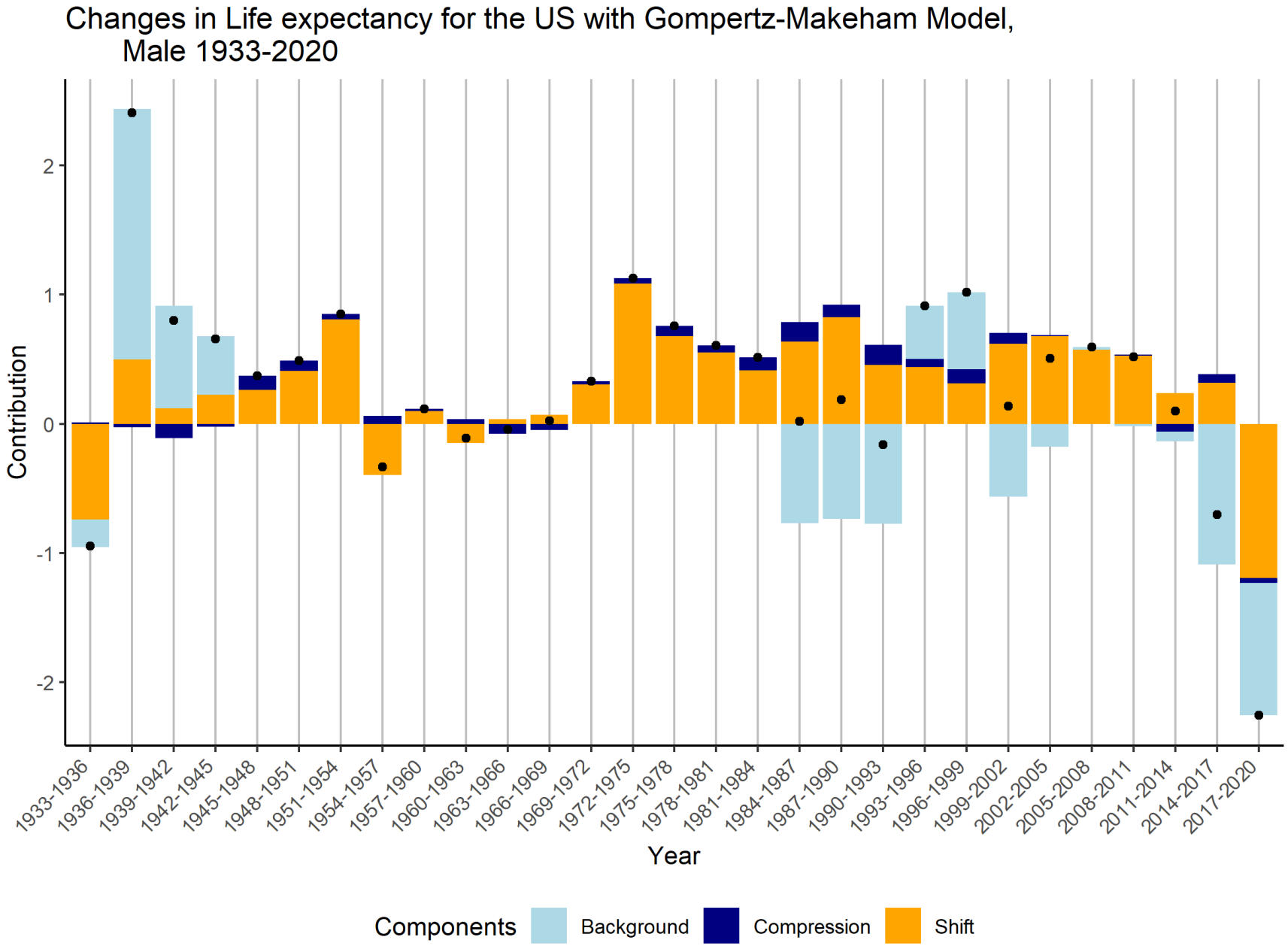
Data

Human Mortality Database

National Centre of Health Statistics (CDC Wonder)

United States During COVID

United States During COVID



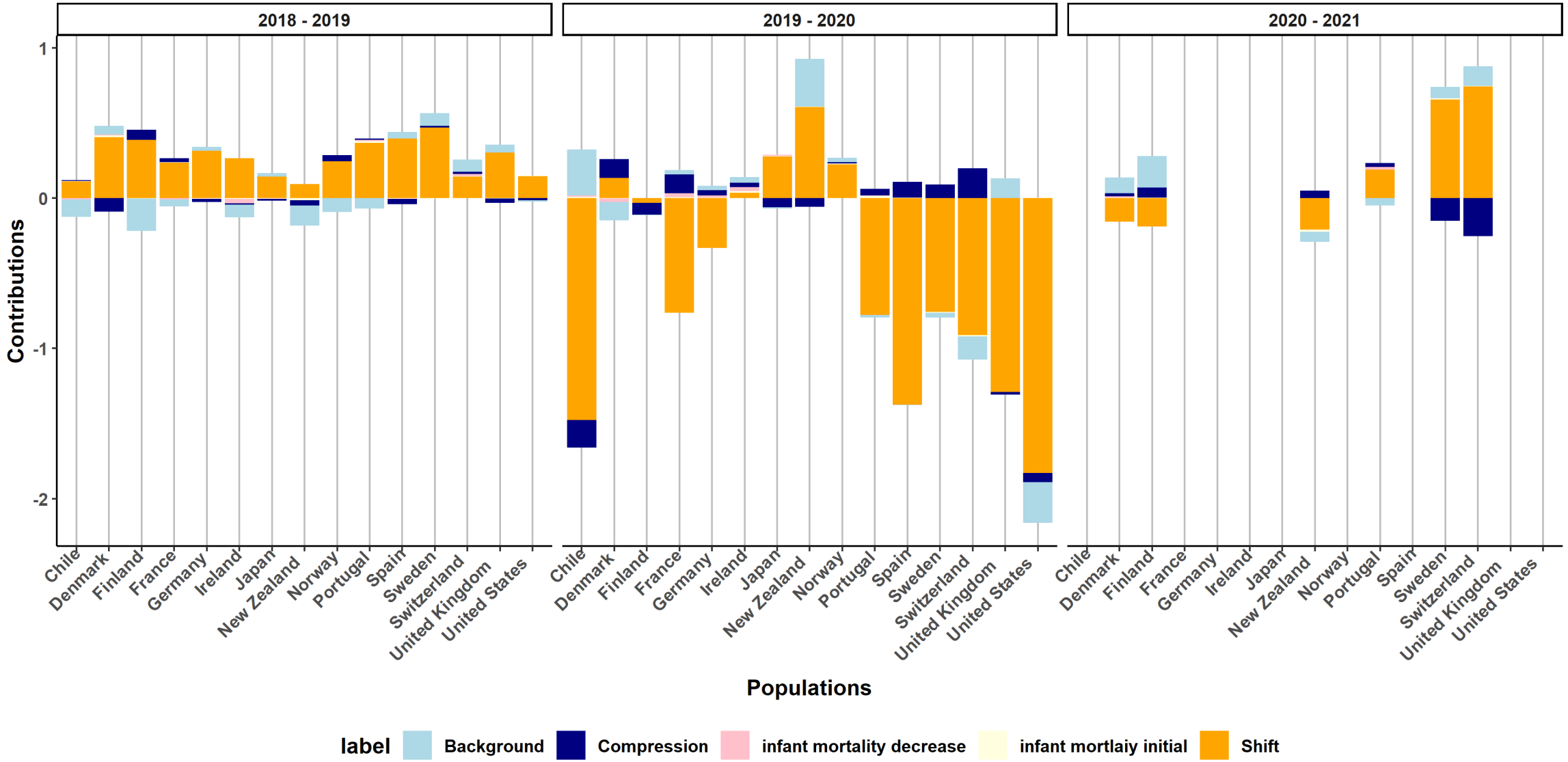
United States During COVID

Table 1. Contributions from background mortality component (light blue), mortality compression component (navy blue), and mortality shift component (orange) to changes in life expectancy for different races of males in the US, 2011-2020.

Sub-populations/Year	2011-2015			2015-2019			2019-2020		
Black Americans	-0.059	-0.211	0.334	-1.175	-0.044	0.372	-1.733	0.226	-2.498
Native Americans	-0.417	-0.398	0.268	-1.432	0.010	1.261	-1.409	-0.378	-2.597
Non-Hispanic White Americans	-0.329	-0.073	0.193	-1.450	0.236	0.459	-2.524	0.369	-0.586
US National	-0.191	-0.097	0.230	-1.273	0.180	0.513	-2.163	0.216	-1.063

United States During COVID

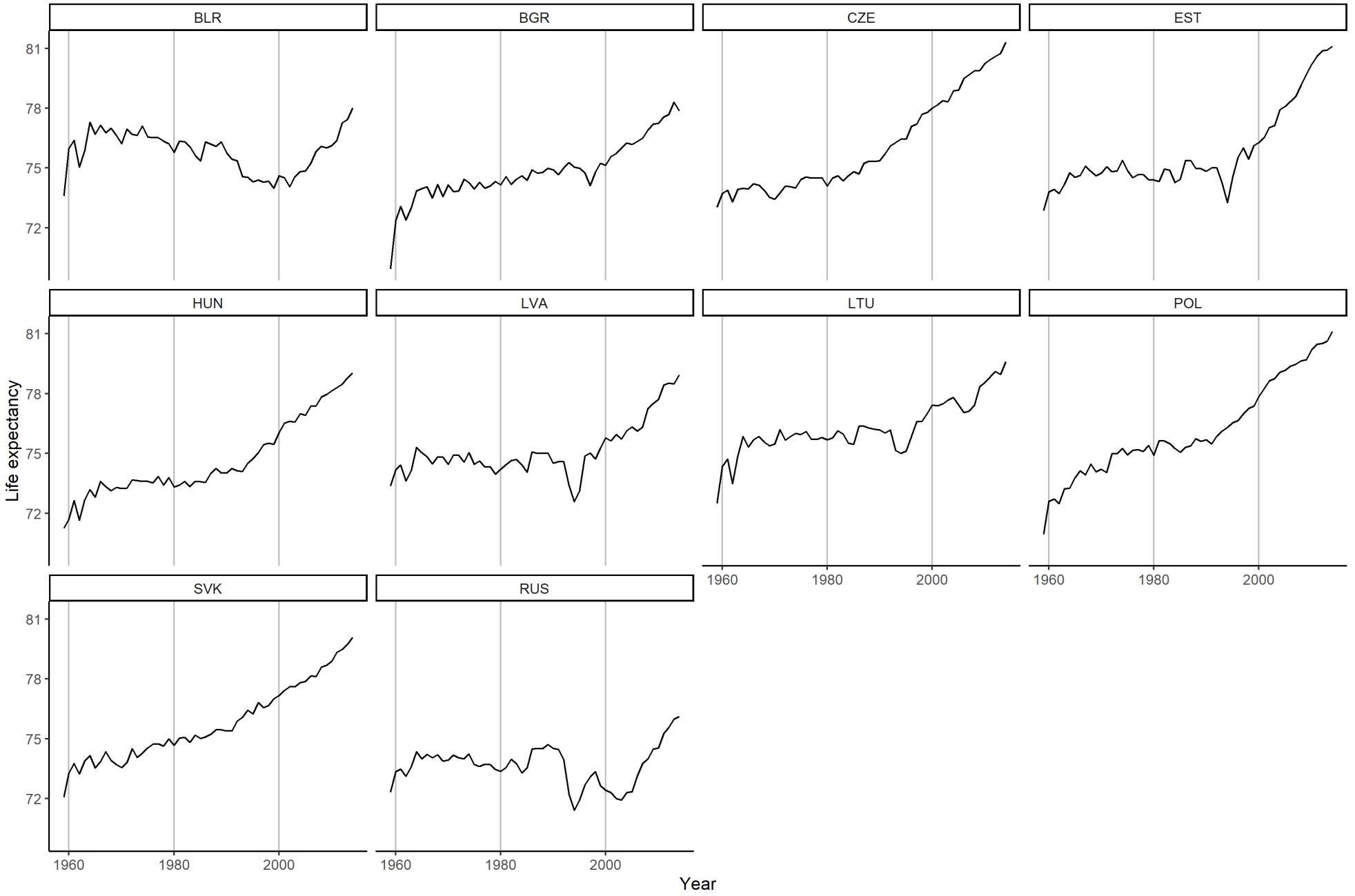
- Discrepancies (big) between CDC data and HMD.
  - Reweight to HMD?
  - Categorical errors

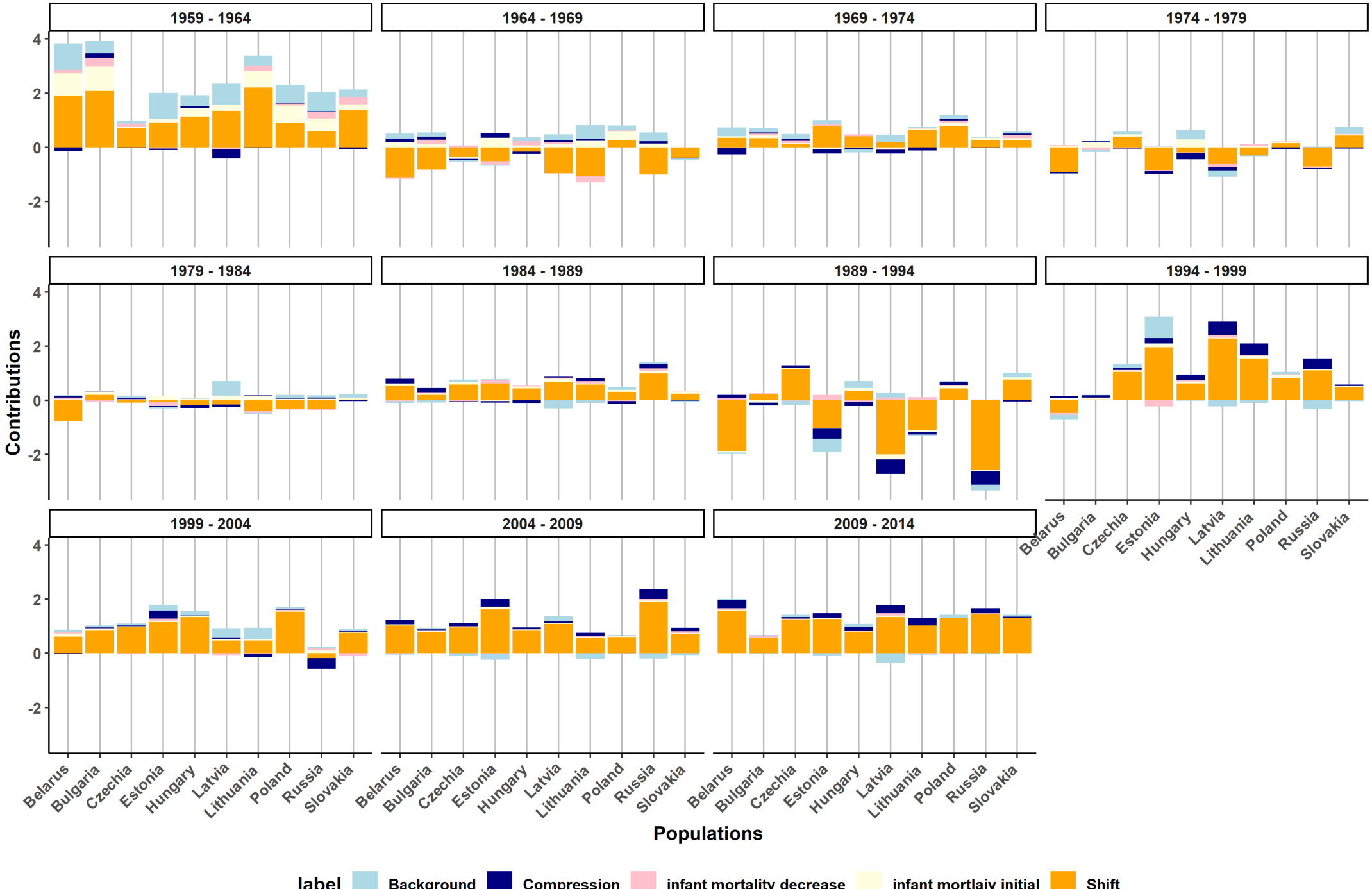

2018 - 2019
2019 - 2020
2020 - 2021
Contributions
1
0
-1
-2
Chile
Denmark
Finland
France
Germany
Ireland
Japan
New Zealand
Norway
Portugal
Spain
Sweden
Switzerland
United Kingdom
United States
Populations
label
Background
Compression
infant mortality decrease
infant mortlaiy initial
Shift

Eastern European Countries

Bergeron-Boucher focused on low-mortality countries.

Does Eastern European countries follow the same step?


BLR
BGR
CZE
EST
HUN
LVA
LTU
POL
SVK
RUS
Life expectancy
81
78
75
72
1960
1980
2000
Year


1959 - 1964
1964 - 1969
1969 - 1974
1974 - 1979
1979 - 1984
1984 - 1989
1989 - 1994
1994 - 1999
1999 - 2004
2004 - 2009
2009 - 2014
Contributions
4
2
0
-2
Belarus
Bulgaria
Czechia
Estonia
Hungary
Latvia
Lithuania
Poland
Russia
Slovakia
Populations
label
Background
Compression
infant mortality decrease
infant mortlaiy initial
Shift

Next step, maybe lifespan variation?

$$\dot{e}^{\dagger}$$

https://github.com/WenSu221/Gompertz_Decomp