

# BACKGROUND AND SENESCENT COMPONENT OF ADULT MORTALITY AND ITS RELATION TO MORTALITY SHIFTING

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Because of the already very low level of mortality at lower ages, the mortality analysis started to be focused mainly on higher ages and the population group of the "oldest-old". Within the analysis of the force of mortality the decomposition of the total mortality into two different components could be seen to be applied (among other methods) – decomposition to the senescent and background mortality. Both these components could be studied separately.

**Background (baseline) mortality** is the component independent on age (constant)

**Senescent mortality** is the component changing (growing) with age

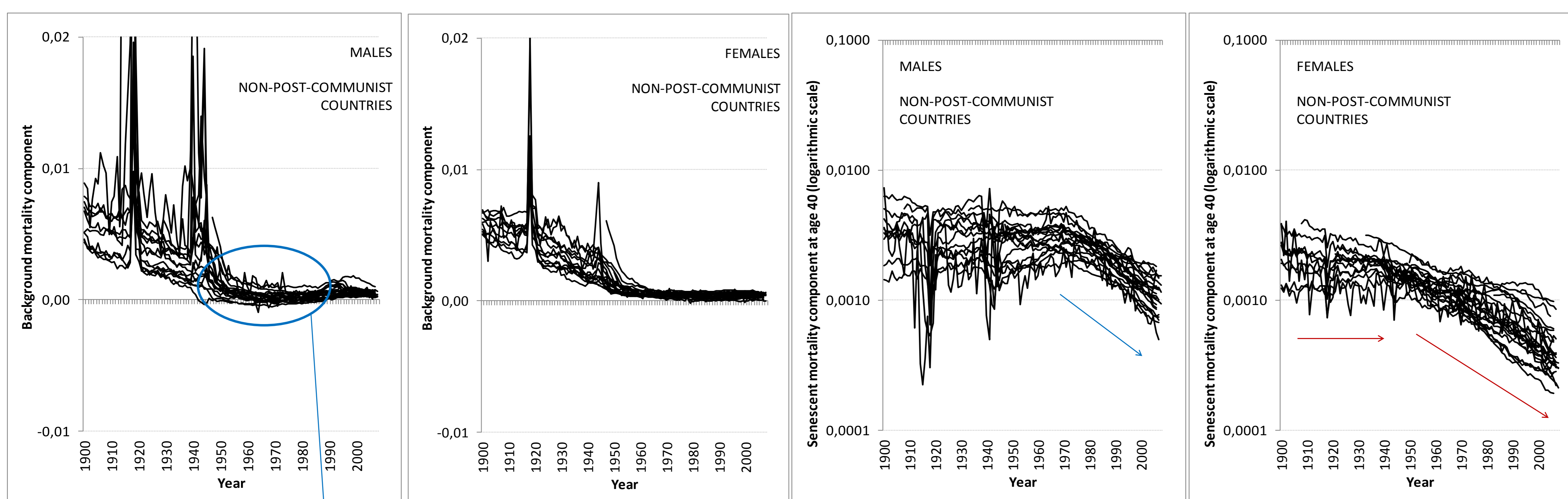
**Main authors of the concept:** Bongaarts 2005, 2009; Gavrilova, Gavrilov, 2011; Gavrilov, Gavrilova, 1979; Gavrilov, Gavrilova, 1991

## 2 main goals of this poster

- 1) To find out whether there are some differences between the results for the non-post-communist and post-communist countries, and whether the considered approach to the decomposition of mortality to the senescent and background components reveals some more universal pattern in both defined groups of countries.
- 2) To apply the concept of the shifting hypothesis to the results. In this phase of the work the process isn't analyzed under the condition of a parallel shift of the whole hazard curve (as it is in the original papers).

## Exponential approach

### – what are the similarities and differences among countries?

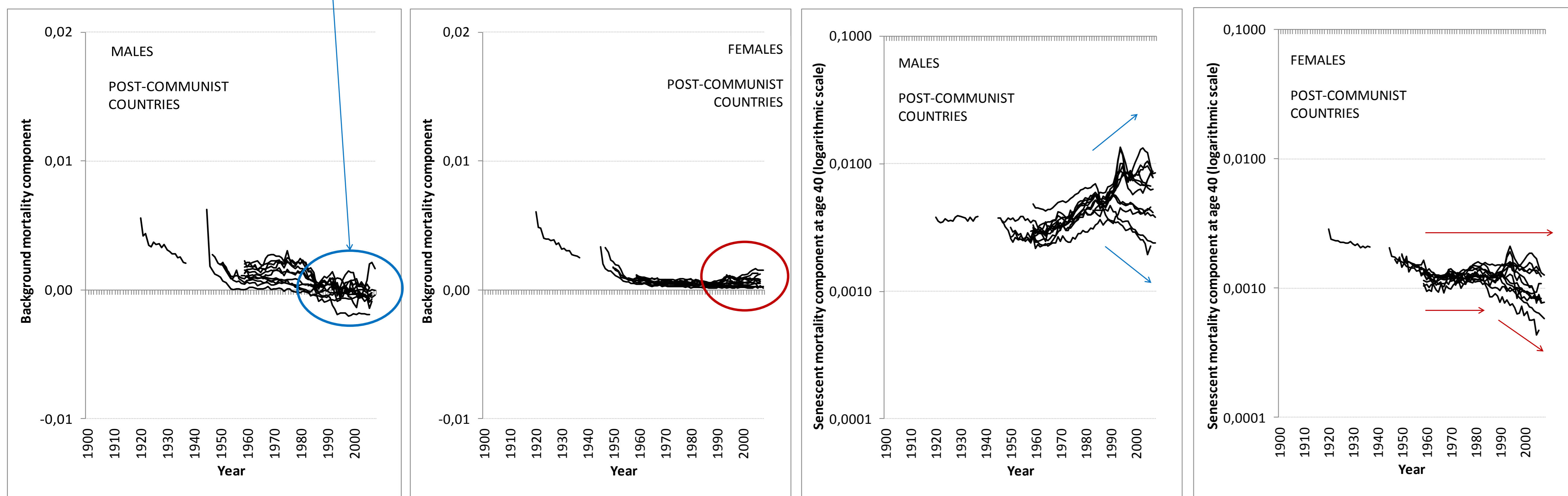


Similar trend...  
... but several decades later

The same trend...  
... worsening in post-Soviet countries

Opposite trend...  
... in Central Europe delayed decrease vs. increase in post-Soviet countries

Decreasing trend...  
... but in post-communist countries later (different development in post-Soviet ones)



## And results...

The decomposition of total mortality into a senescent and background mortality can reveal important similarities in the development (with particular delays in Central and East European countries). That could be useful in mortality forecasting.

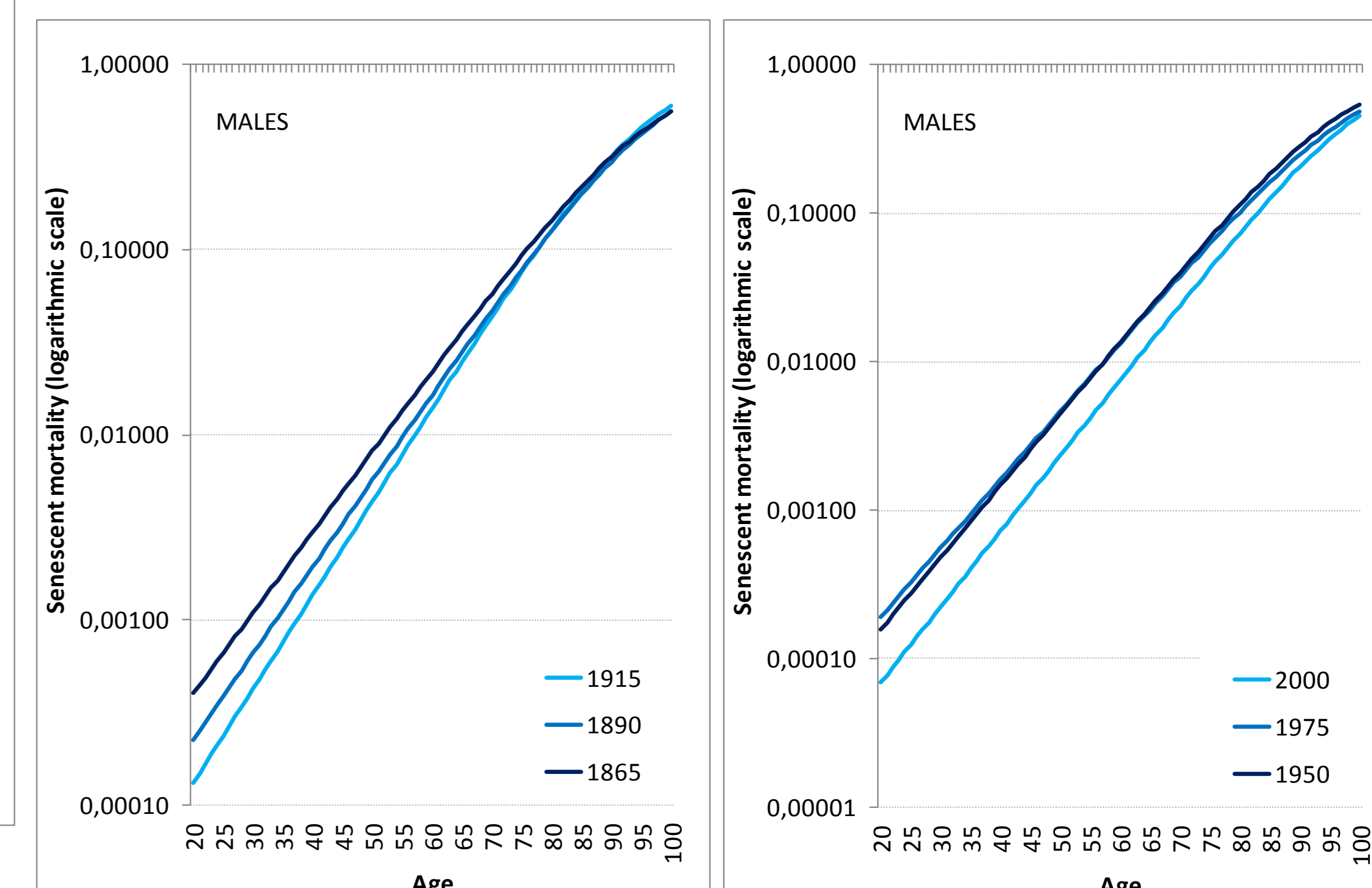
In the same time it could be seen that the differences between post-Soviet (e.g. Russia, Ukraine) and other post-communist countries (e.g. Czech Republic, Slovenia) are increasing in the latest decades.

The assumption of parallel mortality shifting of the senescent component holds only for some contemporary low-mortality countries. The parallel shift could be traced through constant „age-specific“ shifts for all ages (or when the parameter  $B_t$  is constant in time).

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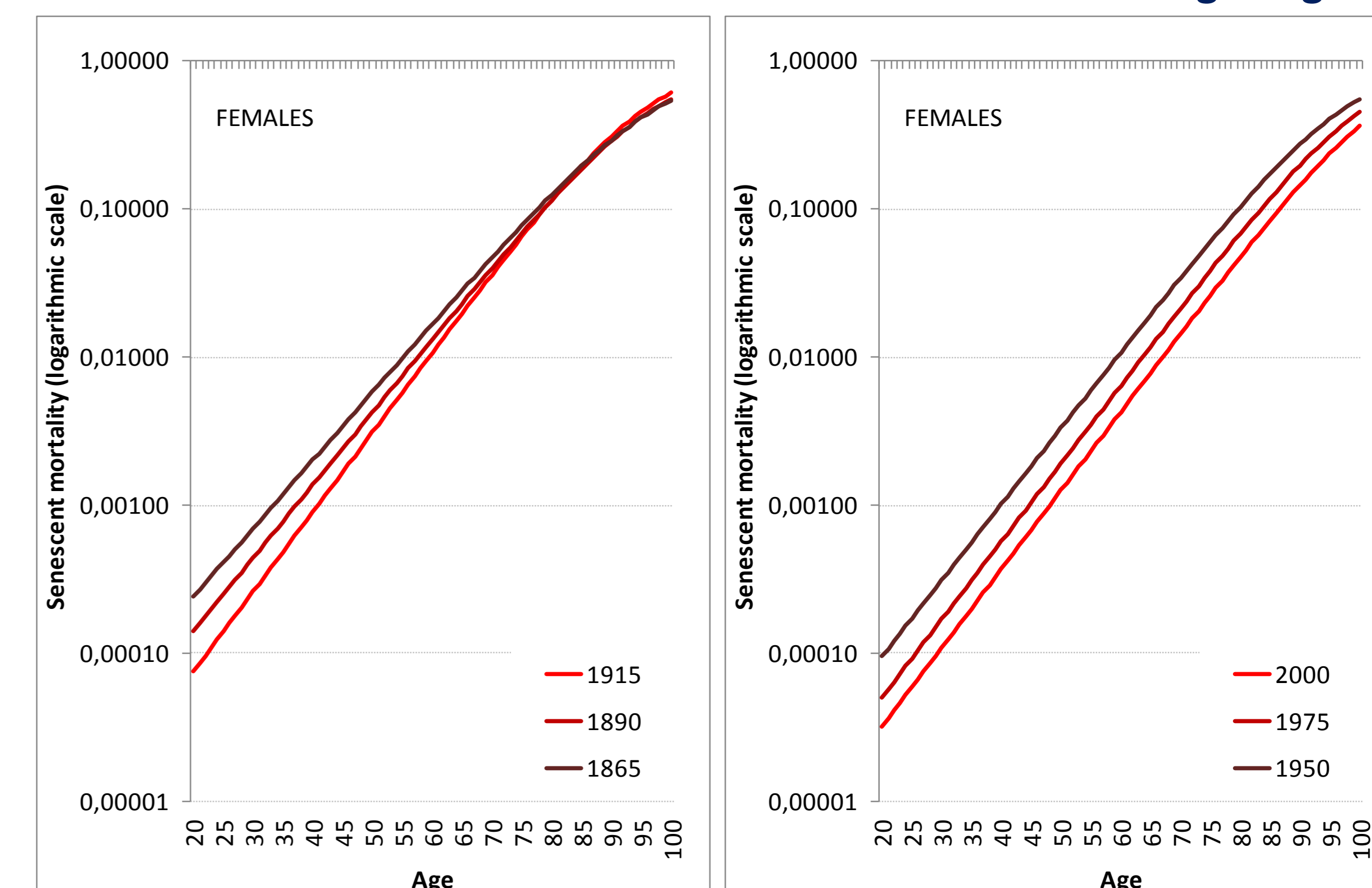
## Logistic approach (Example: SWEDEN)

### – is there a parallel shift?



Parallel shift could be traced only for females and only for the latest decades

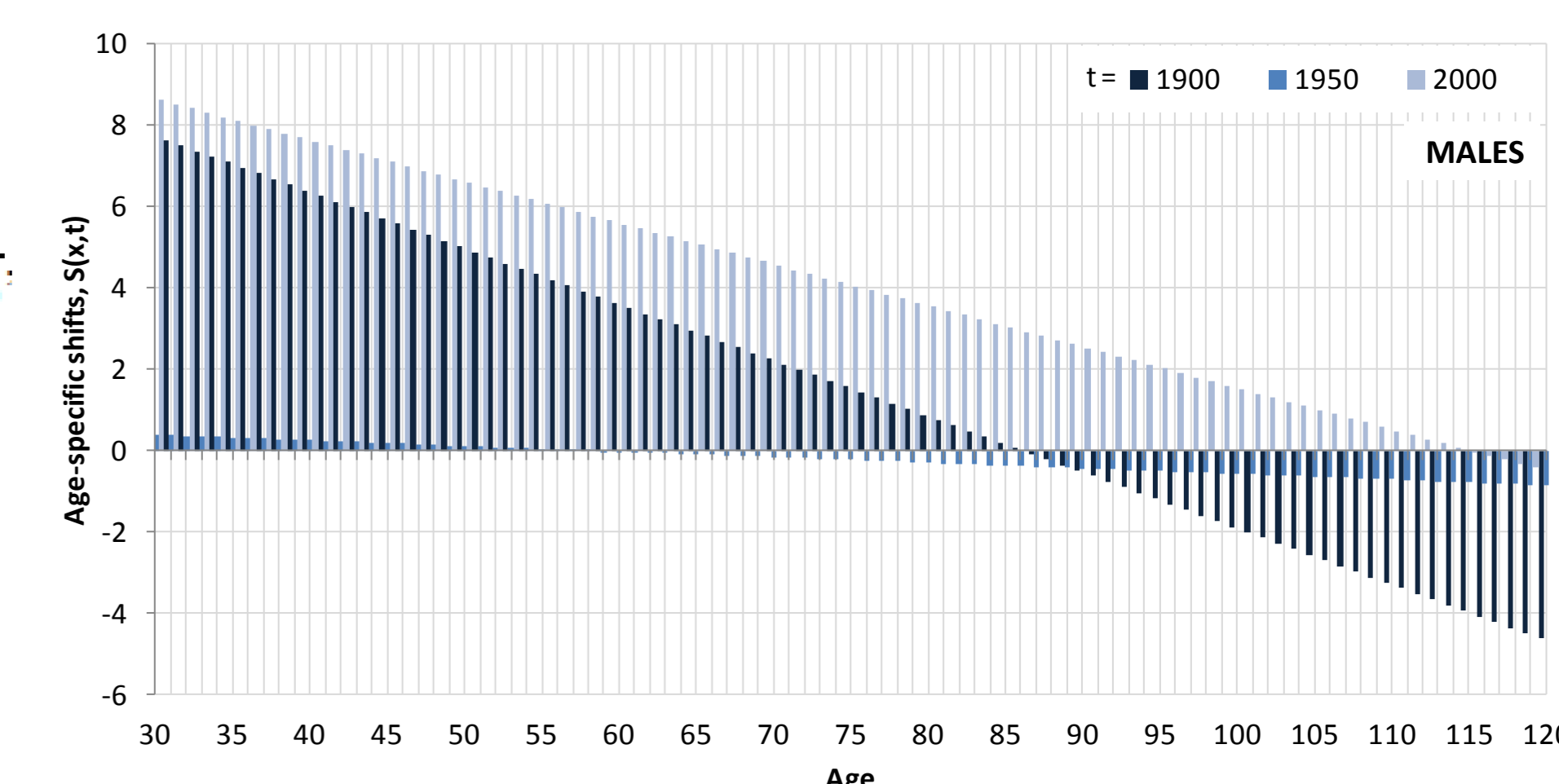
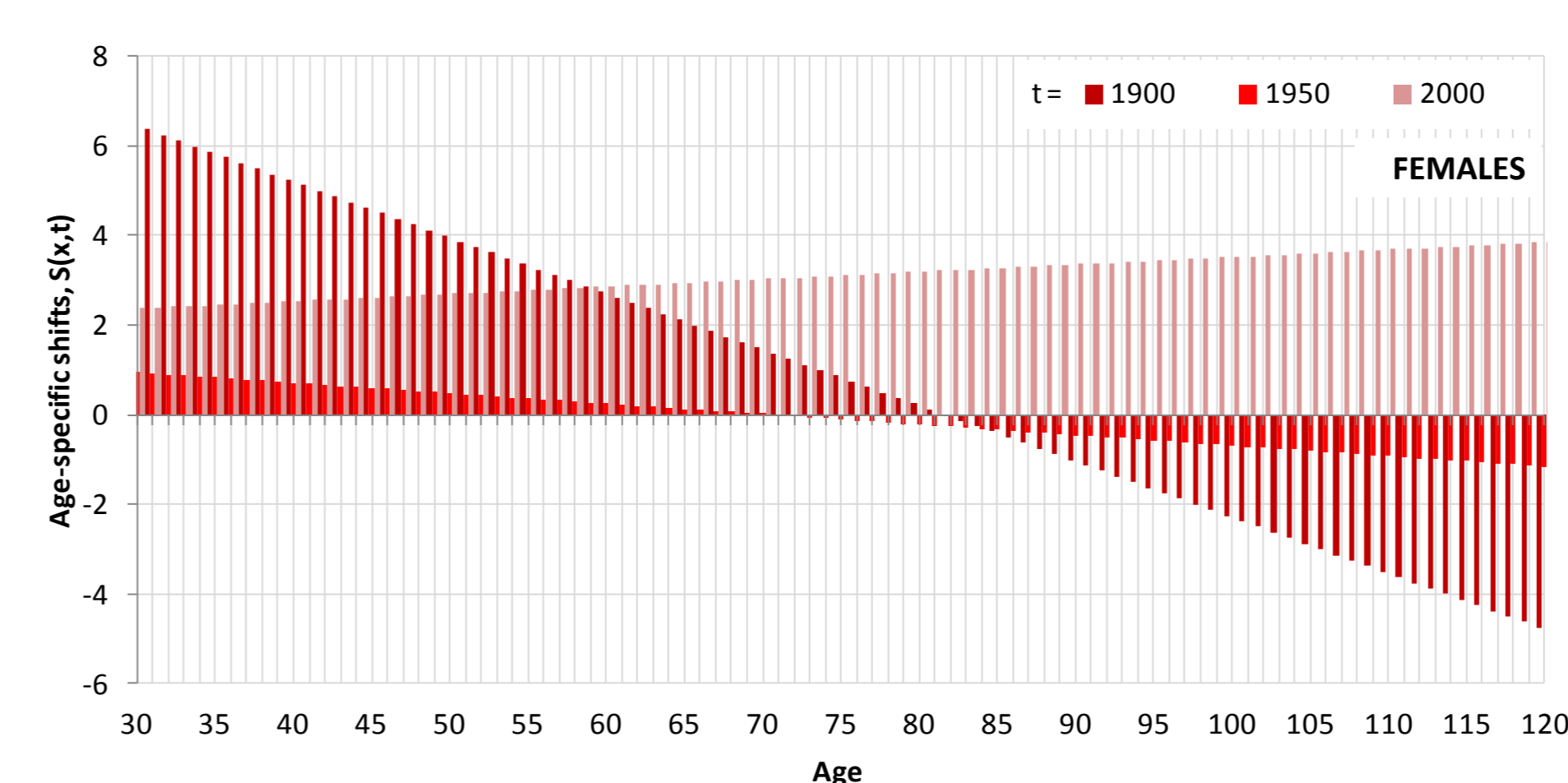
For males and for more historical the shift differs according to age



## „Age-specific shifts“

$$\mu_{x,t}^S = \frac{A_t \cdot \exp(B_t \cdot x)}{1 + A_t \cdot \exp(B_t \cdot x)} \quad \mu_{x-S(x,t),t0}^S = \frac{A_{t0} \cdot \exp(B_{t0} \cdot (x - S(x,t)))}{1 + A_{t0} \cdot \exp(B_{t0} \cdot (x - S(x,t)))}$$

$$S(x,t) = \frac{x(B_{t0} - B_t) - \ln\left(\frac{A_t}{A_{t0}}\right)}{B_{t0}} = x \cdot \frac{(B_{t0} - B_t)}{B_{t0}} - \frac{\ln\left(\frac{A_t}{A_{t0}}\right)}{B_{t0}}$$



**MOST IMPORTANT SOURCES:**  
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GAVRILOV, L. A., GAVRILOVA, N. S. 1979: *Historical perspective on kinetics of human mortality*. Proc. Acad. Sci. USSR [Doklady Akademii Nauk SSSR], 245(4): 1017-1020. English translation by Plenum Publ Corp. pp. 776-778.  
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GAVRILOVA N. S., GAVRILOV L. A. 2011: Aging and Longevity: Mortality laws and mortality forecasts for aging populations / Stárnutí a dlouhověkost: Zákonů a prognózy úmrtnosti pro stárnoucí populace. *Demografie*, Vol. 53, No. 2. 2011. ISSN 0011-8265.