
Continuous
Mortality Investigation

Institute and Faculty of Actuaries

# CMI projections model post-pandemic

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Chair of the CMI Mortality Projections Committee

16 September 2024

# Agenda

- Context – the CMI and its Mortality Projections Model
- Before the pandemic – CMI_2019
- Since the pandemic – CMI_2020 to CMI_2023
- What next? – plans for CMI_2024
- Questions

# Context – the CMI and its Mortality Projections Model

# Continuous Mortality Investigation (CMI)

- Owned by the UK's Institute and Faculty of Actuaries
- Celebrating its centenary – 1924-2024
- Mission:
  - To produce high-quality impartial analysis, standard tables and models of mortality and morbidity for long-term insurance products and pension scheme liabilities on behalf of subscribers and, in doing so, to further actuarial understanding.
- Funded by commercial subscribers
  - Most outputs restricted to authorised users

# CMI Mortality Projections Model

- Very widely used by UK pension schemes and insurers
- Updated annually
- Pragmatic rather than the most sophisticated model:
  - Needs to be understood by non-experts e.g. pension scheme trustees
- Not giving “the answer” – users must form their own view of the long term
- A “common language” – users can compare and communicate views
- A framework with parameters that can be adapted to reflect:
  - Different populations
  - Different views of recent and future mortality

# Before the pandemic – CMI_2019

# Overview of the CMI Model

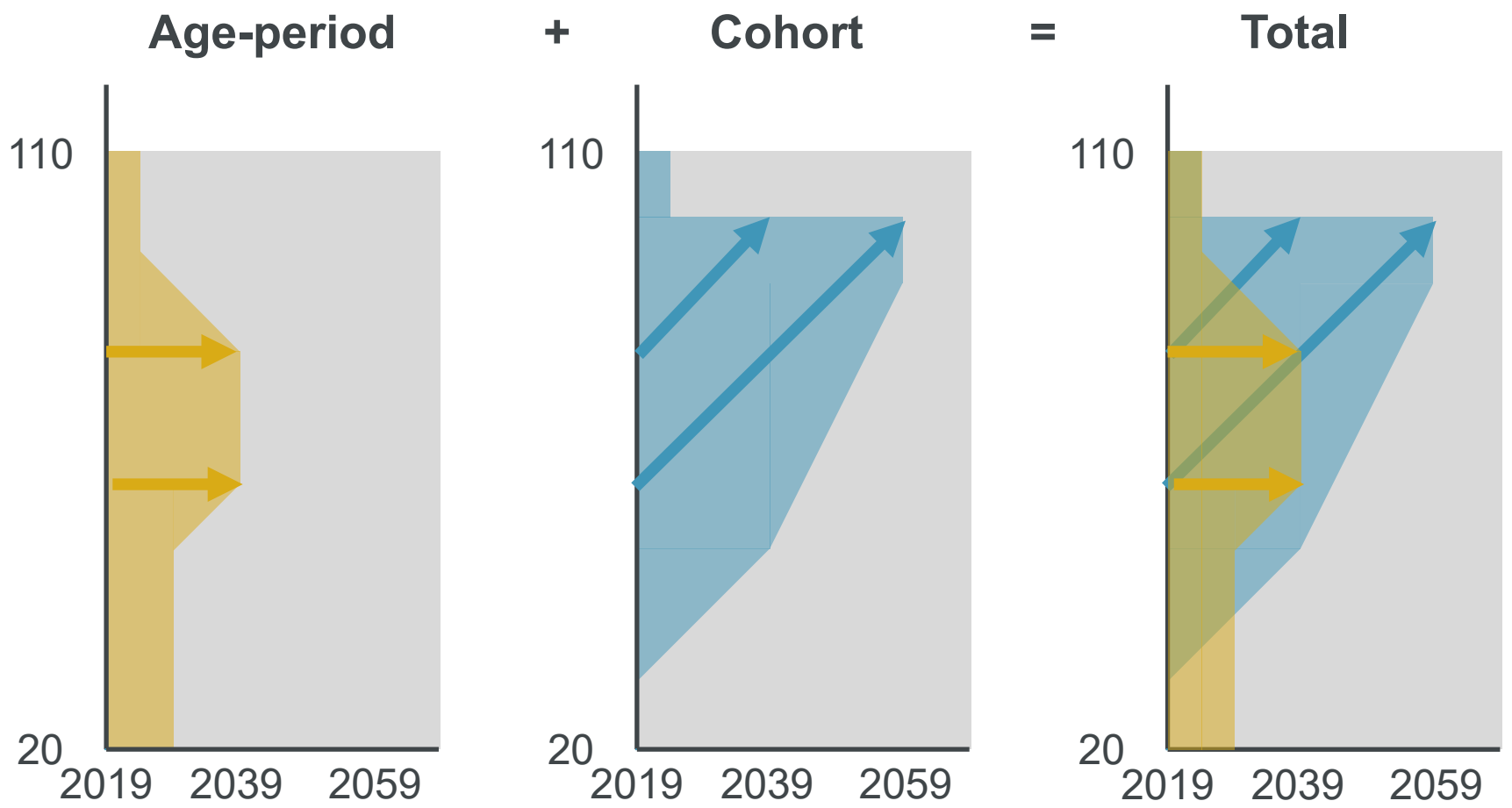
- A model of mortality improvements, that can be applied to any base table
- Separate model for males and females, updated annually
- Interpolates between **“initial”** and **“long-term”** improvements
- **Initial improvements**
  - Estimated from historical data
  - Standard (“Core”) model uses the England & Wales general population
- **Long-term improvements**
  - Different influences on mortality in the past and future
  - CMI does not provide an assumption – users must form their own view

# Fitting initial improvements

- We use our own "APCI" model for central mortality rates
  - $\log m_{x,t} = \alpha_x + \beta_x(t - \bar{t}) + \kappa_t + \gamma_{t-x}$
- Fit this by minimising an objective function, which is the sum of:
  - deviance (Poisson assumption); and
  - smoothness penalties on $\alpha_x$, $\beta_x$, $\kappa_t$, and $\gamma_{t-x}$
- Implied improvements, at the final year $Y$ of the calibration dataset, are then:
  - $MI_{x,t} = \log m_{x,t-1} - \log m_{x,t}$
  - $\boldsymbol{MI_{x,Y} = -\beta_x + \kappa_{Y-1} - \kappa_Y}$ **"age-period" component**

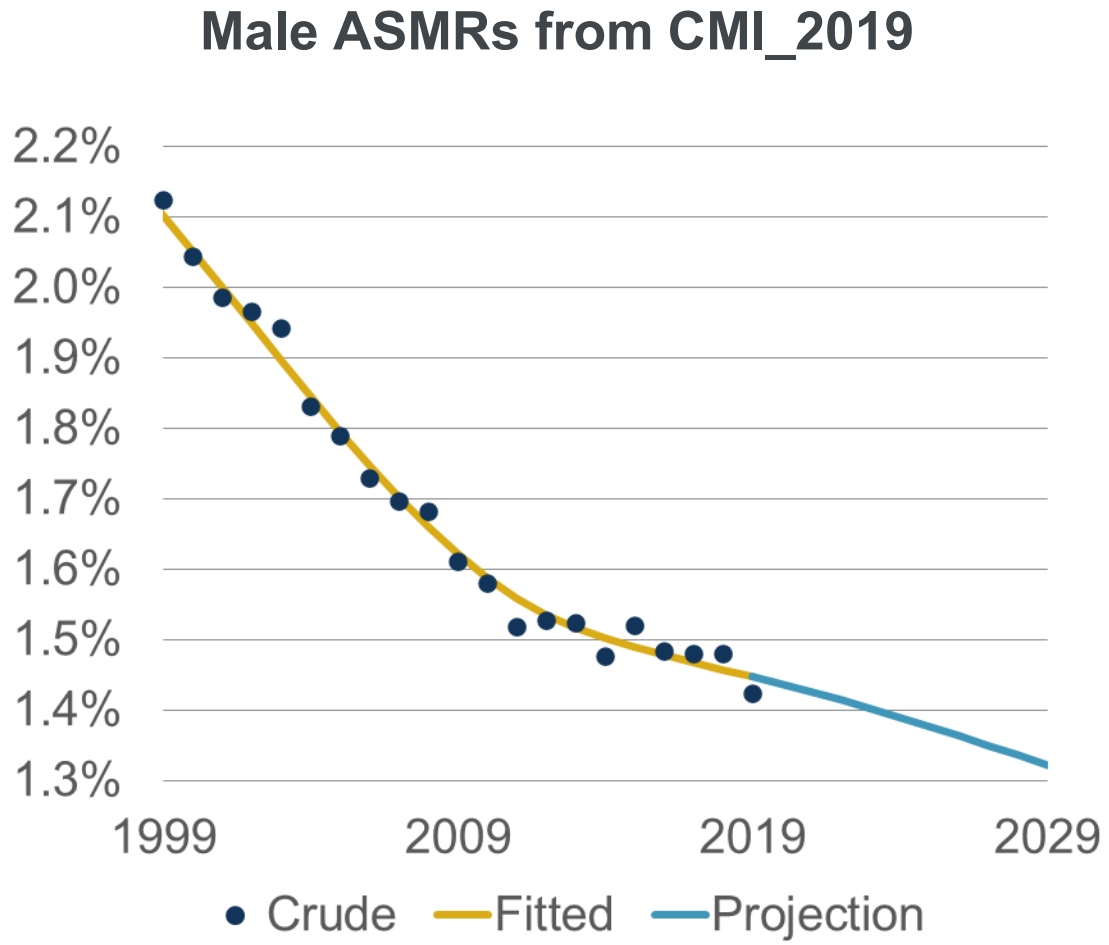
    $\boldsymbol{+\gamma_{Y-1-x} - \gamma_{Y-x}}$ **"cohort" component**

# Projecting improvements



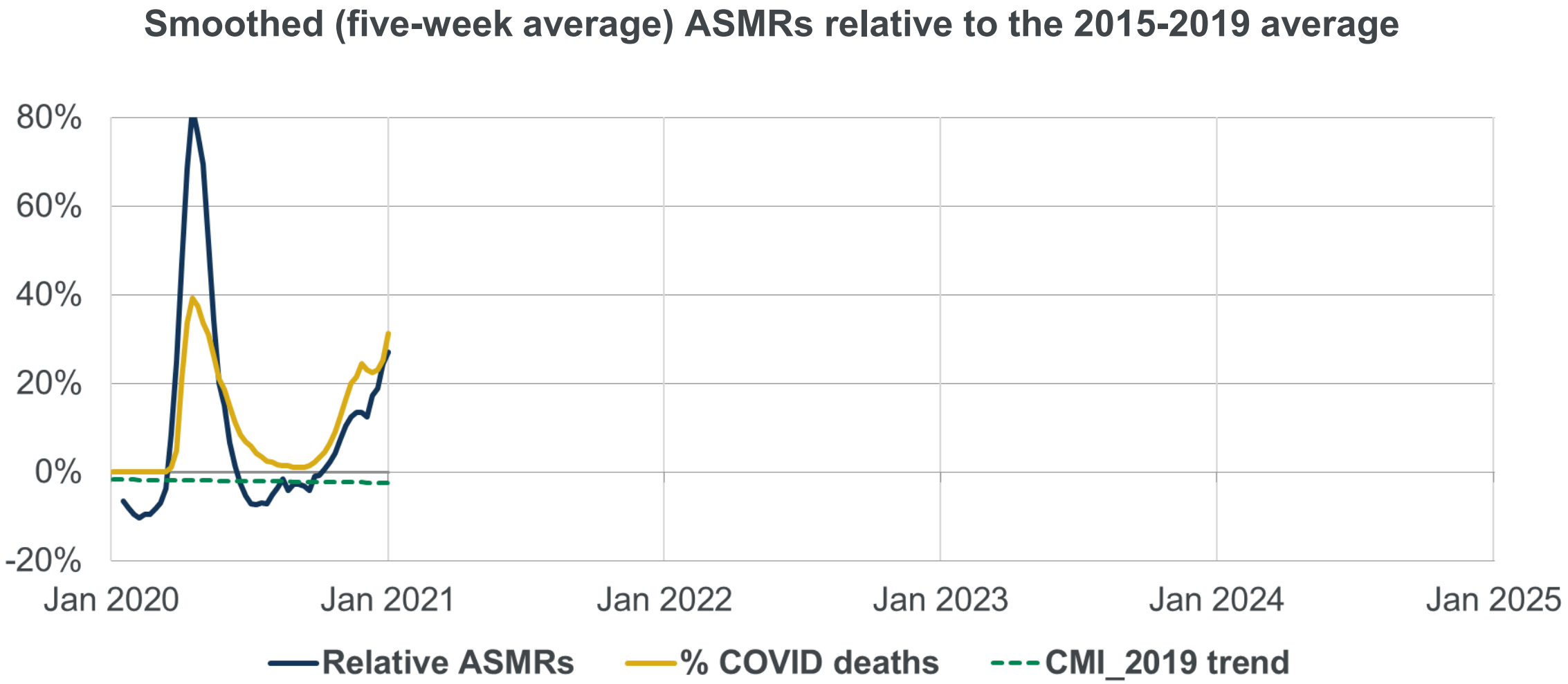
# CMI_2019

- Fit to 1979-2019 data
- Relatively steady pattern to historical mortality, despite annual volatility
- APCI model fits the data well
- Implied initial improvements and projection look plausible



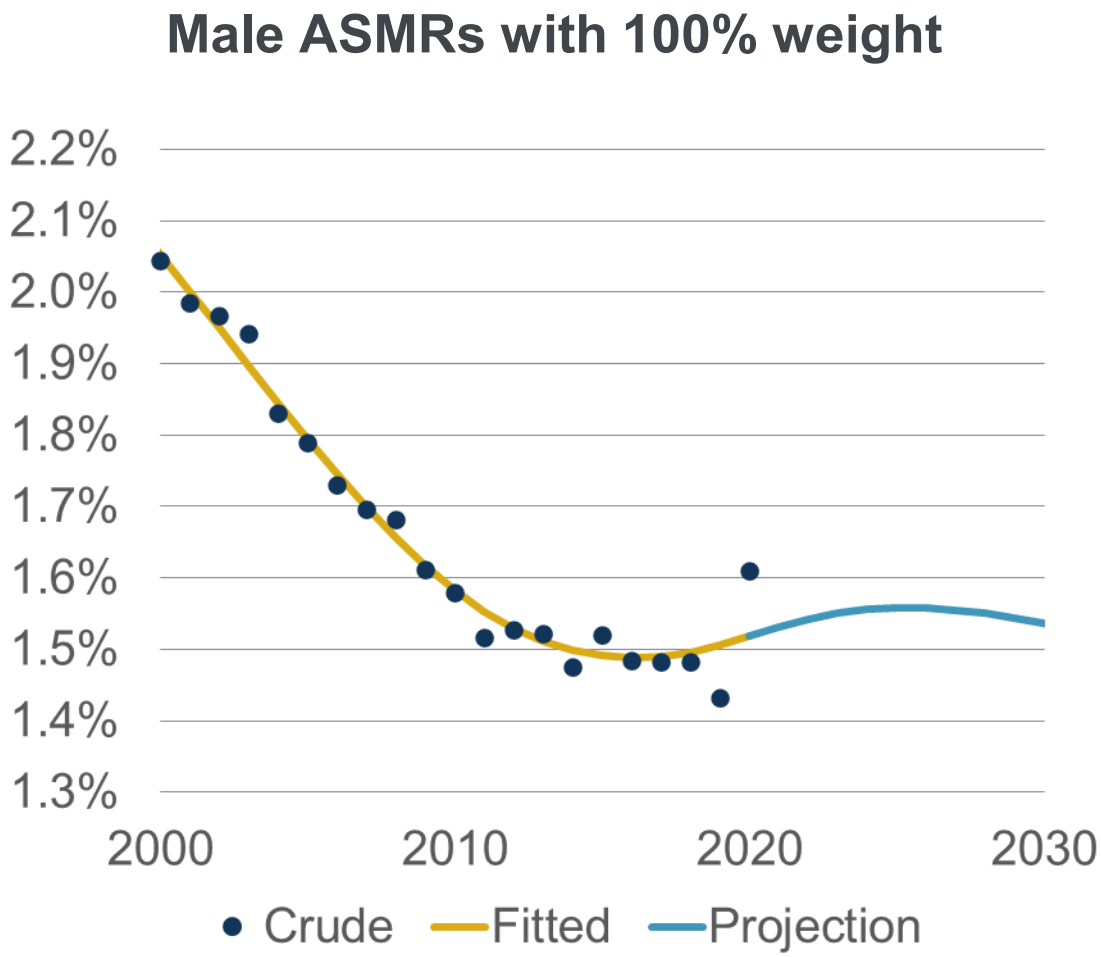
# Since the pandemic – CMI_2020 to CMI_2023

# Weekly mortality to end of 2020



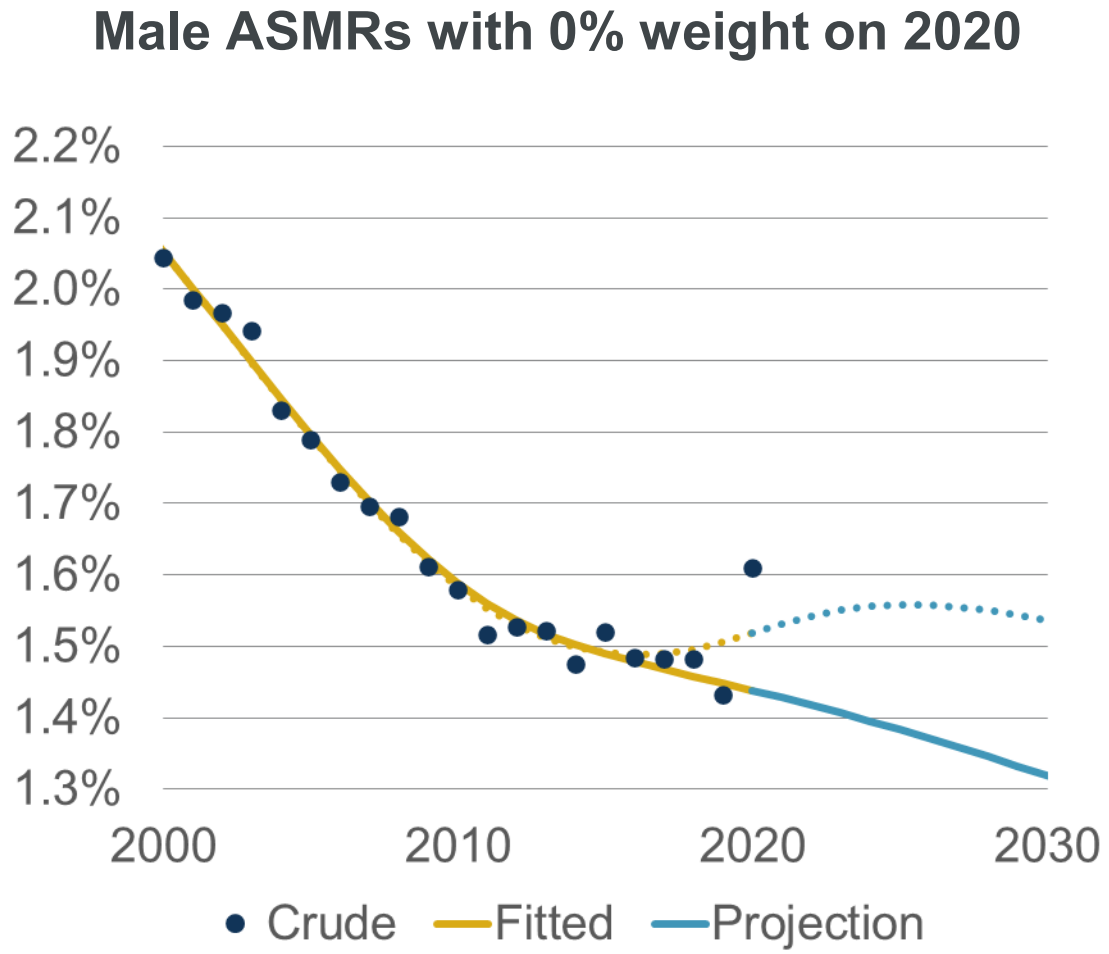
# CMI_2020

- Exceptional mortality in 2020
- Including 2020 data would lead to a rise in projected mortality and an excessive fall in life expectancy
- Considerable uncertainty at the time:
  - Just a one-year “blip”?
  - Impact persists for many years?

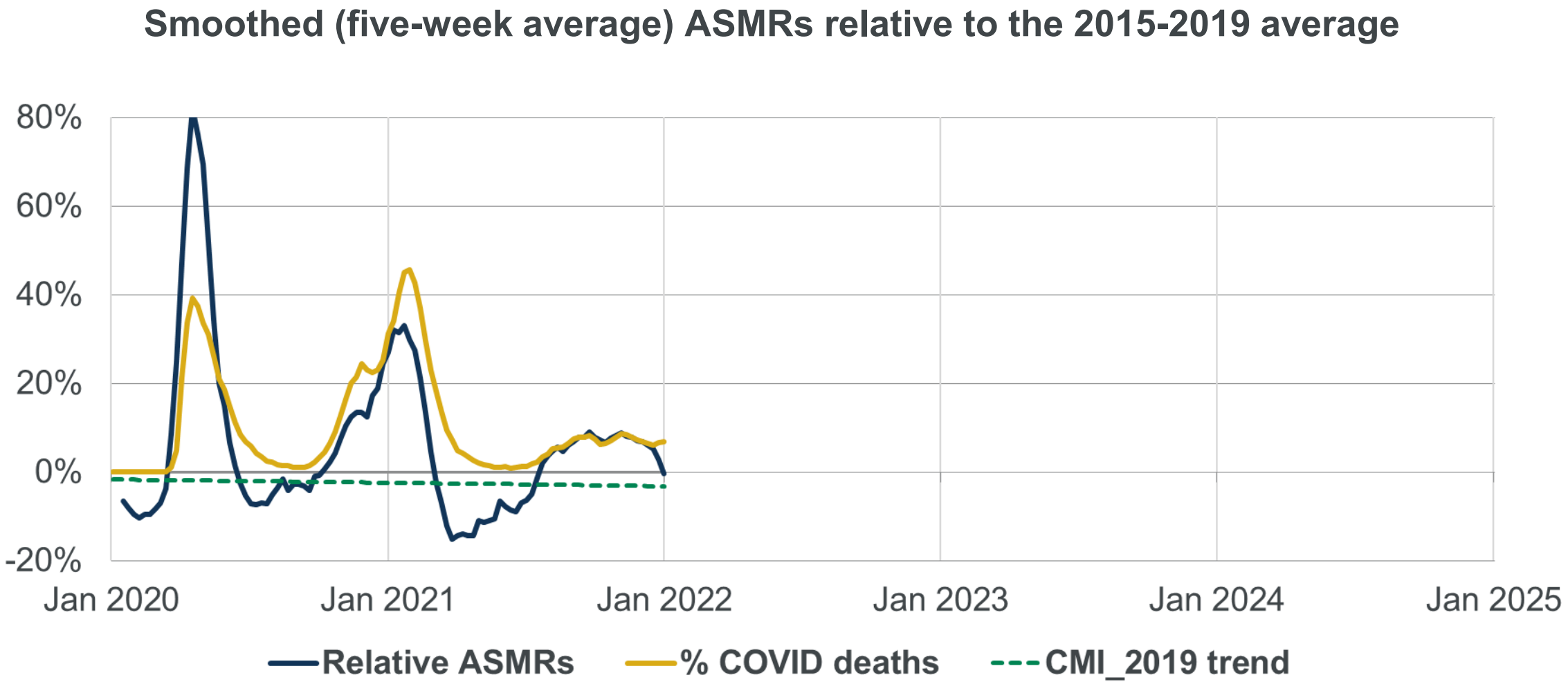


# CMI_2020

- Took a “wait and see” approach
- Added weights so users could vary the weight on each year
- 0% weight in the Core model for 2020 effectively ignores 2020 data
- Consultation, and support for this approach

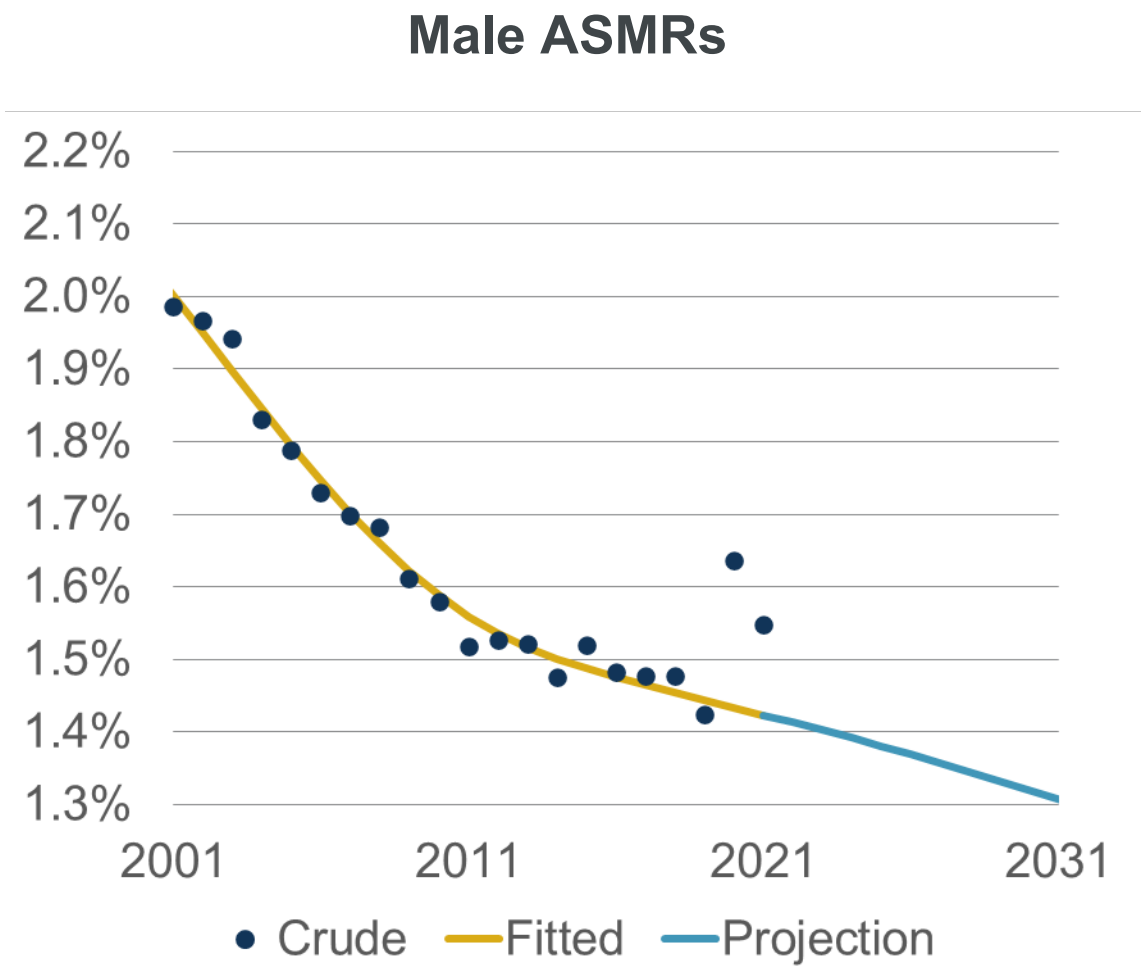


# Weekly mortality to end of 2021

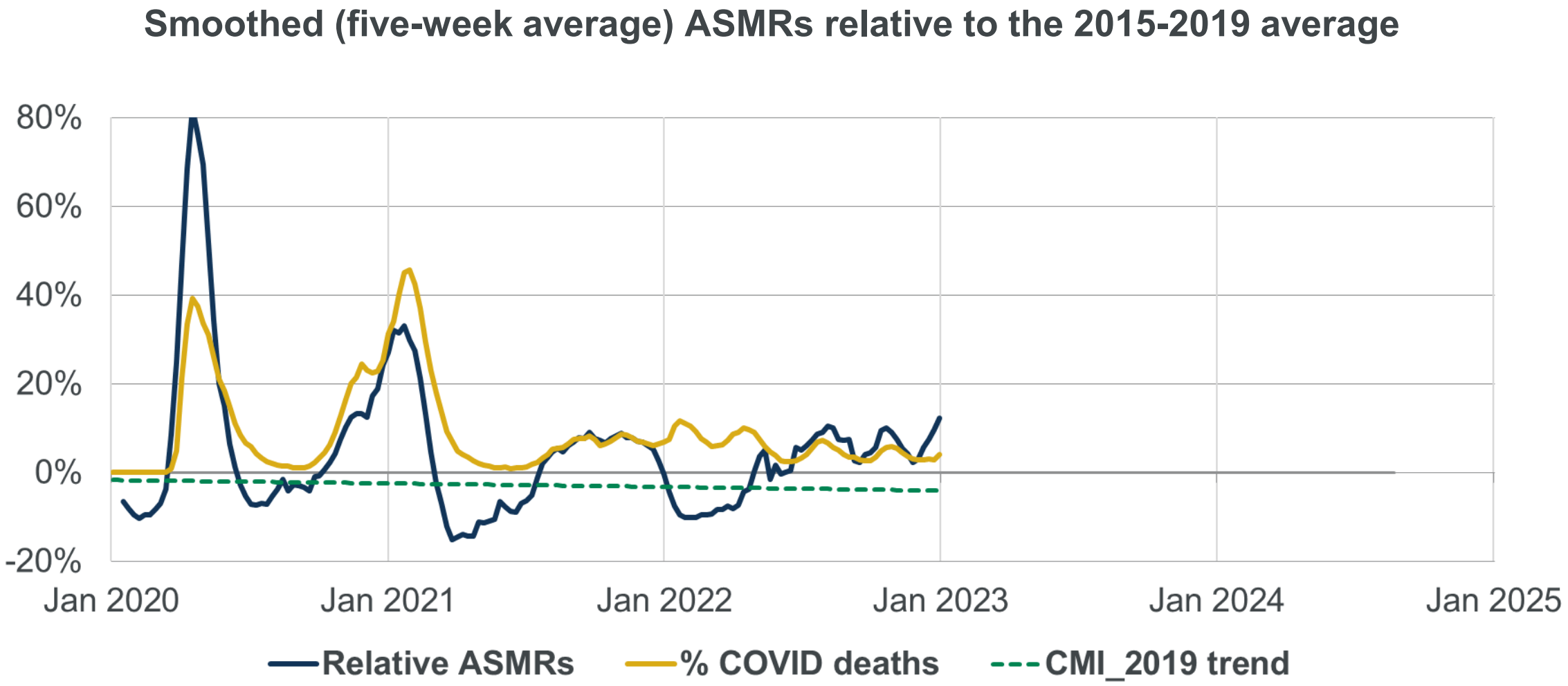


# CMI_2021

- Mortality in 2021 less extreme than 2020, but still exceptional
- Maintained “wait and see” approach
- 0% weight in the Core model for 2020 and 2021



# Weekly mortality to end of 2022

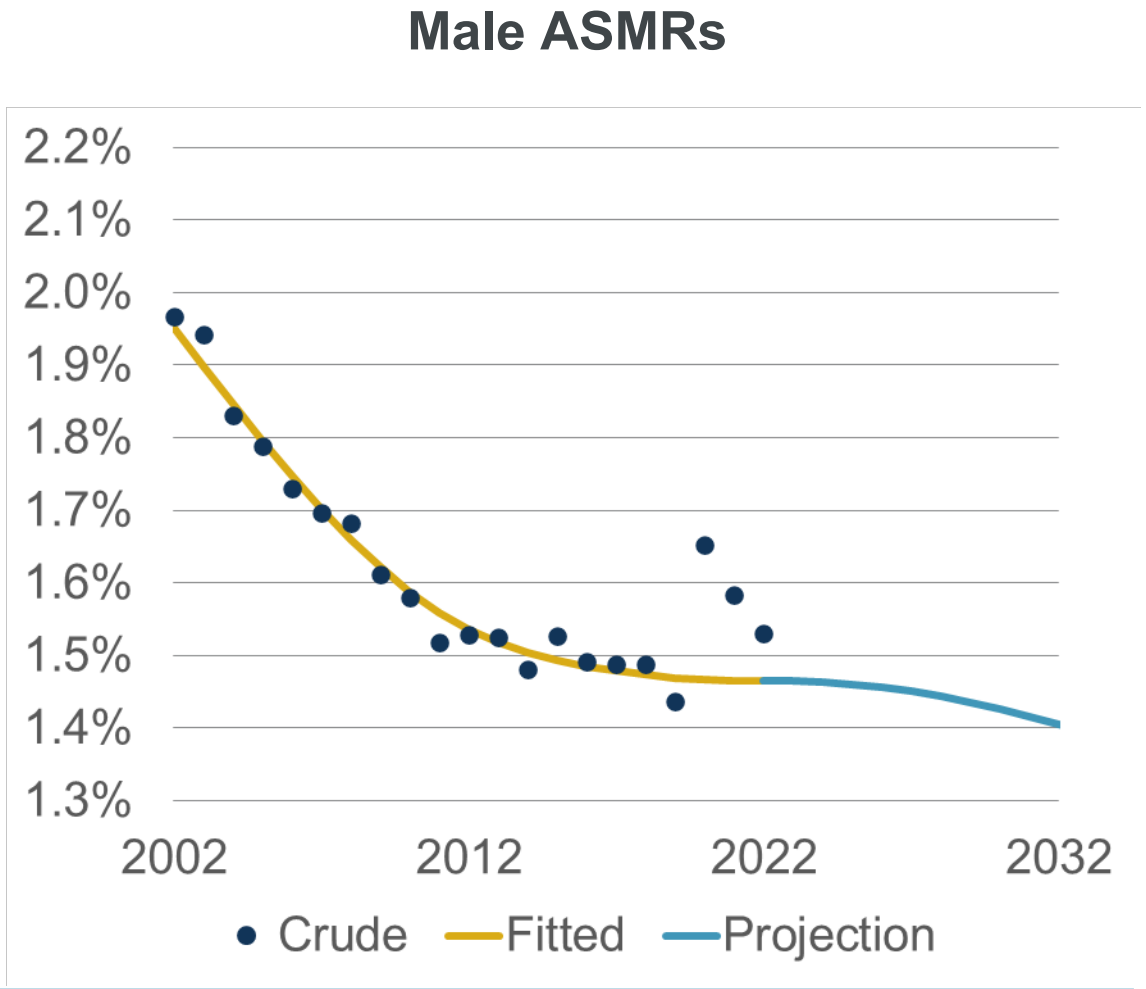


# CMI_2022

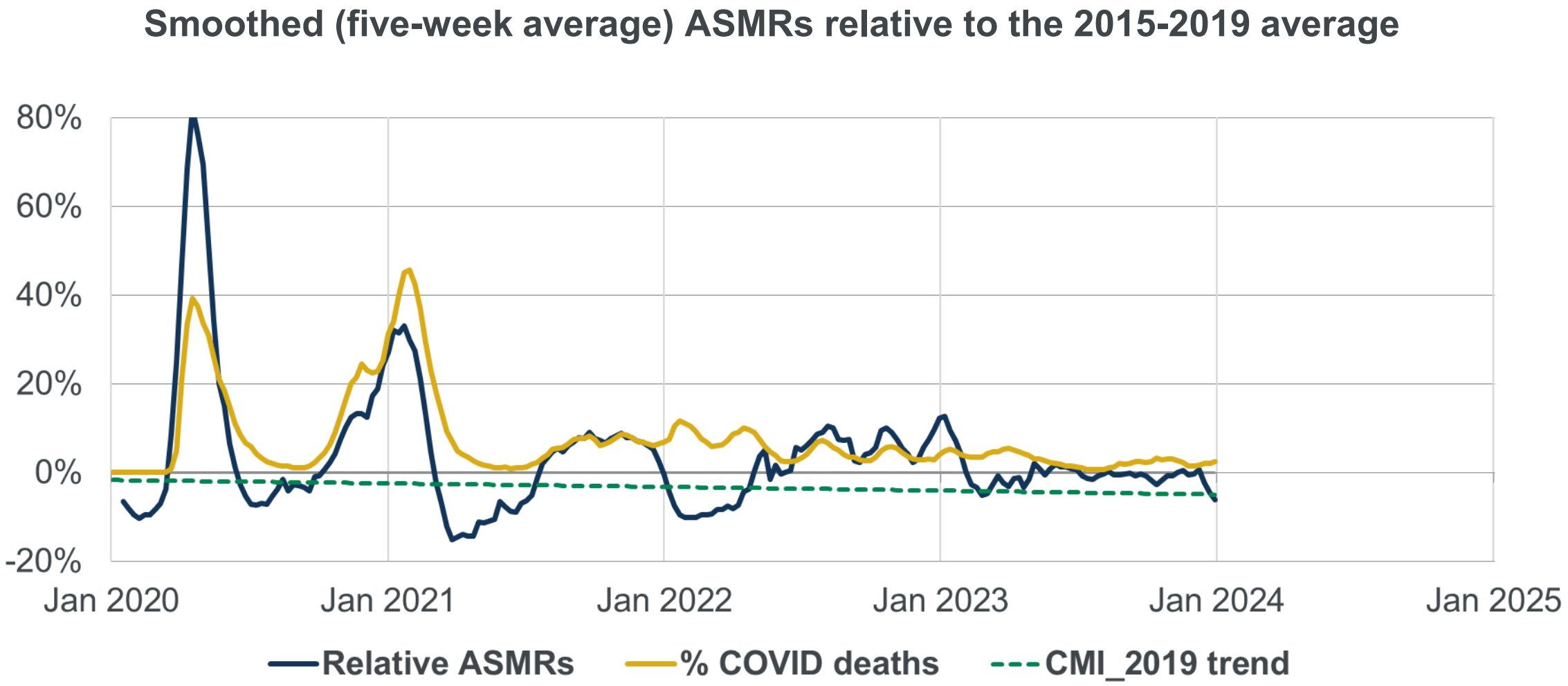
- Mortality for 2020 and H1 2021 had been volatile and extreme
- In H2 2021 and 2022:
  - mortality was less volatile
  - mortality remained above the level immediately before the pandemic
  - excess mortality was higher than COVID-19 mortality in later weeks
- Mortality in 2022 may be indicative of future mortality to some extent?
- Made partial allowance for the mortality experience of 2022
- Led to lower life expectancies than before the pandemic

# CMI_2022

- In the Core model:
  - 0% weight for 2020 and 2021
  - **25%** weight for 2022
- Intention to return to 100% weight over several years
- Subjective choice of 25% reflects:
  - views of committee; and
  - perceptions of industry views

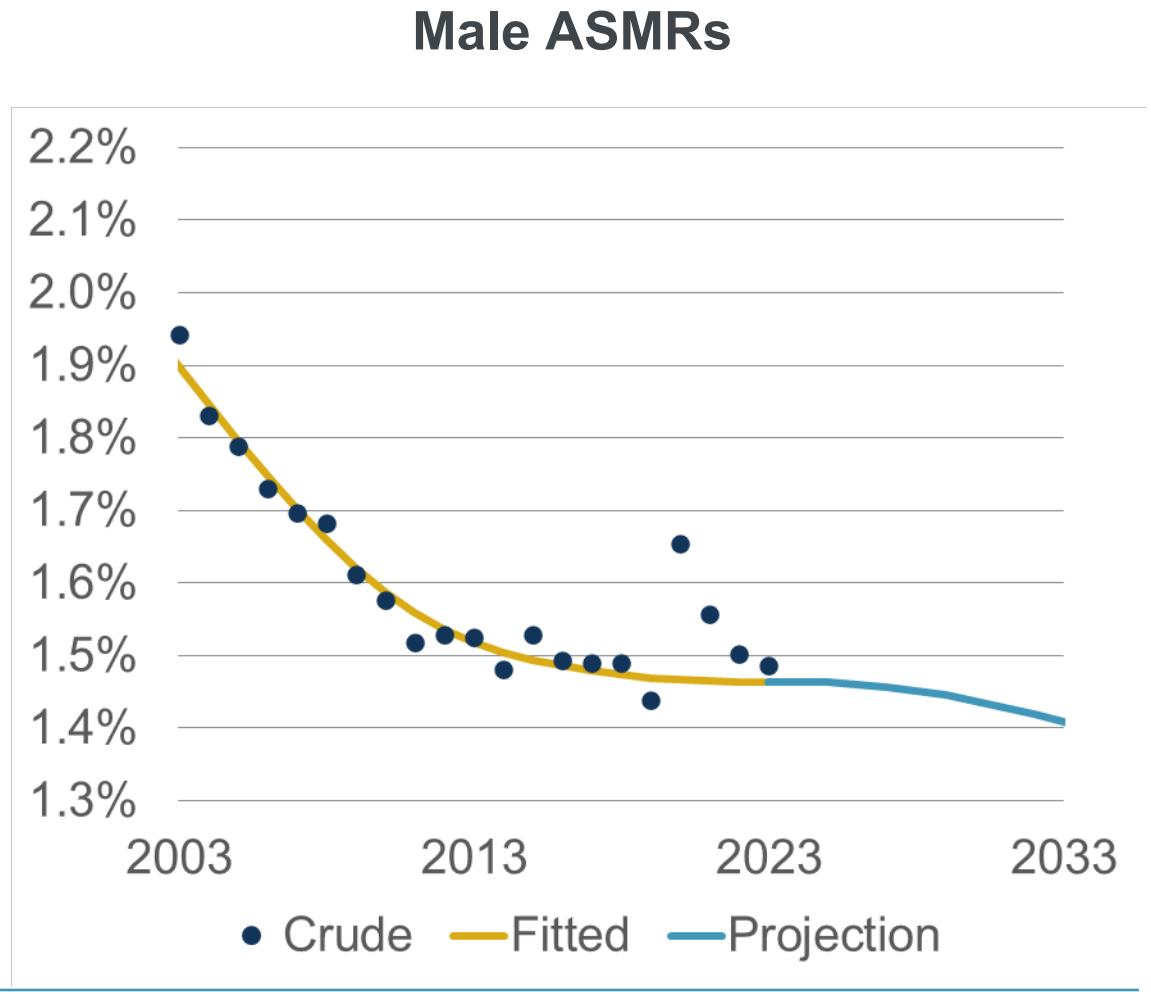


# Weekly mortality to end of 2023



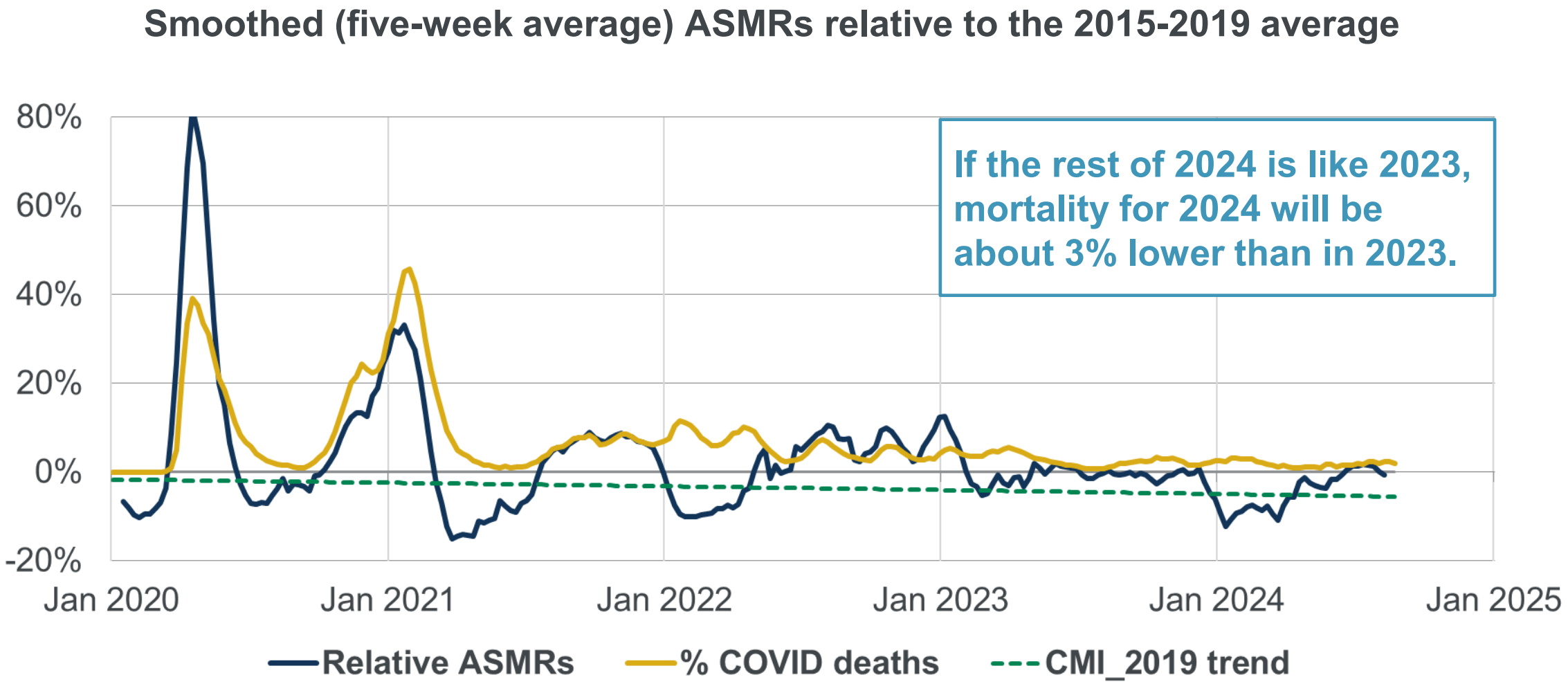
# CMI_2023

- Continued to use weights and smooth through the pandemic data
- In the Core model:
  - 0% weight for 2020 and 2021
  - **15%** weight for 2022 and 2023
- Compared to CMI_2022, lower weight for 2022 data but similar life expectancy
- Majority support in consultation; but concerns about the sustainability of this approach



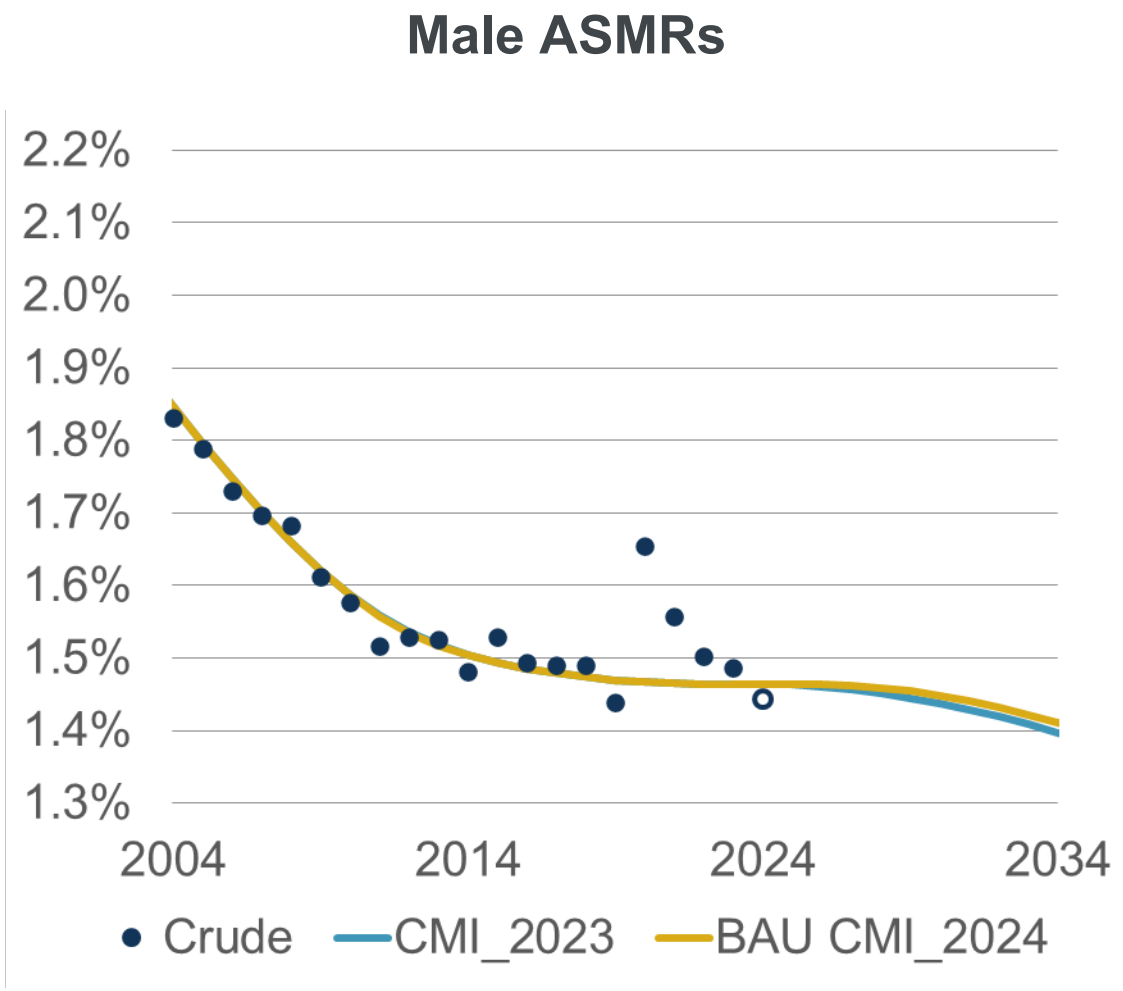
# What next? – plans for CMI_2024

# Weekly mortality to August 2024

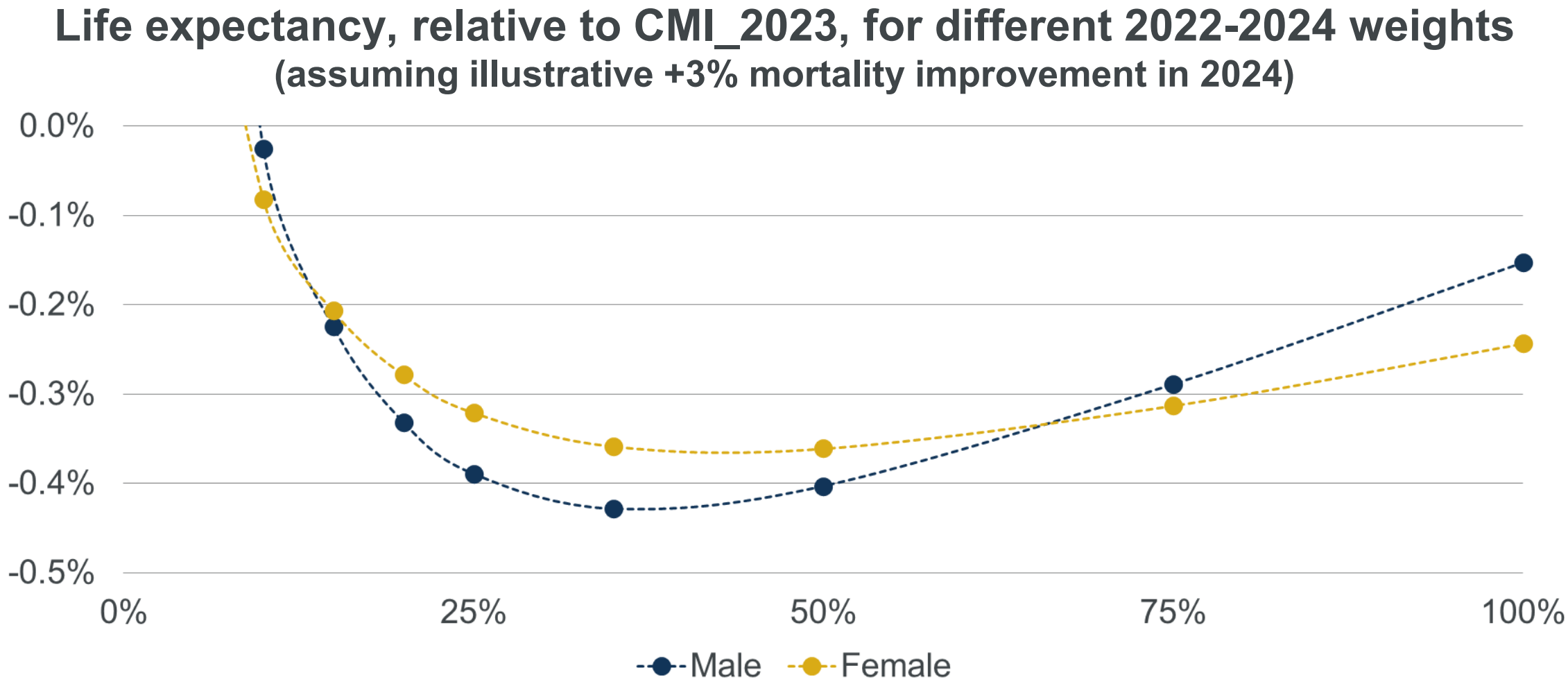


# CMI_2024 model review

- Investigating options – no decisions made yet.
- Held user group meeting in July 2024 and will consult later in 2024
- Concerns over current approach
  - business as usual (BAU) version with 20% weights would increase projected mortality compared to CMI_2023 despite +3% mortality improvement in 2024
  - “non-monotonicity” of weights



# Possible CMI_2024 if retaining current approach



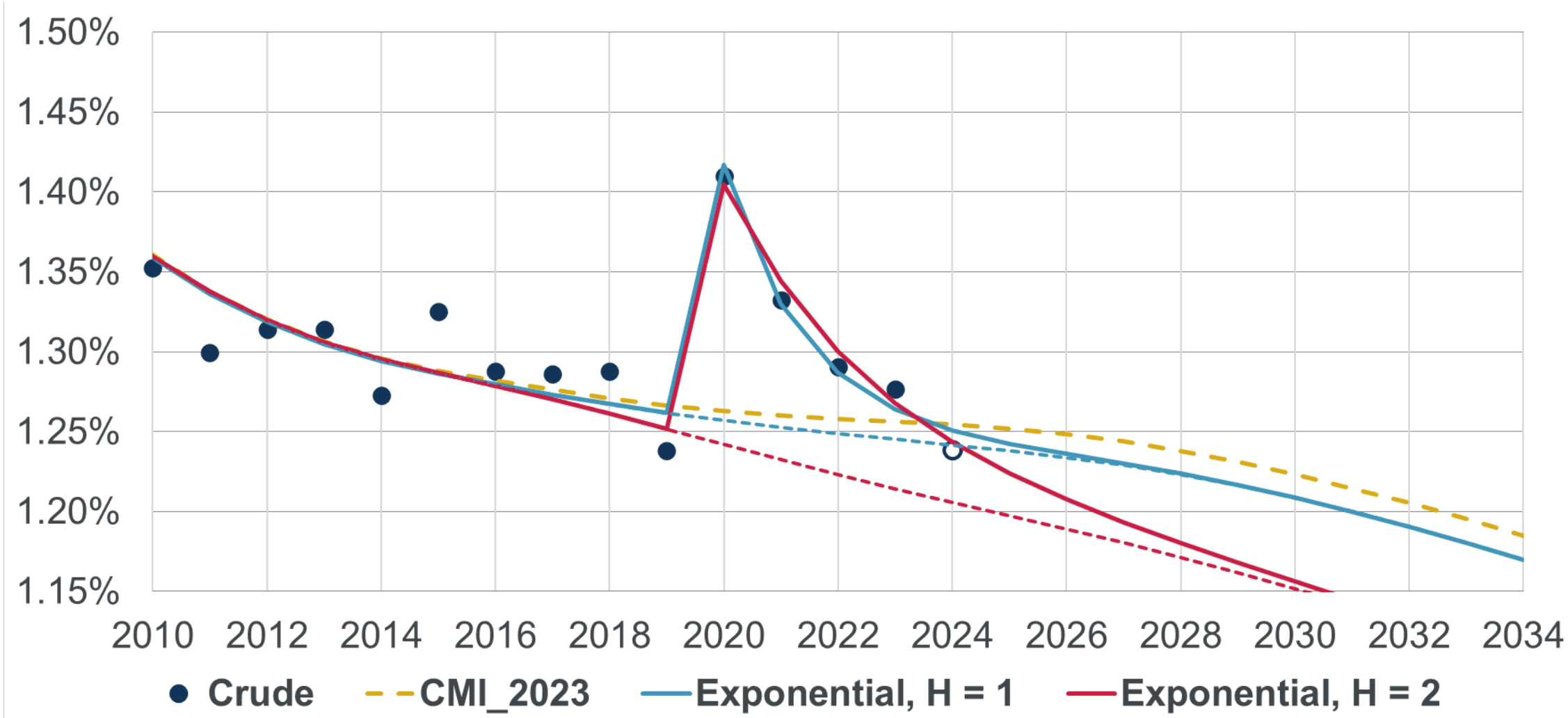
## Possible options

A. Current approach
B. 0% or 100% weights
C. Current overlay
D. Enhanced overlay
E. Period smoothing parameter
F. Counterfactual dataset
G. Multiple period terms

## Criteria

1. Pragmatic
2. Straightforward, common currency
3. Flexible
4. Transparent and objective
5. Consistency with pre-pandemic
6. Appropriately responsive
7. Broadly unbiased
8. Fit to historical data

# CMI_2024 model review – illustrative fitted overlay




Questions
Comments

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