

Forecasting the age structure of the scientific workforce in Australia

Rob J Hyndman & Kelly Nguyen

30 June 2025



Labour force model

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

- $P_{x,t}$ = number of equivalent full-time workers
- $D_{x,t}$ = number of deaths
- $R_{x,t}$ = number of retirements.
- $N_{x,t}$ = number of graduates
- $G_{x,t}$ = net number of migrants

x = Age
 t = Year

Labour force model

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

x = Age
 t = Year

- $P_{x,t}$ = number of equivalent full-time workers
- $D_{x,t}$ = number of deaths
- $R_{x,t}$ = number of retirements.
- $N_{x,t}$ = number of graduates
- $G_{x,t}$ = net number of migrants

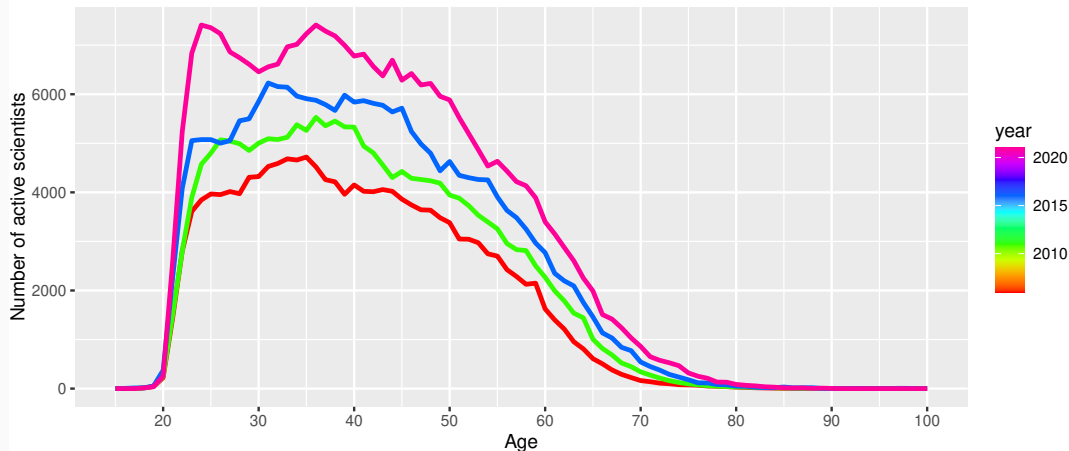
Assumptions:

- All processes are smooth functions of x .
- $N_{x,t} = G_{x,t} = 0$ for $x \geq 100$.

Working population: $P_{x,t}$

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

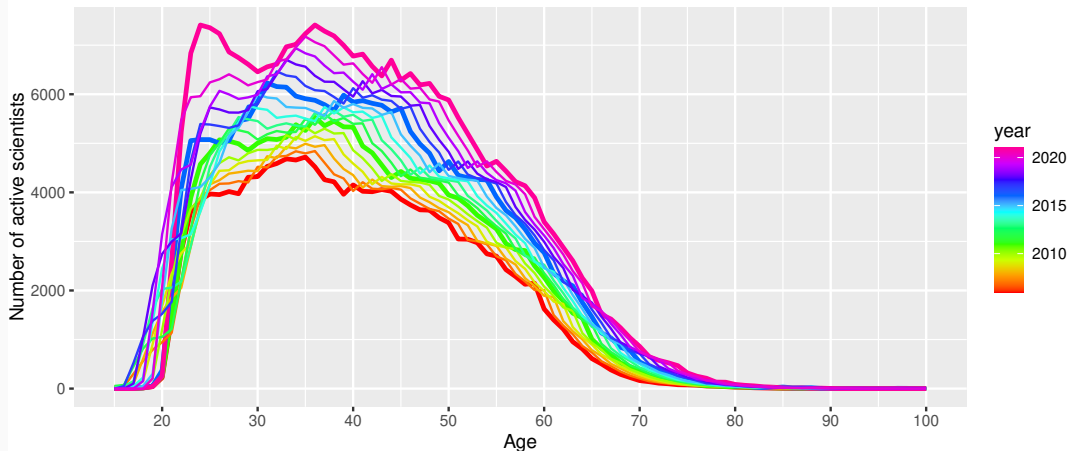
Working Population: Natural and Physical Sciences (2006 – 2021)



Working population: $P_{x,t}$

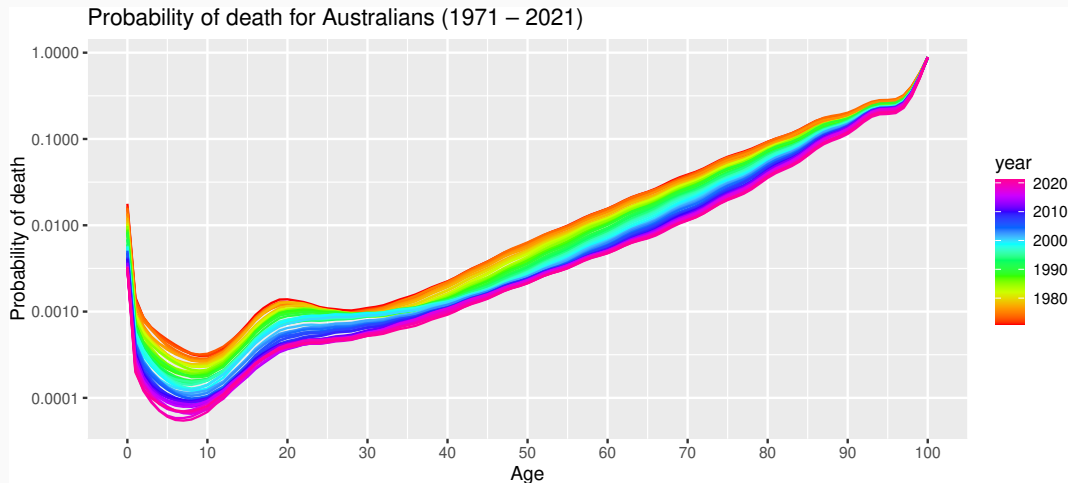
$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

Working Population: Natural and Physical Sciences (2006 – 2021)



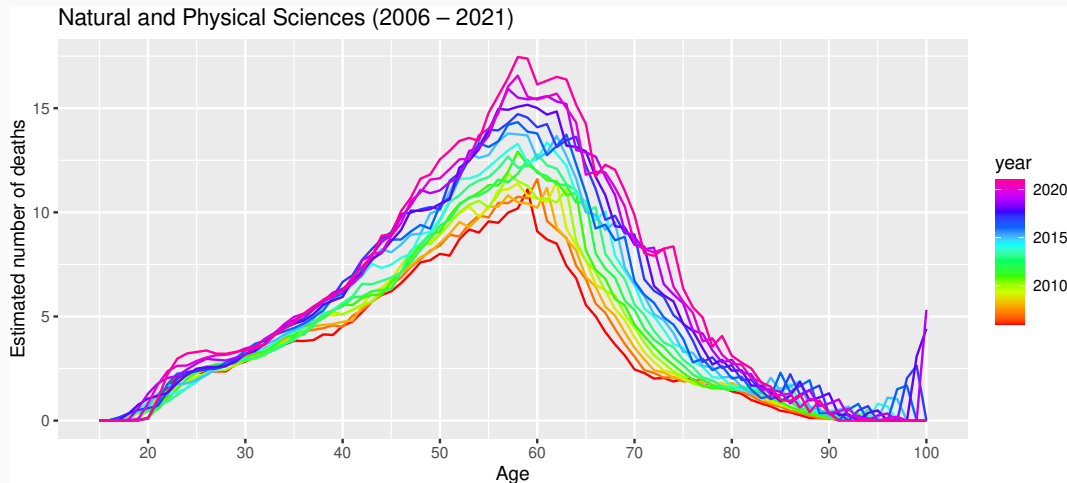
Deaths: $D_{x,t}$

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$



Deaths: $D_{x,t}$

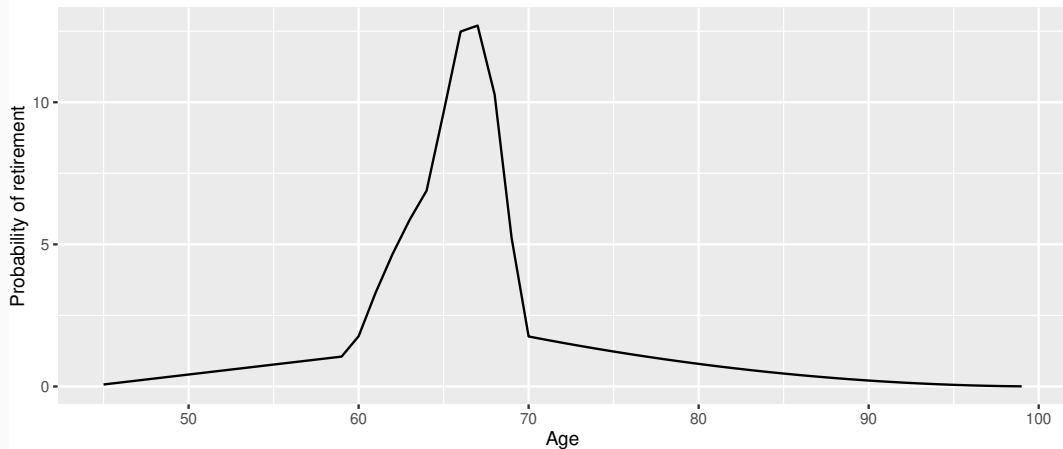
$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$



Retirements: $R_{x,t}$

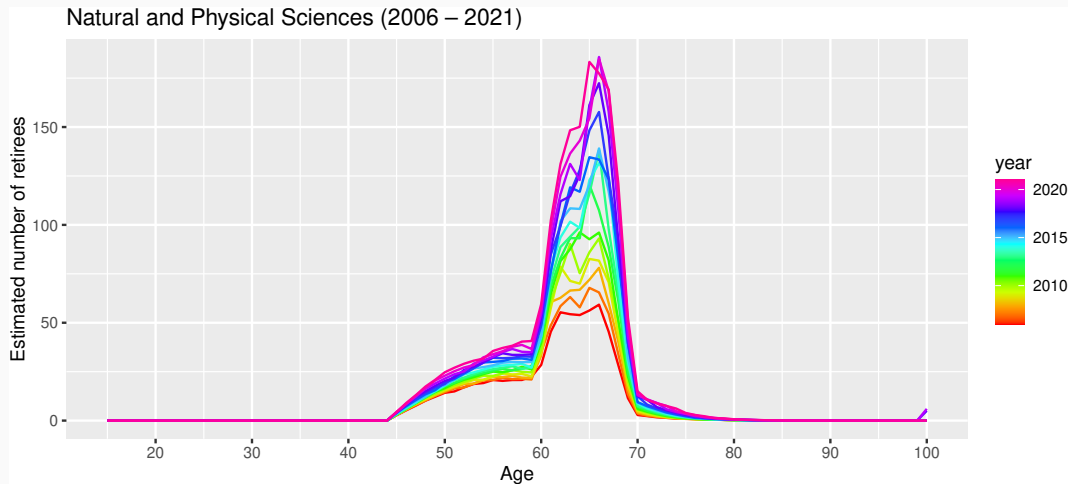
$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

Probability of retirement for Australian scientists (2022 – 23)



Retirements: $R_{x,t}$

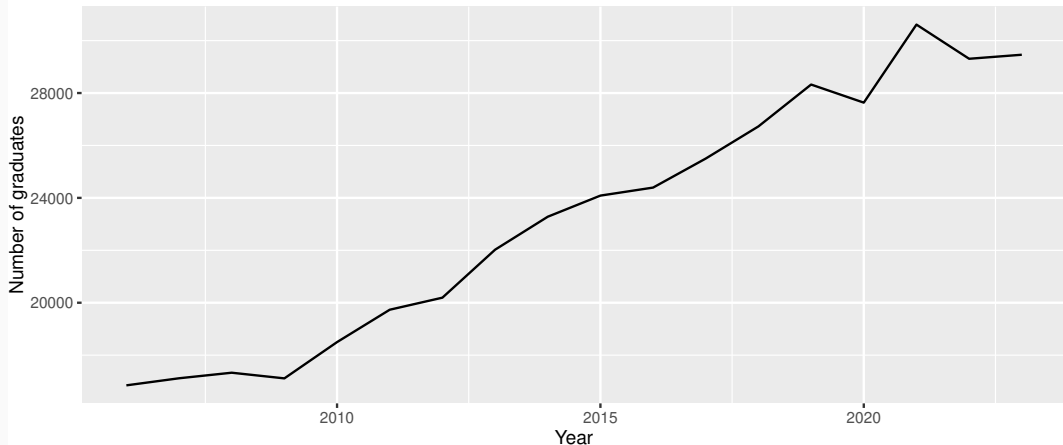
$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$



Graduate completions: $G_{x,t}$

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

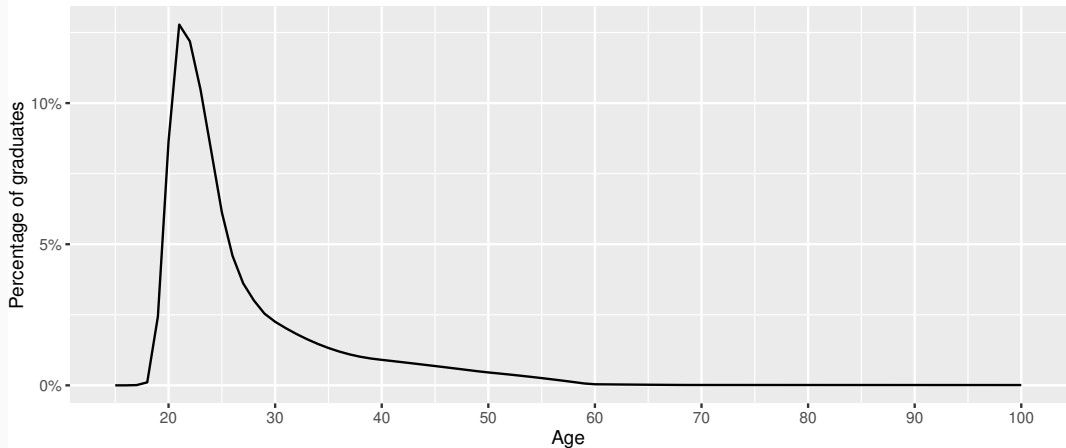
Total graduates: Natural and Physical Sciences (2006 – 2023)



Graduate completions: $G_{x,t}$

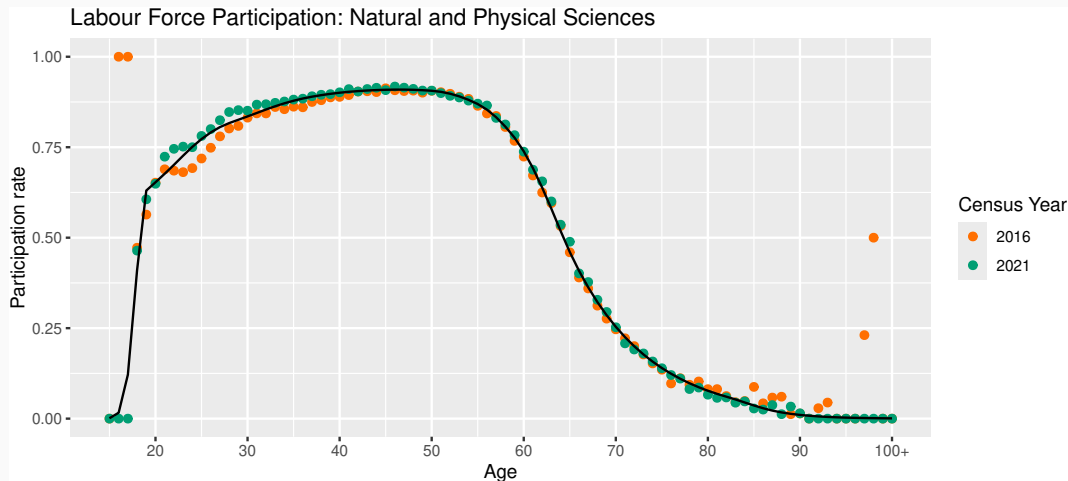
$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

Average graduate completions by age (2006 – 2023)



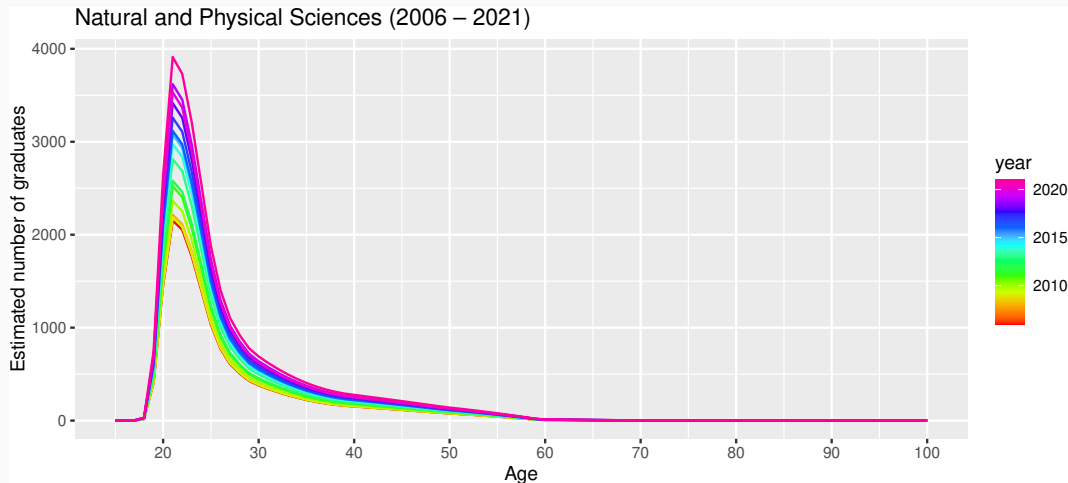
Graduate completions: $G_{x,t}$

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$



Graduate completions: $G_{x,t}$

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$



Net migration: $N_{x,t}$

$$P_{x+1,t+1} = P_{x,t} - D_{x,t} - R_{x,t} + G_{x,t} + N_{x,t}$$

Net migration: $N_{x,t}$

$$N_{x,t} = P_{x+1,t+1} - P_{x,t} + D_{x,t} + R_{x,t} - G_{x,t}$$

Net migration: $N_{x,t}$

$$N_{x,t} = P_{x+1,t+1} - P_{x,t} + D_{x,t} + R_{x,t} - G_{x,t}$$

