NATURAM PRIMUM COGNOSCERE RERUM

Australian
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Workshop on Decomposition Methods

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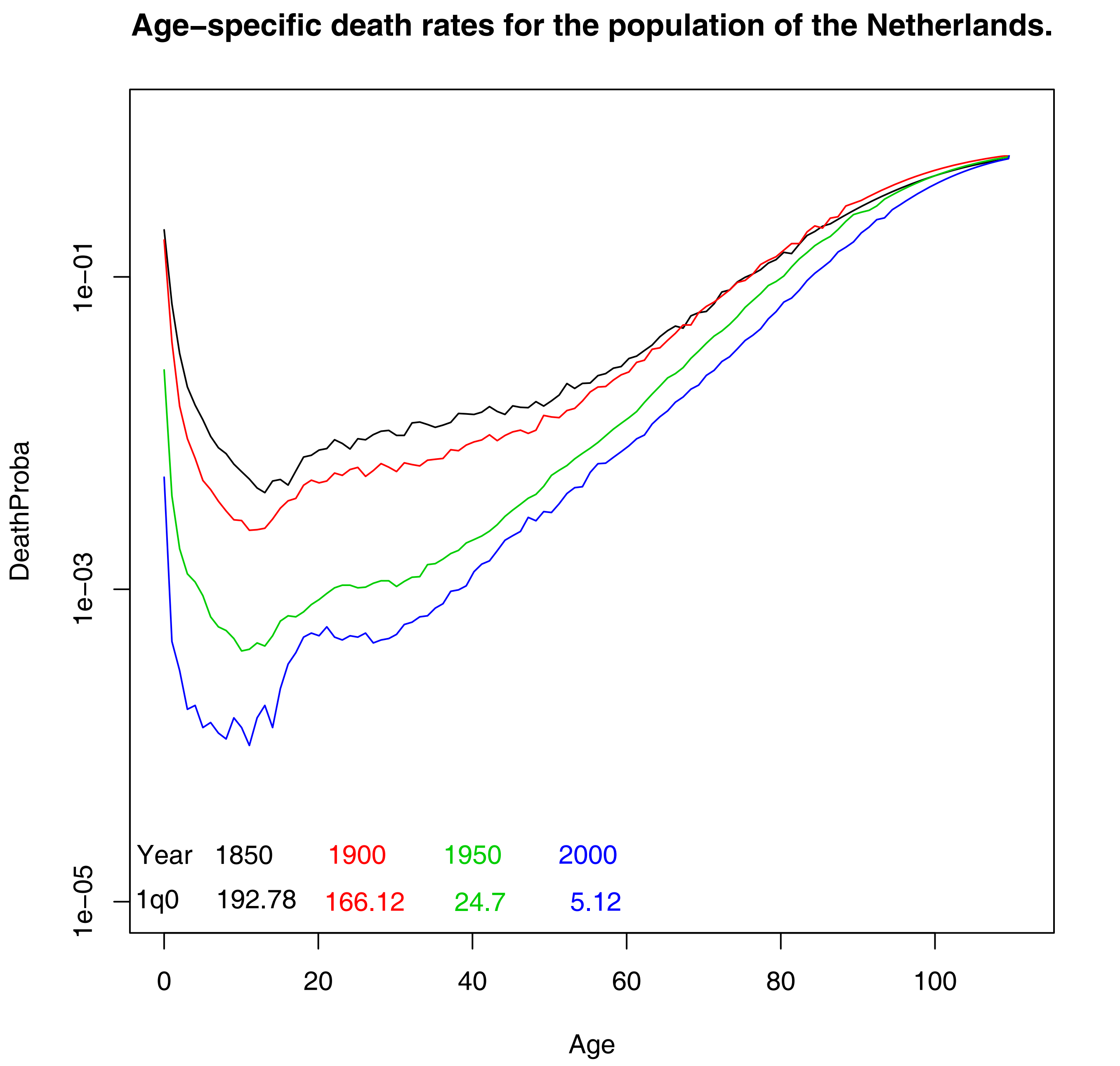
Decomposing Mortality Measures

Life Tables

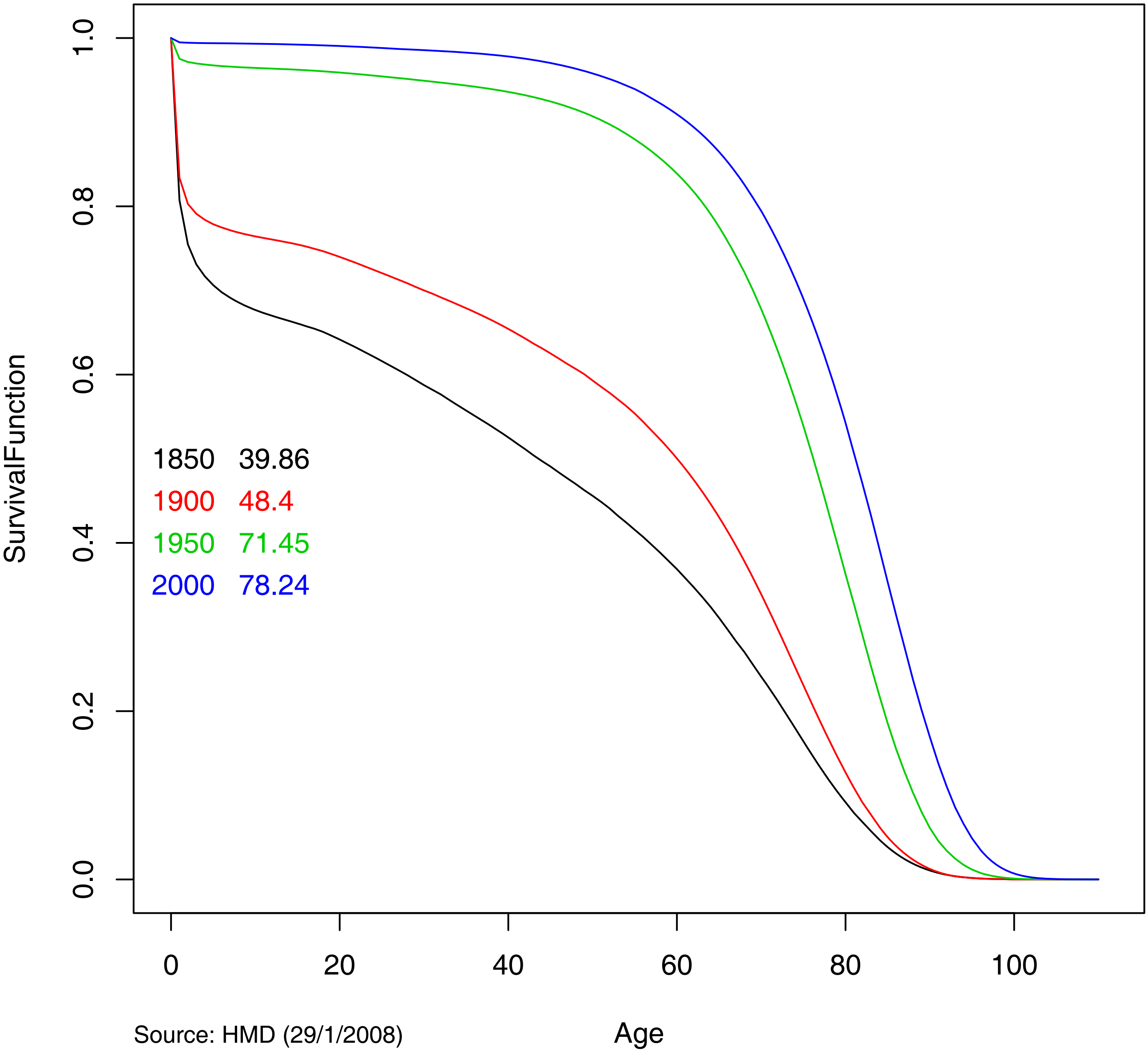
$q(a)$ Probability of Death

$\ell(a)$ Survival Function

$f(a)$ Function of the Distribution of Deaths


Age−specific death rates for the population of the Netherlands.
DeathProba
1e−01
1e−03
1e−05
Age
0
20
40
60
80
100
Year 1850 1900 1950 2000
1q0 192.78 166.12 24.7 5.12

Survival function for the population of the Netherlands.

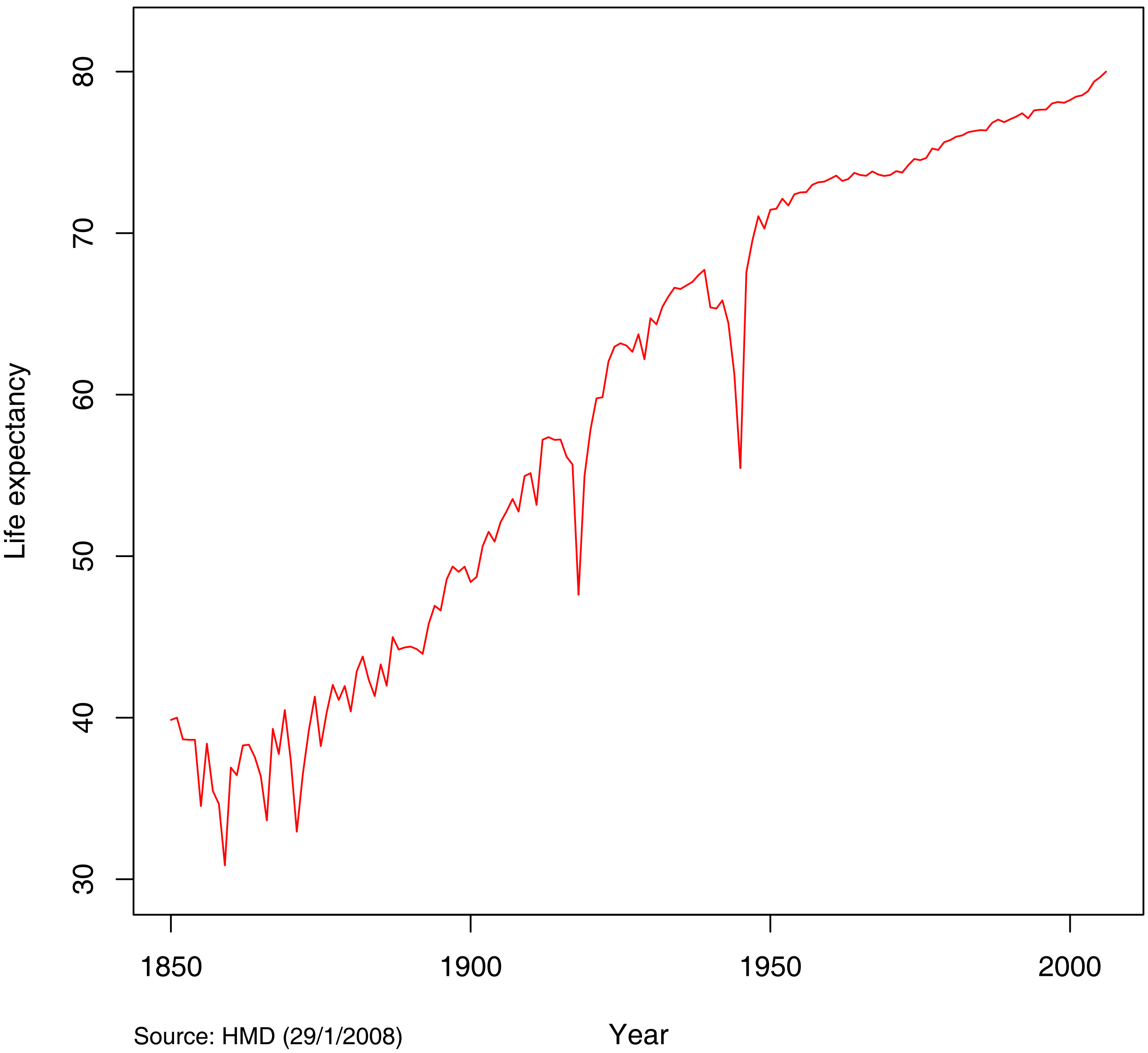


Source: HMD (29/1/2008)

Life expectancy

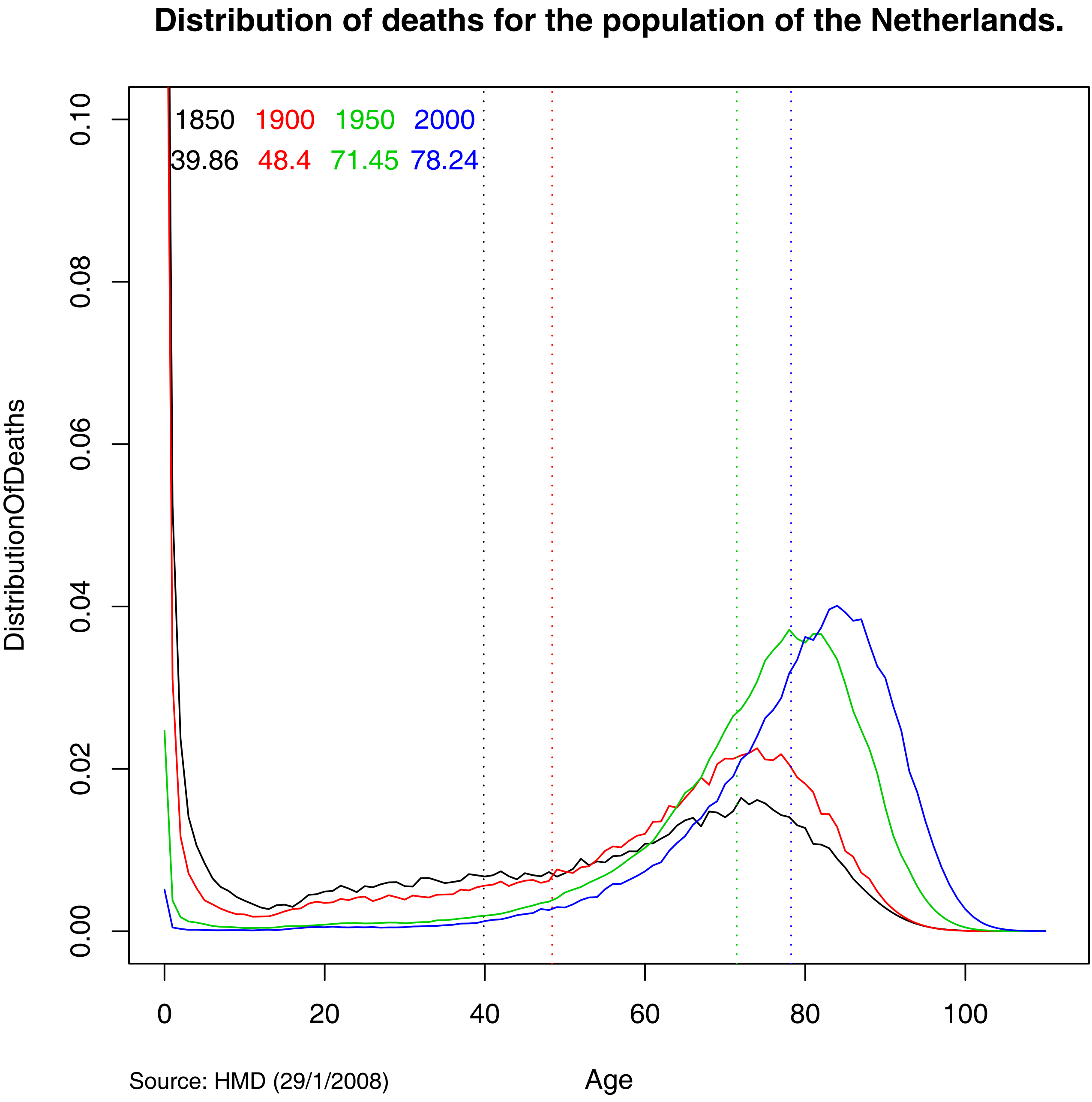
$$e_0(t) = \int_0^{\omega} \ell(x,t)dx$$

Period life expectancy for the population of the Netherlands.



Life Tables

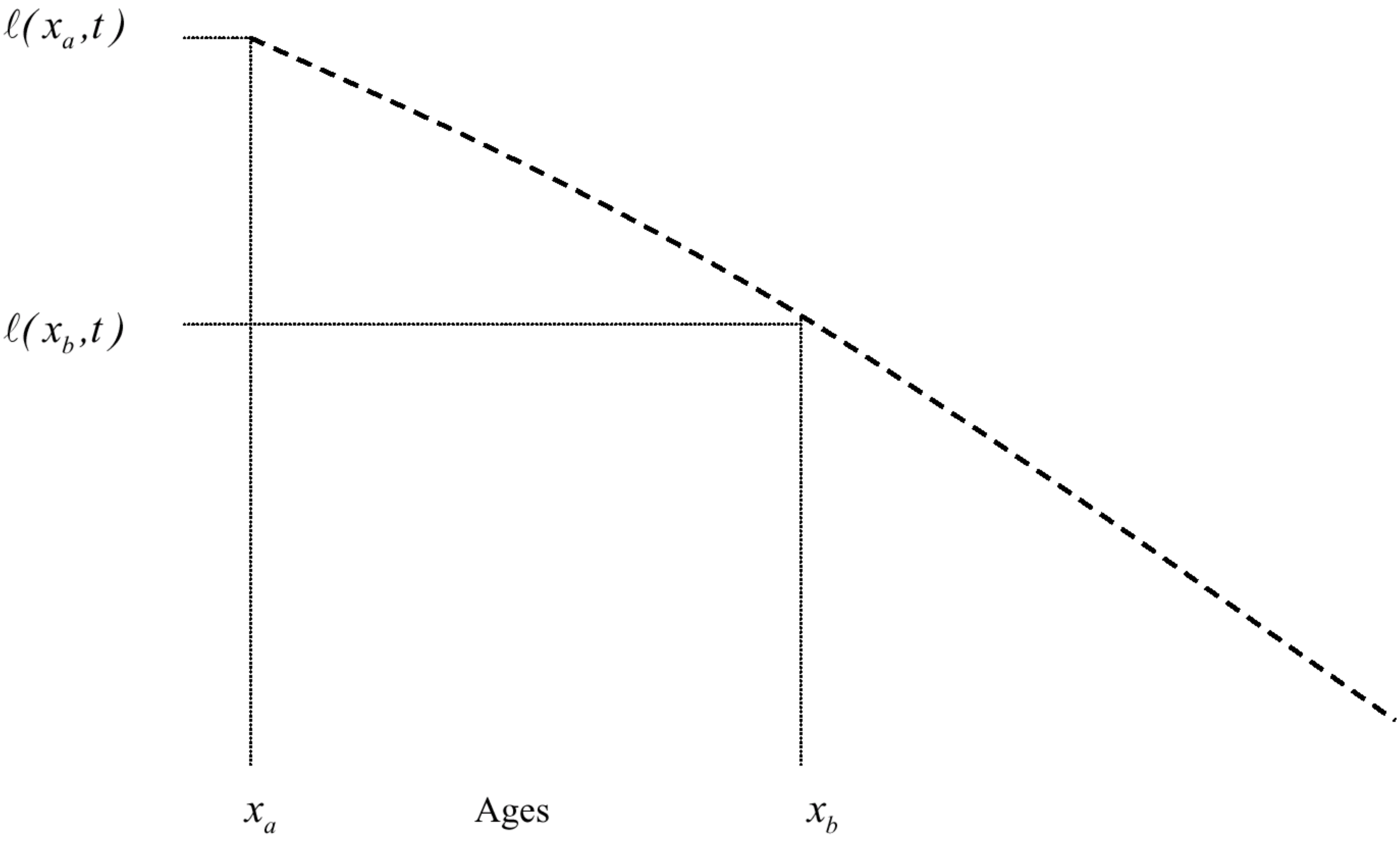
$$f(a) = \ell(a)q(a)$$


Distribution of deaths for the population of the Netherlands.
1850 1900 1950 2000
39.86 48.4 71.45 78.24
0.00
0.02
0.04
0.06
0.08
0.10
DistributionOfDeaths
0
20
40
60
80
100
Age
Source: HMD (29/1/2008)

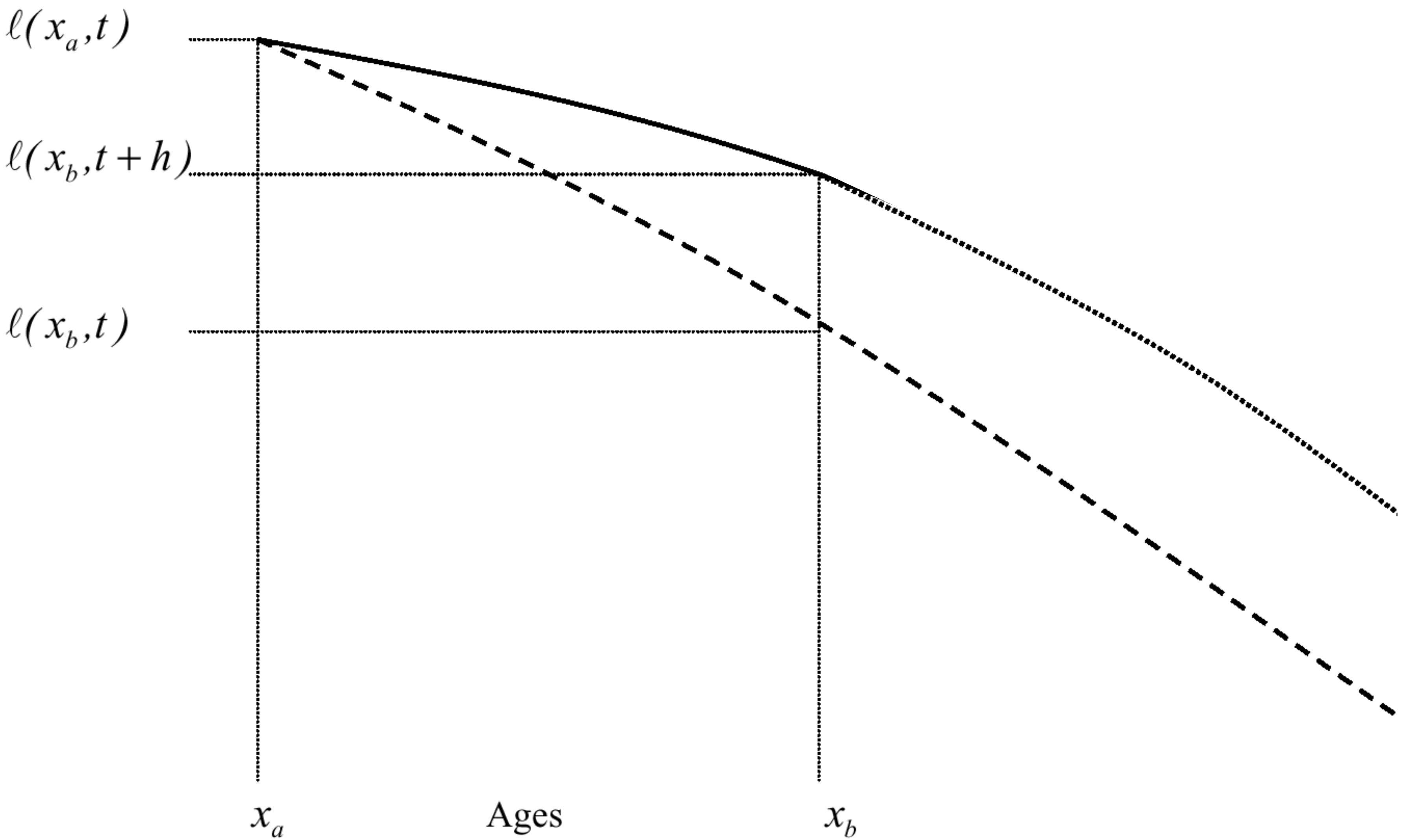
Life expectancy decomposition

$$\Delta e_0 = DE + IE$$

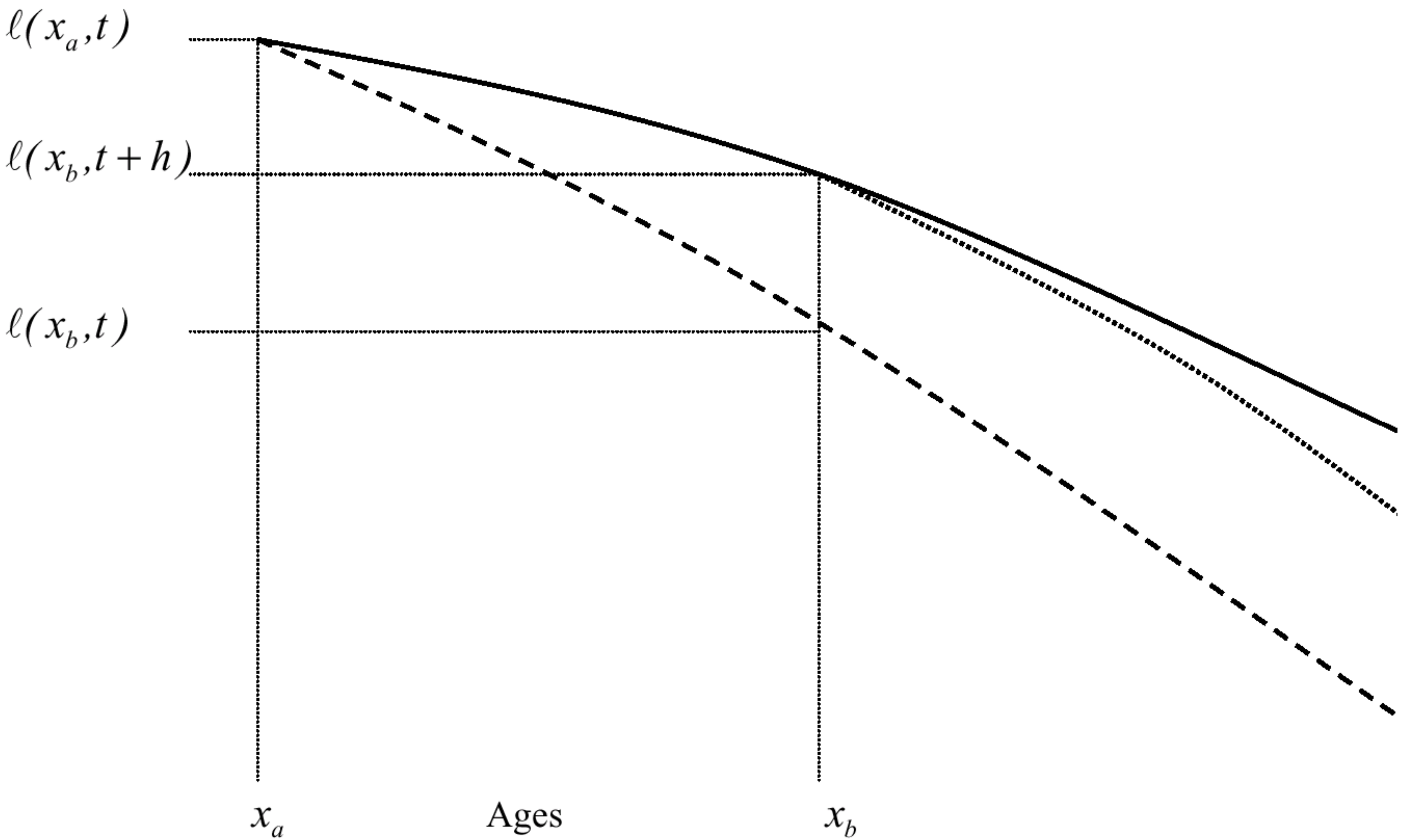
Life expectancy decomposition



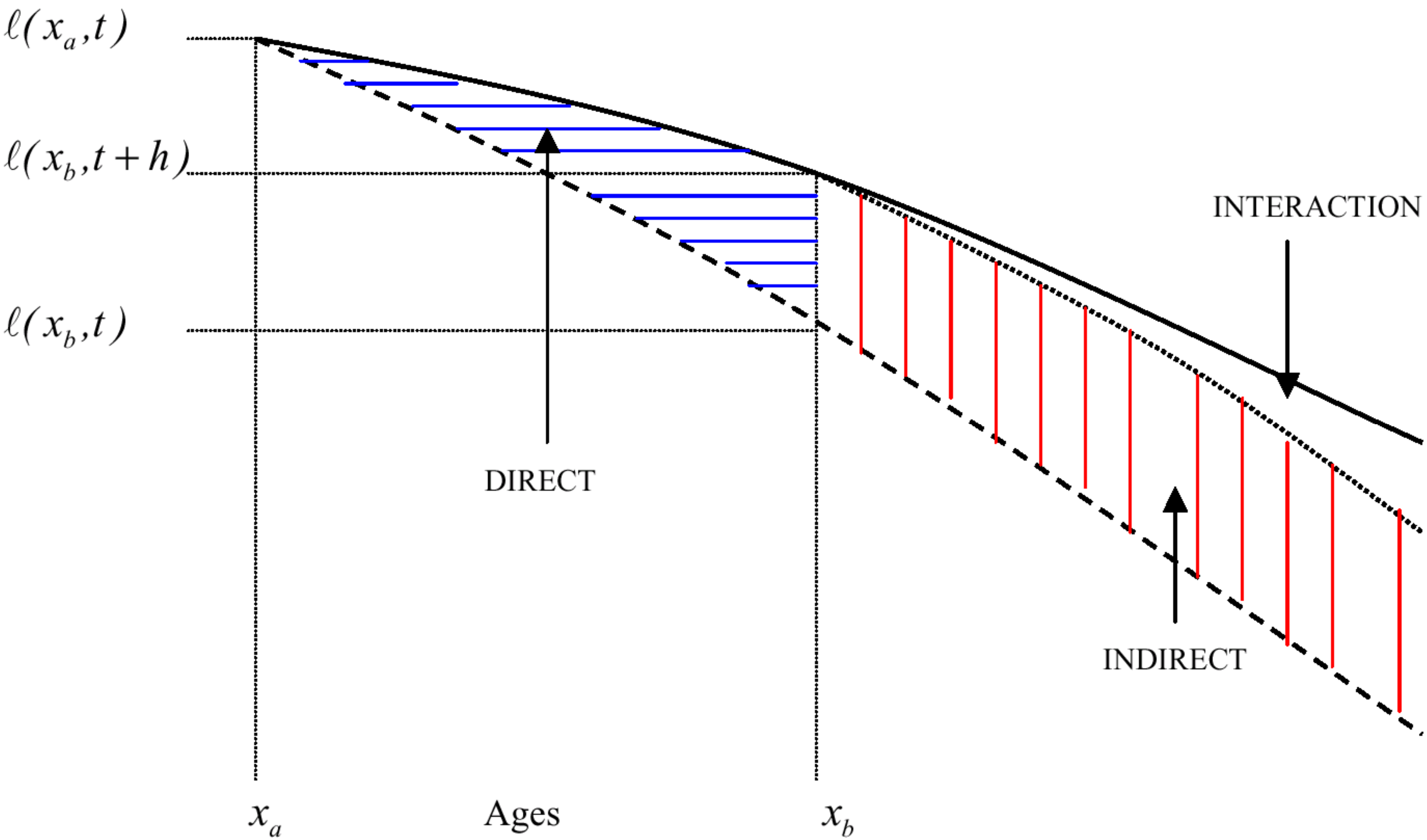
Life expectancy decomposition



Life expectancy decomposition



Life expectancy decomposition



Direct effect

$$DE = \sum_{0}^{\omega-1} l_x^1 \left[\frac{L_x^2}{l_x^2} - \frac{L_x^1}{l_x^1} \right]$$

Indirect effect

$$IE = \sum_{0}^{\omega-1} T_{x+1}^{2} \left[\frac{l_x^1}{l_x^2} - \frac{l_{x+1}^1}{l_{x+1}^2} \right]$$

Life expectancy decomposition

Table 1: Female life expectancy gap, Korea - USA, 2019

	Arriaga
Life expectancy at birth for Korea	86.3
Life expectancy at birth for USA	81.5
Life expectancy difference betwen Korea and USA	
Estimated difference from decompositon	

Life expectancy decomposition

Table 2: Female life expectancy gap, Korea - USA, and its components 2019

	Arriaga
Life expectancy at birth for Korea	86.3
Life expectancy at birth for USA	81.5
Life expectancy difference betwen Korea and USA	4.9
Direct component	
Indirect and interaction component	
Estimated difference from decompositon	

Age- & Cause-decomposition

$$e_0 = \sum_x \sum_c \Delta_x^c * \Delta_x$$

Age- & Cause-decomposition

$$\Delta_x^c = \frac{R_x^c(2)m_x(2) - R_x^c(1)m_x(1)}{m_x(2) - m_x(1)}$$

Data Description

Human Causes of Death database (HCoD)

1. Neoplasms
2. Cardiovascular Diseases
3. External causes
4. Other causes

USA Causes-decomposition

Table 3: Arriaga Decomposition by age and cause

	USA
Life expectancy at birth for USA, 2010	81.06
Life expectancy at birth for USA, 2018	81.35
Life expectancy difference betwen 2010 and 2018	0.28
Cardiovascular disease	
Neoplasms	
External causes	
Other causes	
Estimated total difference from decompositon	

BREAK

RESEARCH ARTICLE | MAY 01 2003

Decomposing change in life expectancy: A bouquet of formulas in honor of Nathan Keyfitz's 90th birthday FREE

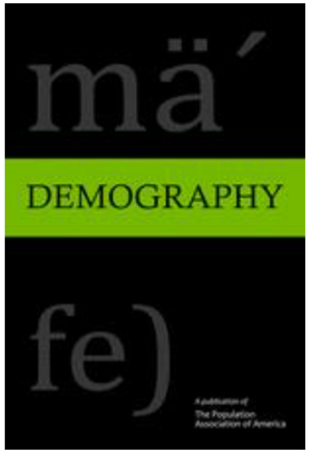
James W. Vaupel; Vladimir Canudas Romo

Demography (2003) 40 (2): 201–216.

https://doi.org/10.1353/dem.2003.0018

Volume 40, Issue 2

May 1, 2003



Abstract

We extend Nathan Keyfitz's research on continuous change in life expectancy over time by presenting and proving a new formula for decomposing such change. The formula separates change in life expectancy over time into two terms. The first term captures the general

Article Contents

Vaupel & Canudas-Romo Decomposition of Life Expectancy

$$\rho(x) = -\frac{\dot{m}_x}{m_x}$$

VCR decomposition

$$e^{\dagger}(t) = \int_0^{\omega} e(x,t) f(x,t) dx$$

VCR decomposition

$$\dot{e}_0(t) =$$

$$\bar{\rho}(t)e^{\dagger}(t) + Cov_f(\rho, e)$$

Decomposing change in life expectancy

Table 1: Life expectancy at birth, $e^o(0,t)$, and the decomposition of the annual change around the first of January of 1903, 1953 and 1998, in Sweden.

t	1903	1953	1998
$e^o(0, t-2.5)$	52.239	71.130	78.784
$e^o(0, t+2.5)$	54.527	72.586	79.740
$\dot{e}^o(0,t)$	0.458	0.291	0.191

Source: Vaupel & Canudas-Romo 2003

Population Studies ›
A Journal of Demography
Volume 69, 2015 - Issue 2

Original Articles

Truncated cross-sectional average length of life: A measure for comparing the mortality history of cohorts

Vladimir Canudas-Romo & Michel Guillot

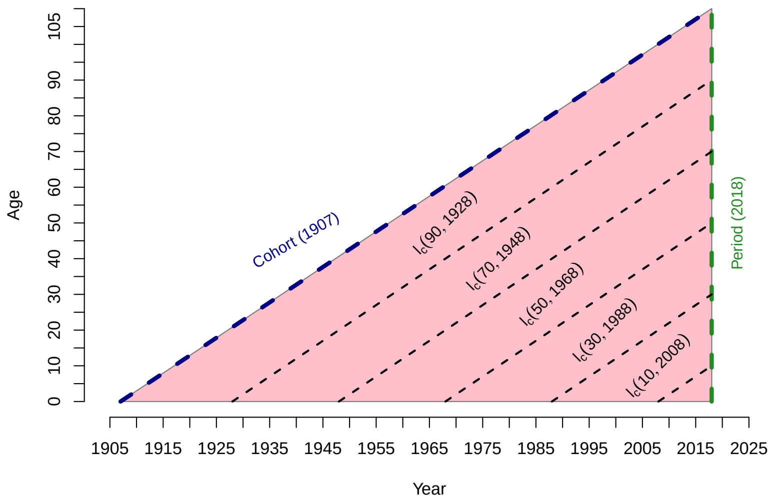
Pages 147-159 | Received 01 Oct 2013, Accepted 01 Oct 2014, Published online: 14 Apr 2015

Download citation https://doi.org/10.1080/00324728.2015.1019955 Check for updates

Abstract

Period life expectancies are commonly used to compare populations, but these correspond to simple juxtapositions of current mortality levels. In order to construct life expectancies for cohorts, a complete historical series of mortality rates is needed, and these are available for only a subset of developed countries. The truncated cross-sectional average length of life (TCAL) is a new measure that captures historical

Cross-sectional Average Length of Life (CAL)



CAL

$$CAL(t) = \int_0^{\omega} \ell_c(x,t)\,dx$$

Decomposition of CAL

$$\ell_c(x, t, i) =$$

$$p_0(t - x, i) \ldots p_{x-1}(t - x, i)$$

Decomposition of CAL

$$\dot{C}AL(t,\xi) =$$

$$\int_0^{\omega} \ell_c^*(x,t,\xi) \left[\sum_{a=0}^{x} \frac{\dot{p}_a(t-x,\xi)}{p_a(t-x,\xi)} \right] dx$$

CAL decomposition

Table 5: CAL decomposition between France & Italy

CAL- France	CAL- Italy	Diff	est-Diff
43.33	61.77	-18.44	-18.83

Assignment 3

Select one of the measures in the examples of this section and apply to a different population from HMD or HFD.

Submit ONE page: one Figure (or Table) and a brief paragraph describing the results that you find.