



PHI Applied Research Fellows 2021 Intro to Demography

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What is Demography?

What is Demography?

$$P_{t+1} = P_t + B_t - D_t + IM_t - OM_t$$

- ▶ Fertility, mortality, migration, population size
- ▶ The balancing equation
- ▶ How these processes work together in a population
- ▶ Break it all down by age and sex and ...

Why is Demography?

Why is Demography?

- ▶ Understand a population's make up today
- ▶ Targeted intervention
- ▶ Projections allow planning for future population
- ▶ Historical demography
- ▶ Social demography

The main textbooks

- ▶ Demography: Measuring and Modeling Population Processes
 - ▶ Samuel Preston, Patrick Heuveline, Michell Guillot
 - ▶ Essential Demographic Methods
- ▶ Kenneth Wachter
 - ▶ Tools for Demographic Estimation
- ▶ IUSSP (many prominent world demographers)

The Demographic Transition Theory

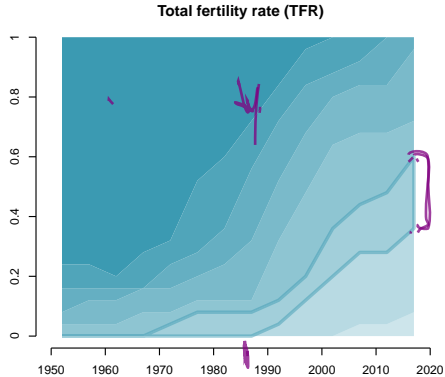
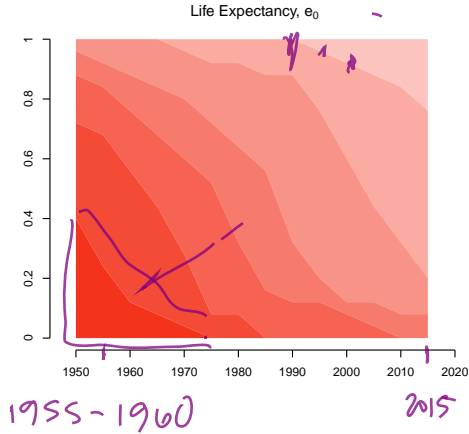
Deppen and Vanyet

- ▶ Mortality begins to decrease →
- ▶ Fertility begins to decrease →
- ▶ In countries that have already experienced the transition to below “replacement level” ≈ 2.1 children per parents → rise to and fluctuation around this point
- ▶ behind model in WPP (Alkema et al., 2011)
- ▶ Is this true in places where TFR remains high? Is all “high” fertility a result of unmet family planning needs?
- ▶ This really succinct amazing graphic on Wikipedia



N Africa & West Asia: 1950-1955 to 2015-2020

WPP (2019)



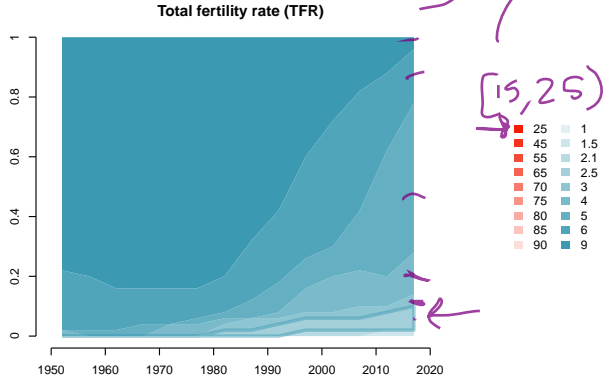
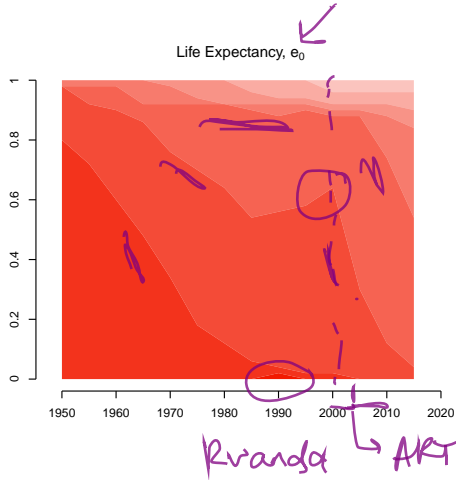
(15, 25) [75, 85]

→

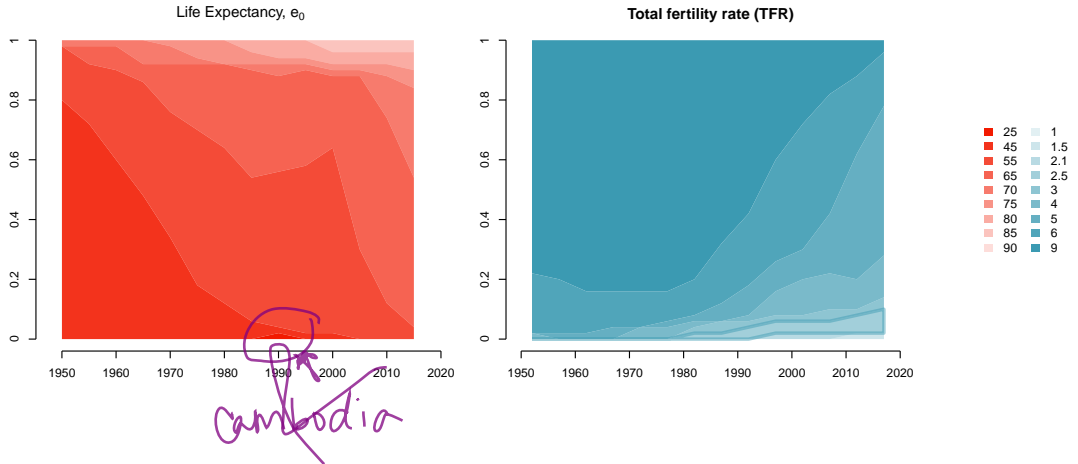
25	1
45	1.5
55	2.1
65	2.5
70	3
75	4
80	5
85	6
90	9

[85, 90]

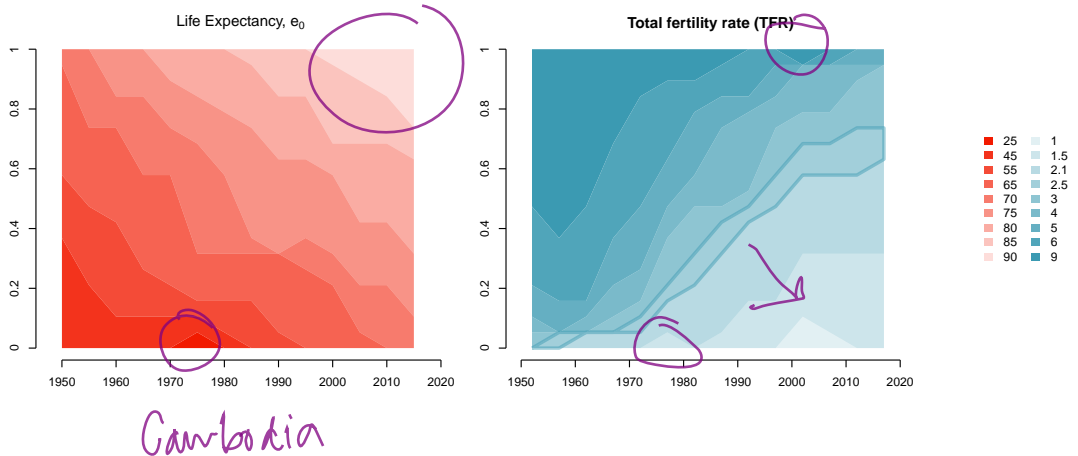
Sub-Saharan Africa: 1950-1955 to 2015-2020



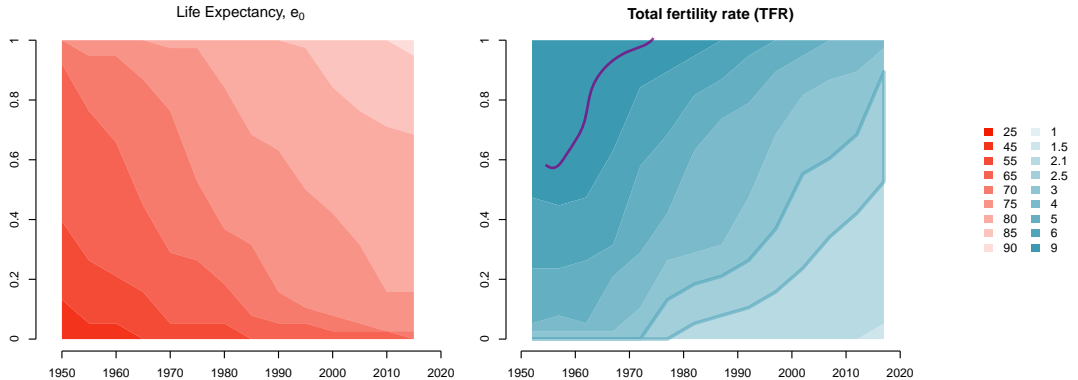
Central & South Asia: 1950-1955 to 2015-2020



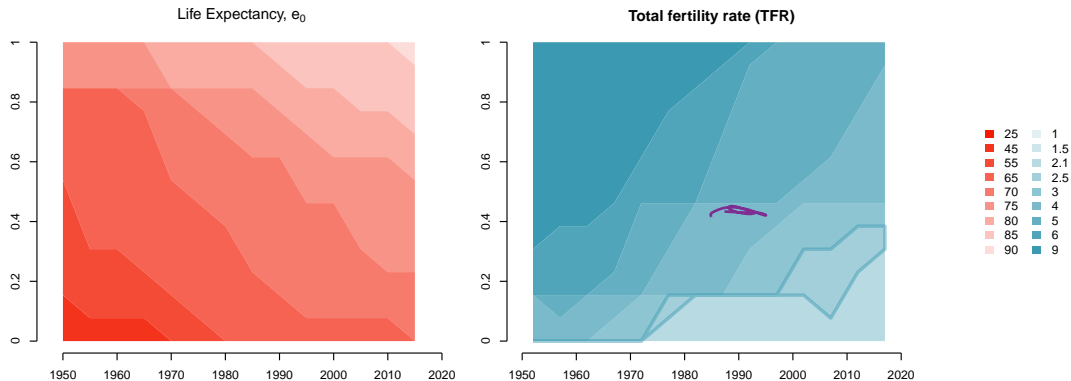
East & South-Eastern Asia: 1950-1955 to 2015-2020



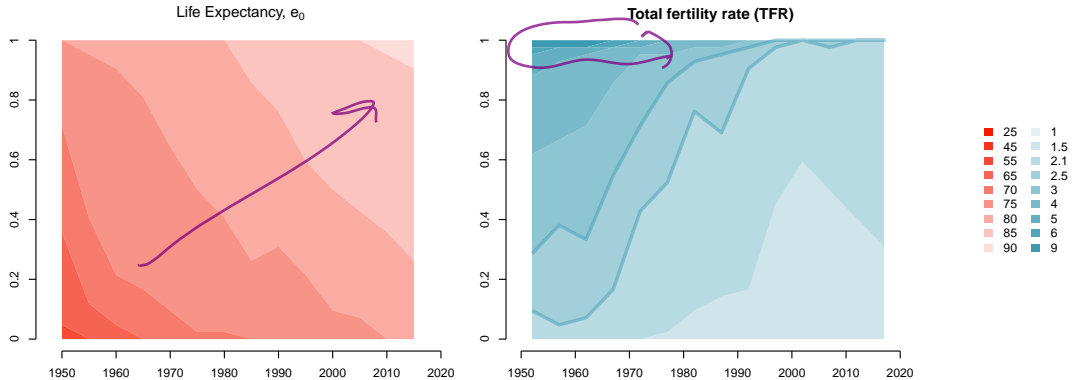
Latin America & the Caribbean: 1950-1955 to 2015-2020



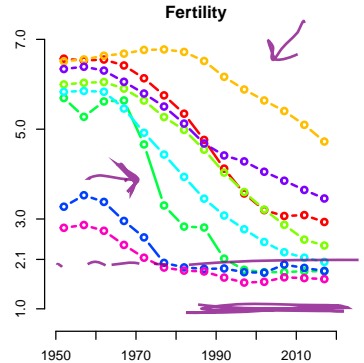
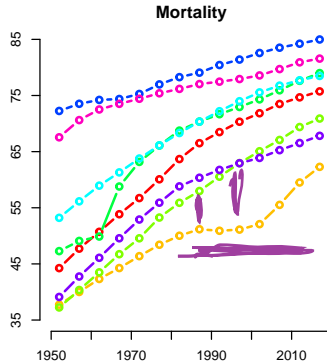
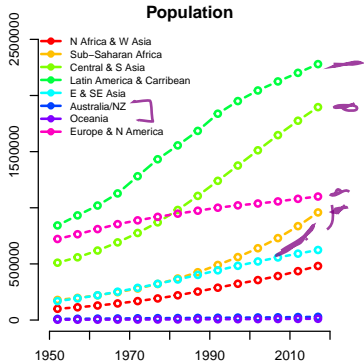
Australia, New Zealand, Oceania: 1950-1955 to 2015-2020



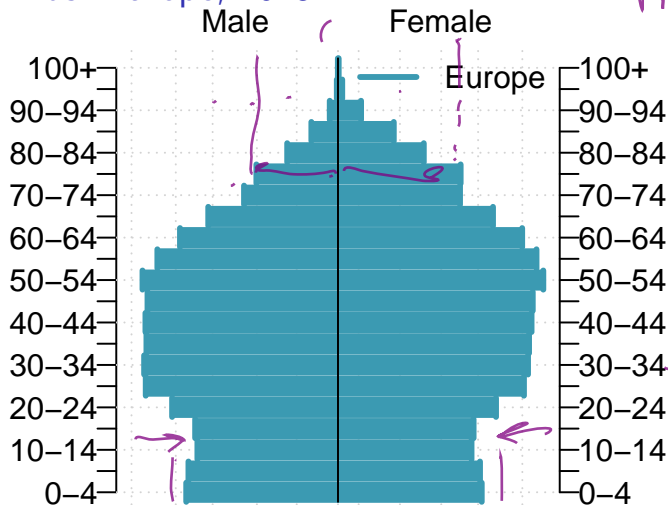
Europe & North America: 1950-1955 to 2015-2020



Population Growth by Continent



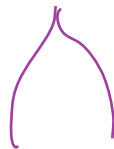
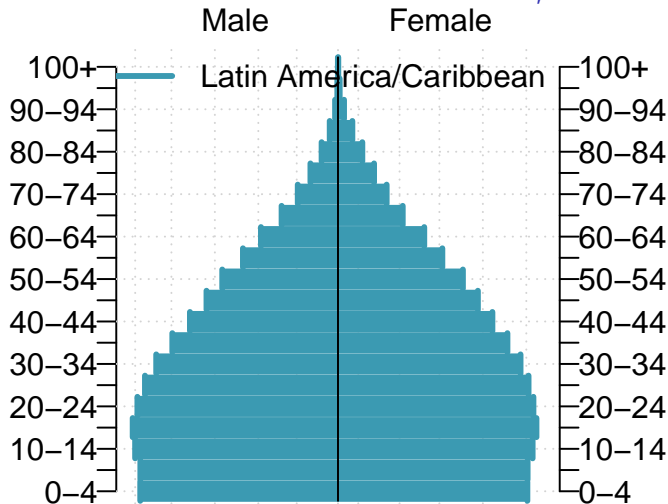
Population Pyramids: Europe, 2015



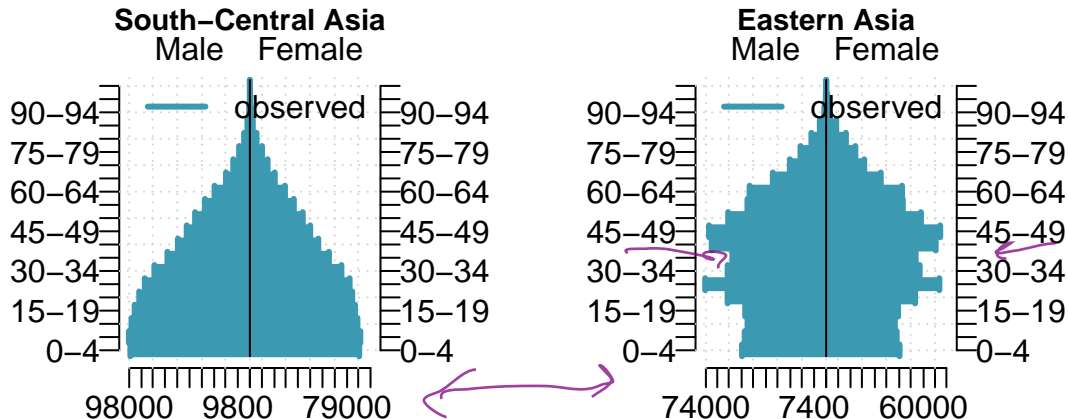
Preston
Kidney Li



Population Pyramids: Latin America & Caribbean, 2015

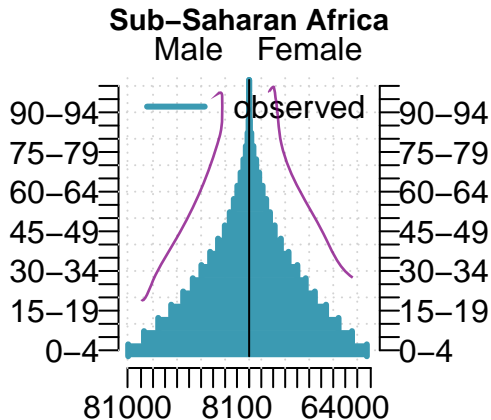
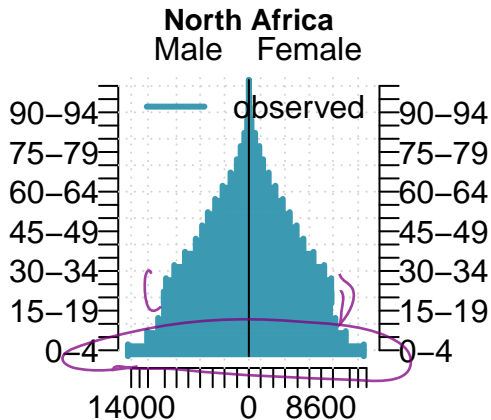


Population Pyramids: Asia, 2015



Population Pyramids: Africa, 2015

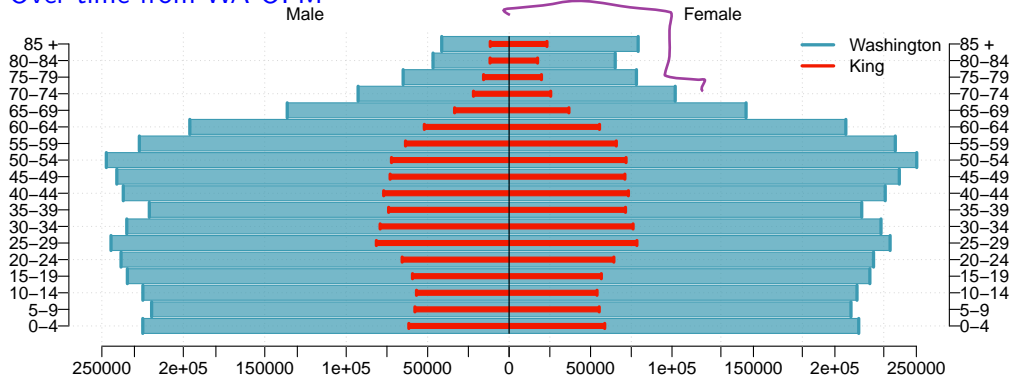
Gerland



Population Pyramids: WA, 2011

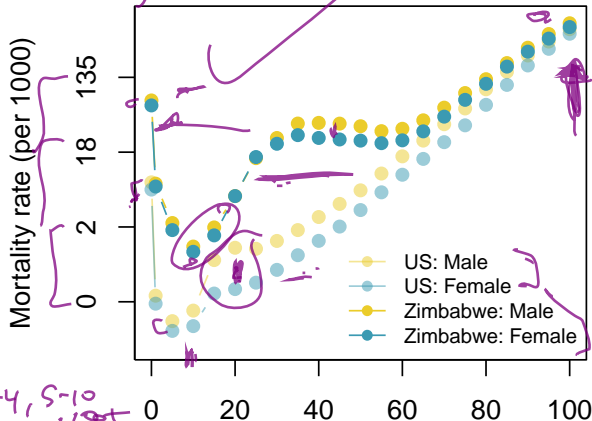


► Over time from WA OFM



Mortality: Age-specific Mortality

$\log(nm_x)$ 1995-2000



die Day 1
 $\frac{1}{365}$

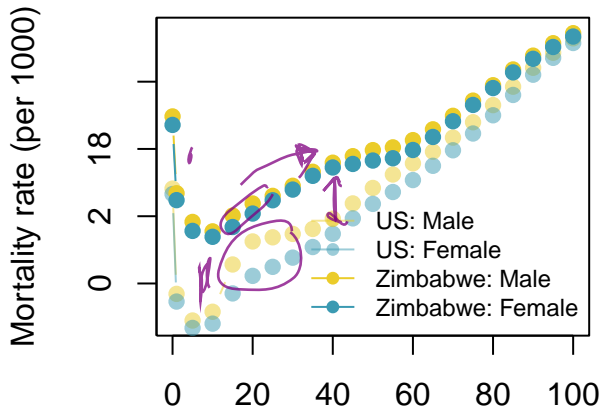
die Day 364
 $\left[\frac{364}{365} \right]$

01 1-4, 5-10
... , 100

$\frac{D}{R \cdot Y}$ $\left(\frac{NMR_{1960}}{1200} \right)$
 nmx rate
 $[x, x+n)$
 nmx prob $\left(\frac{IMR_{1960}}{100} \right)$
 $[x, x+n)$
 $\frac{D}{N}$ $\left(\frac{USMR_{90}}{5yr} \right)$
 $\left(\frac{CMR_{1964}}{100} \right)$

Mortality: Age-specific Mortality

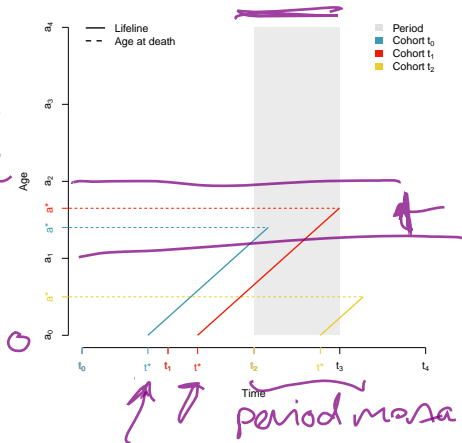
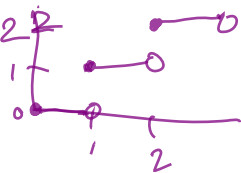
2015–2020



The Lexis Diagram: Age-Period-Cohort

birth cohort / year birth

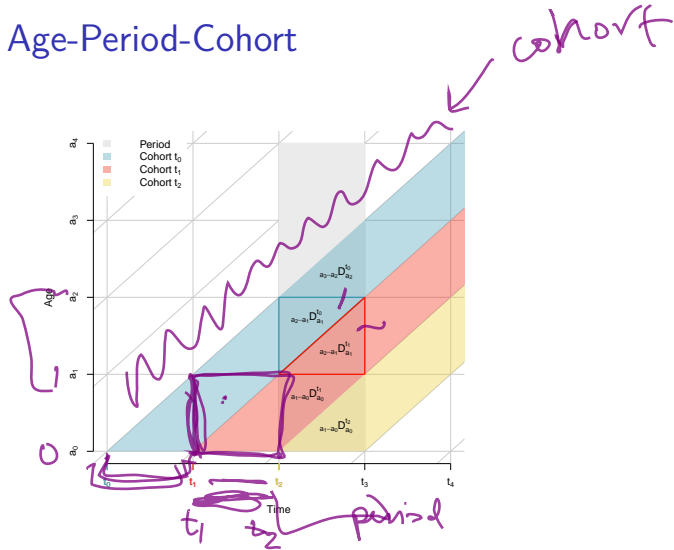
age
social construct
function of time



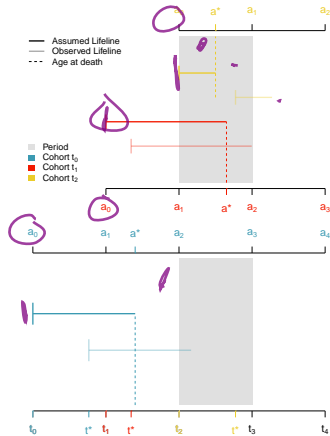
calendar /
periods
social
construct
&
discrete

period mortality

The Lexis Diagram: Age-Period-Cohort



The Life Table: Age-Period-Cohort



time = 1D

The Life Table: Age-Period-Cohort

radix l_0

x	l_x	${}_n d_x$	${}_n q_x$	${}_n L_x$	${}_n m_x$
a_0	l_0	$a_1 - a_0$	$\frac{a_1 - a_0 D_{a_0}^{t_2}}{B_{a_0}^{t_2}}$	$(a_1 - a_0) \times (B_{a_0}^{t_2} - \frac{1}{2} D_{a_0}^{t_2})$	$\frac{a_1 - a_0 d_{a_0}}{a_1 - a_0 L_{a_0}}$
a_1	$l_0 - {}_{a_1 - a_0} d_{a_0}$	$a_2 - a_1$	$\frac{a_2 - a_1 D_{a_1}^{t_1}}{B_{a_1}^{t_1}}$	$(a_2 - a_1) \times (B_{a_1}^{t_1} - \frac{1}{2} D_{a_1}^{t_1})$	$\frac{a_2 - a_1 d_{a_1}}{a_2 - a_1 L_{a_1}}$
a_2	$l_{a_1} - {}_{a_2 - a_1} d_{a_1}$	$a_3 - a_2$	$\frac{a_3 - a_2 D_{a_2}^{t_0}}{B_{a_2}^{t_0}}$	$(a_3 - a_2) \times (B_{a_2}^{t_0} - \frac{1}{2} D_{a_2}^{t_0})$	$\frac{a_3 - a_2 d_{a_2}}{a_3 - a_2 L_{a_2}}$
a_4	l_∞	l_∞	1		

"open-ended"

P-7