# Forecasting dementia incidence in the England: considering bias and time-series uncertainty



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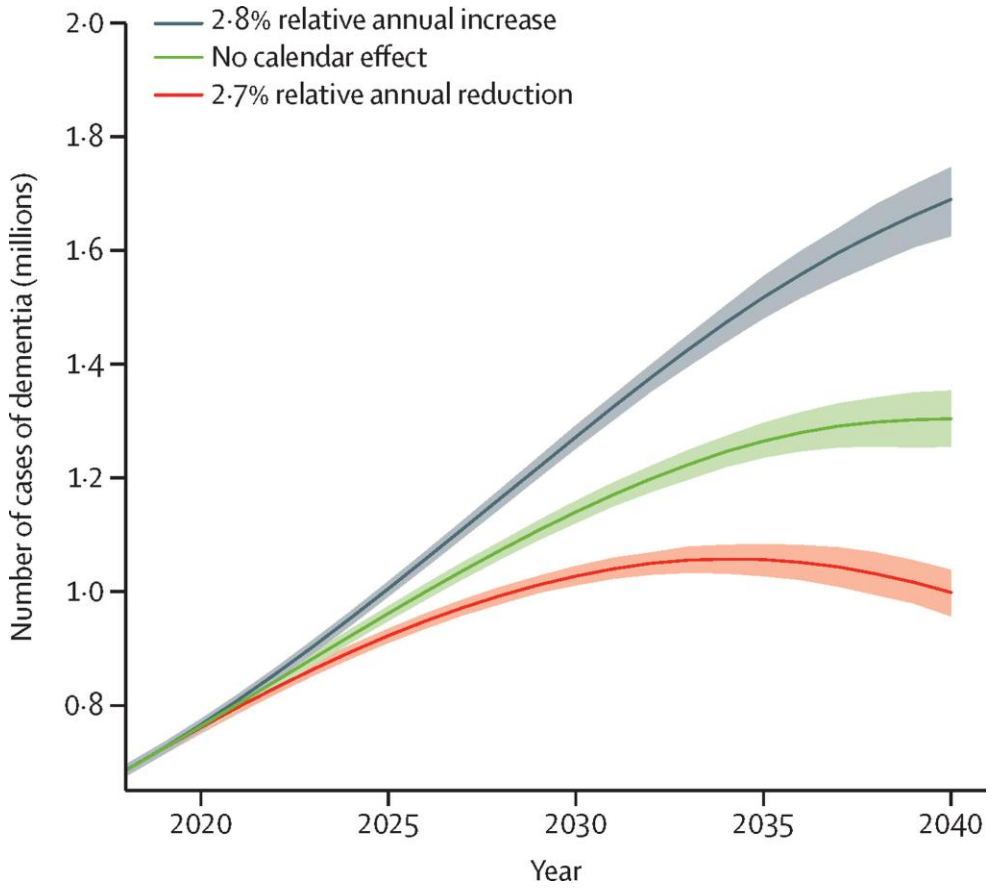
# Rationale

Dementia cases/prevalence projection

- Population structure
- Dementia incidence trend

# Rationale

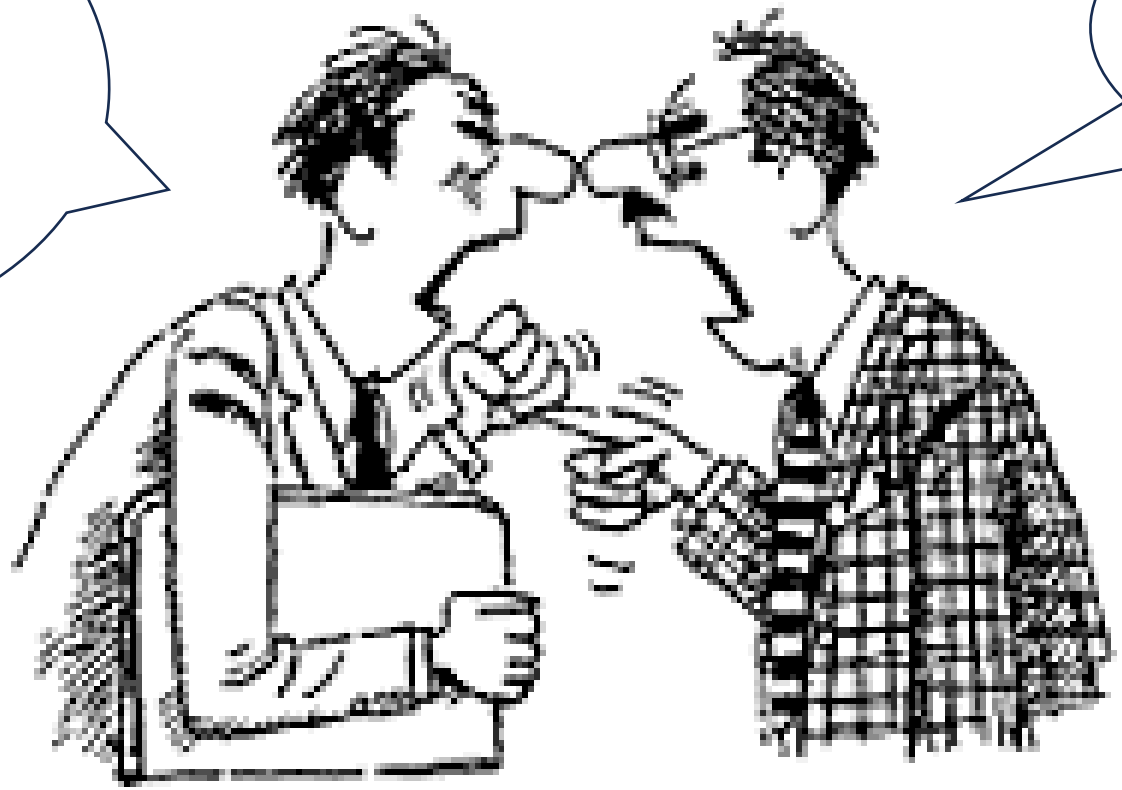
## Projecting dementia cases in the UK using a ten-state macro-simulation model




Chen et al. Lancet Public Health 2023

# Rationale

We did not consider **time-series uncertainty** in the dementia incidence.



Your uncertainty interval is **unexpectedly** narrow!

Epidemiologists

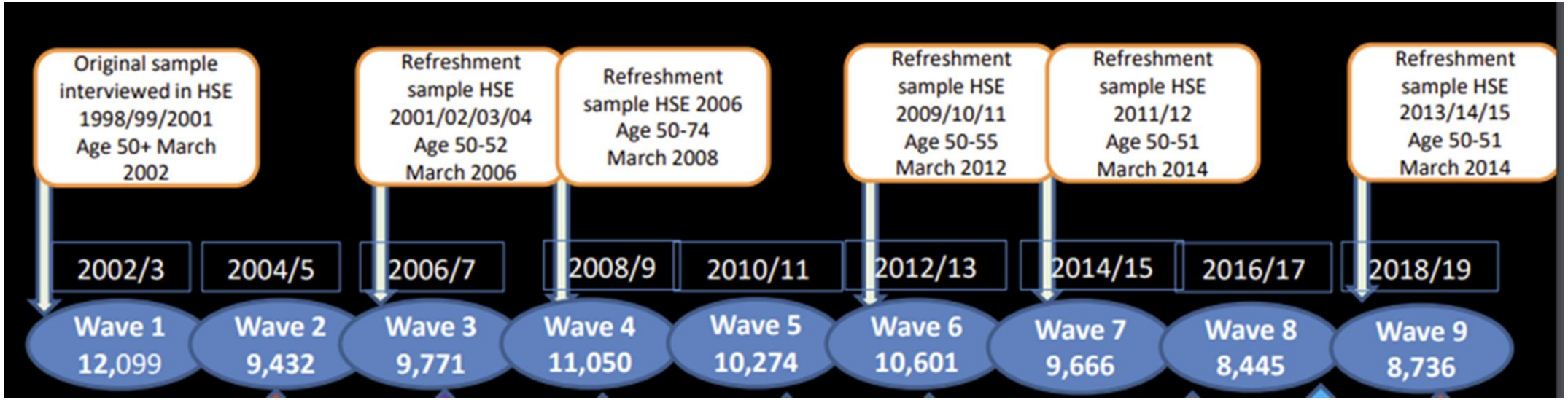
Econometricians

# Research question

- To forecast dementia incidence trend and its uncertainty using short sample
  - To account for bias in the observed data
  - To develop forecast approach that accommodates short sample

# Data

## English Longitudinal Study of Ageing (ELSA) wave 1-9




**Case definition of dementia**

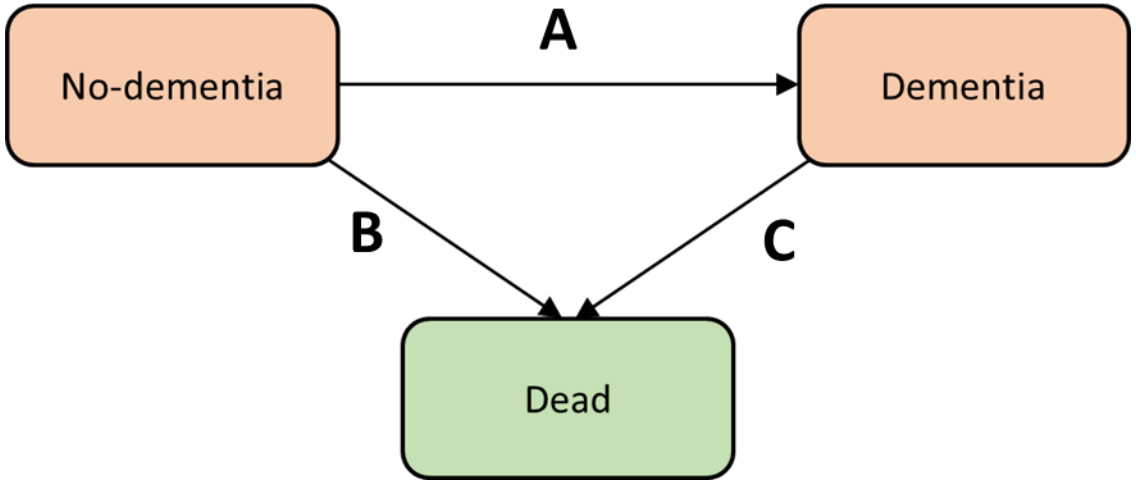
Algorithmic case definition based on coexistence of cognitive impairment and functional impairment, or a report of a doctor's diagnosis of dementia by the participant or caregiver. (Ahmadi-Abhari et al. BMJ 2017)

# Analytic strategy (two step approach)

Step 1: To estimate a time series using multi-state model accounting for missing dementia cases because of death bias

Step 2: To forecast the dementia incidence trend based on a time series model using the estimates from step 1 as input.

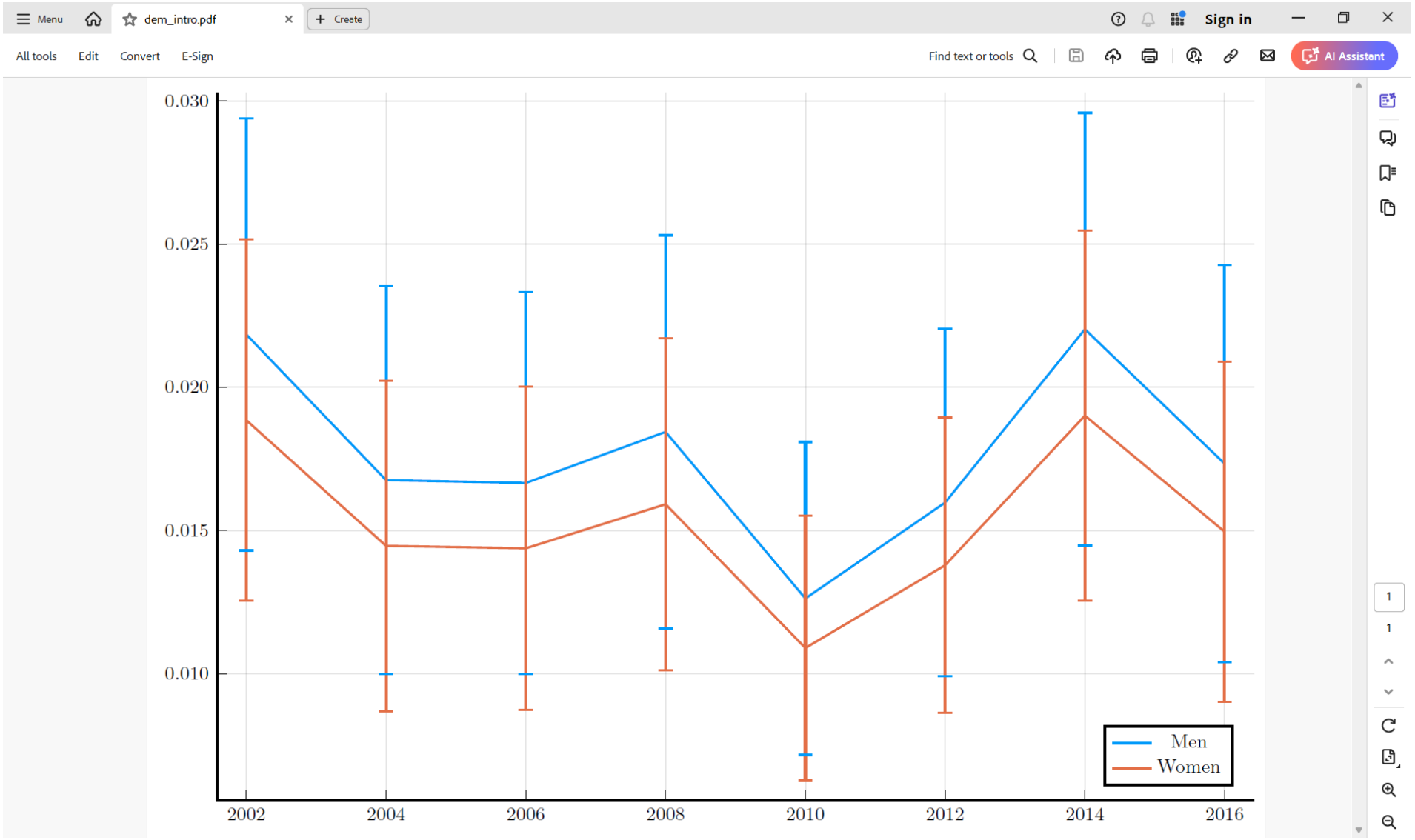
# Step 1 Analysis and bias




We will miss those dementia cases going paths A and C in consecutive wave, thus underestimating dementia incidence

Transition rates B and C are different across calendar year, meaning the degree of underestimation is different.

# Step 1 Results – dementia incidence rate at age 75

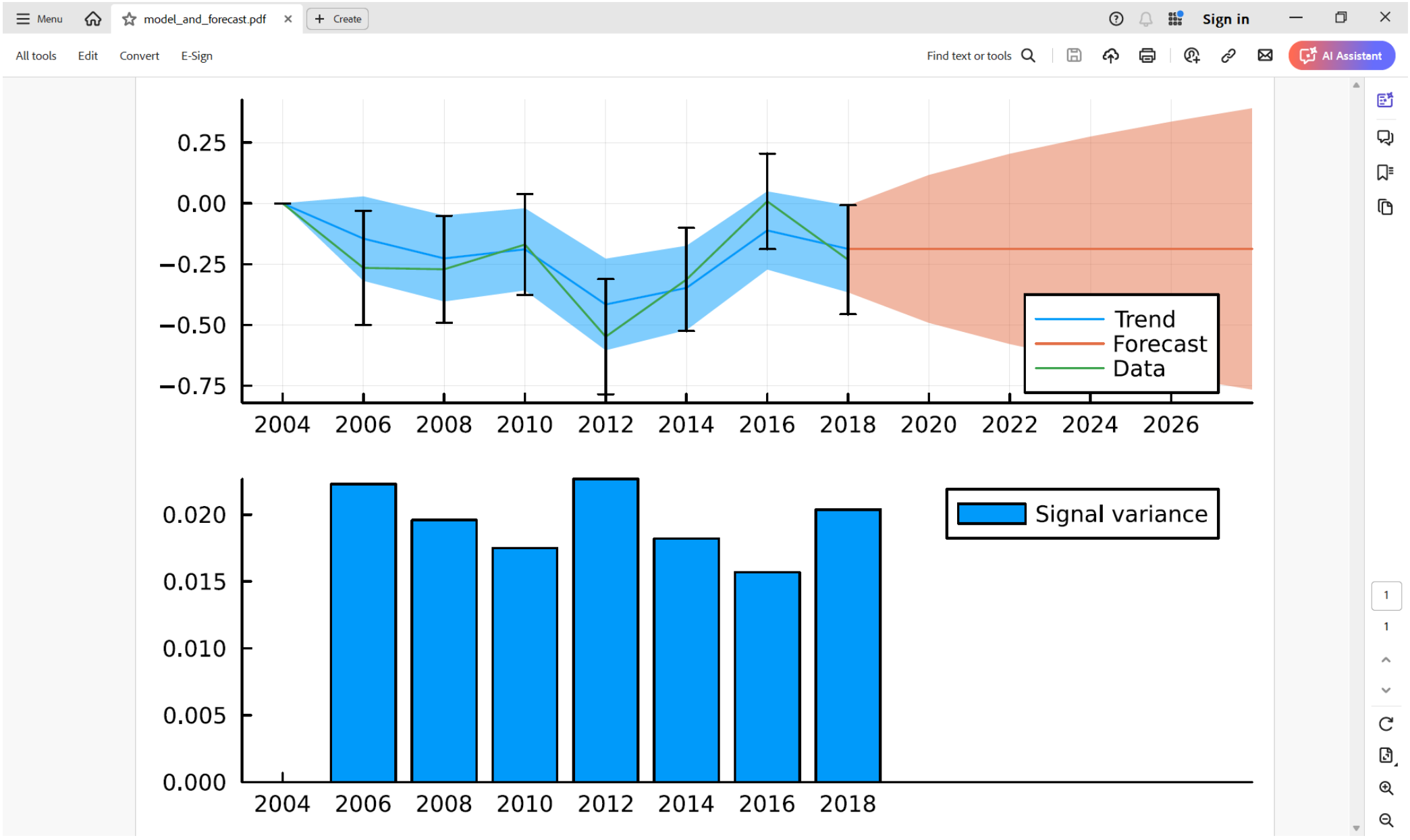


# Step 2 time series model

- Compare different time series models
  1）random walk with time-dependent drift
  2) random walk with time-constant drift
  3) random walk with no drift

- Estimate and forecast using a constrained Kalman Filter

# Step2 Results



# Conclusion and implication

- Dementia incidence in the England has stopped declining.
- Our work will contribute towards the statistical literature by developing an efficient forecast approach using short sample
- Our work will contribute towards the epidemiological literature by more precisely forecasting future dementia cases considering uncertainty around dementia incidence trend.

# Acknowledgements

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