COS-D409. Forecasting II: Applied Research Project

Lecturer: Christina Bohk-Ewald

– Week 1 – Wednesday –

University of Helsinki, Finland
15.03.2021–05.05.2021

First week's Wednesday session

- We talk about possible research questions in the field of demographic forecasting to give you some inspiration
- You develop (or select) a research question for your own applied research project
- We choose *student reviewers* for projects
- You create a tentative plan for your applied research project and set and specify weekly goals

How to plan your applied research project

Major steps:

- **Develop a research question**
- Collect and synthesize related work
- Collect and prepare relevant real-world data
- Design and conduct necessary analysis with real-world data in the statistical software R
- Analyze and interpret main results
- Summarize and discuss main findings and their possible limitations
- Report your results and how you have generated and validated them in a presentation and brief paper

How to plan your applied research project

Make a timetable stretching over 7 course weeks
including each of these major steps,

then prepare a plan detailing what it will take to achieve these weekly goals,

and finally revise or adjust your plan
while you are on your scientific adventure
and gather new information, and, perhaps, encounter unforeseen events.

How to plan your applied research project

Week	Major step	Details
Week 1	**Develop research question and draft project plan**	...
Week 2	Collect related work and relevant data	...
Week 3	Design and conduct data analysis	...
Week 4	Continue to conduct data analysis	...
Week 5	Analyze, interpret, and discuss results	...
Week 6	Summarize main findings and prepare presentation	...
Week 7	Present your project and complete your report	...

→ Please adjust and specify this timetable to your needs

How to plan your applied research project

However, note:
"Plans are nothing; planning is everything"
(Dwight D. Eisenhower).

So, your initial plan will need to be adjusted on the way.

And it is always a good idea to conduct a small-scale pilot study or test case in order to make sure that you will invest your energy and time wisely.

Possible research questions in demographic forecasting

- Nowcast the total number of COVID-19 infections
- Forecast mortality by age and sex 50 calendar years ahead
- Forecast fertility 20 years ahead
- Forecast population size and structure 50 years ahead
- Validate demographic forecast methods

Possible research questions in demographic forecasting

Research topics belong to two previous courses

- COS-R403: Forecasting I: Introduction

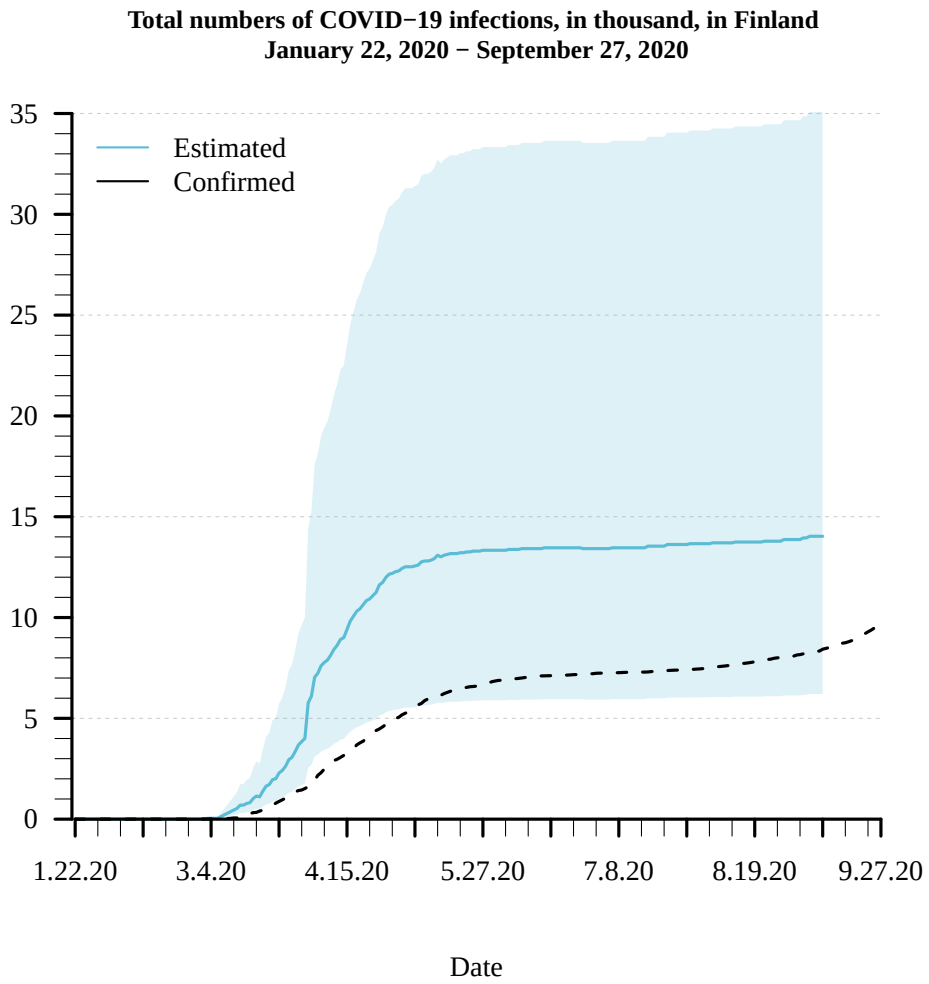
  `https://github.com/christina-bohk-ewald/2020-COS-R403-forecasting-I-introduction`

- COS-D407: Scientific modeling and model validation

  `https://github.com/christina-bohk-ewald/2020-COS-D407-scientific-modeling-and-model-validation`

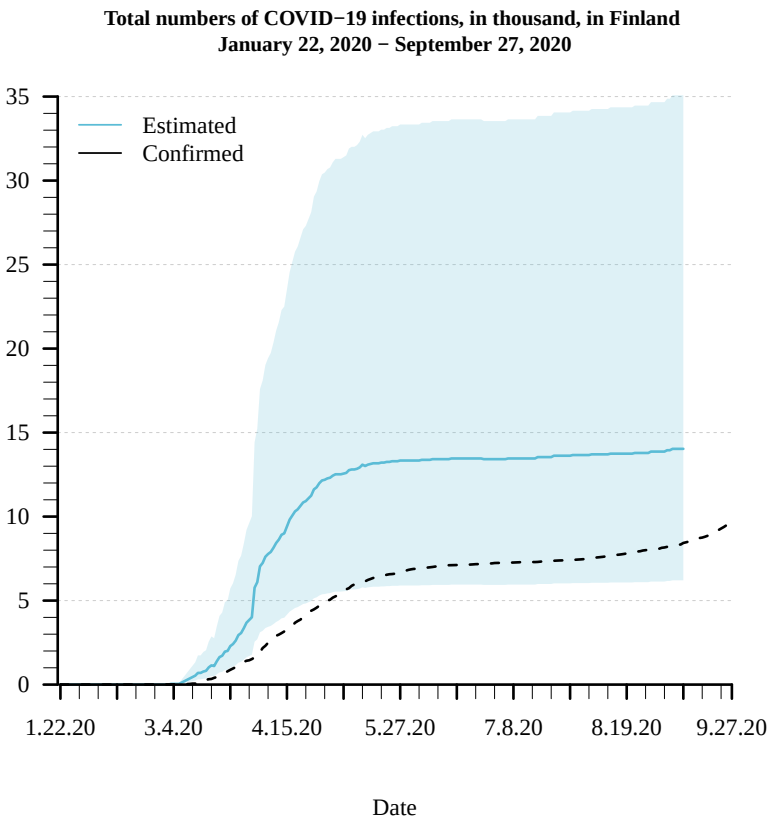
You have open access to all course material (e.g., literature, basic concepts, examples with real-world data, and R programming code).

Nowcast the total number of COVID-19 infections



- Confirmed cases are probably just a lower estimate of the number of COVID-19 cases.
- How many COVID-19 cases are their in Finland?
- How many COVID-19 cases are there in other countries?

Nowcast the total number of COVID-19 infections



Sources of information to start with:

- COS-D407: Scientific modeling and model validation. Weeks 3–5.

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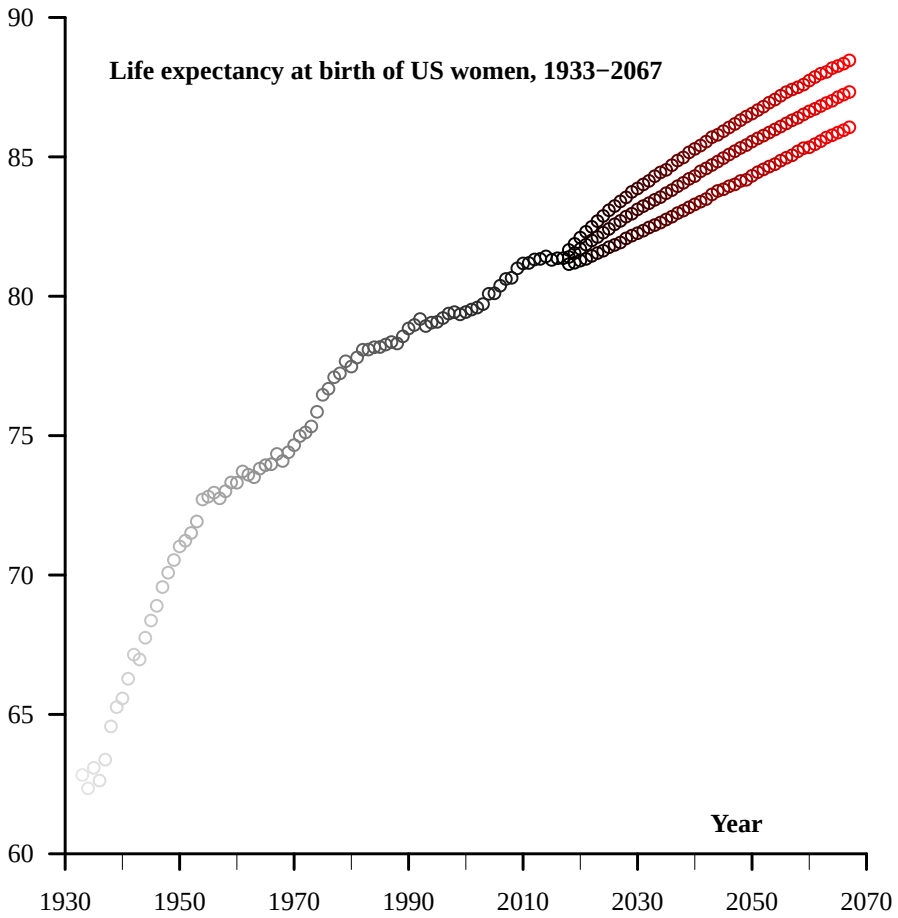
- Bohk-Ewald et al. (2020): A demographic scaling model for estimating total numbers of COVID-19 infections, *International Journal of Epidemiology* 49(6), 1963-1971,

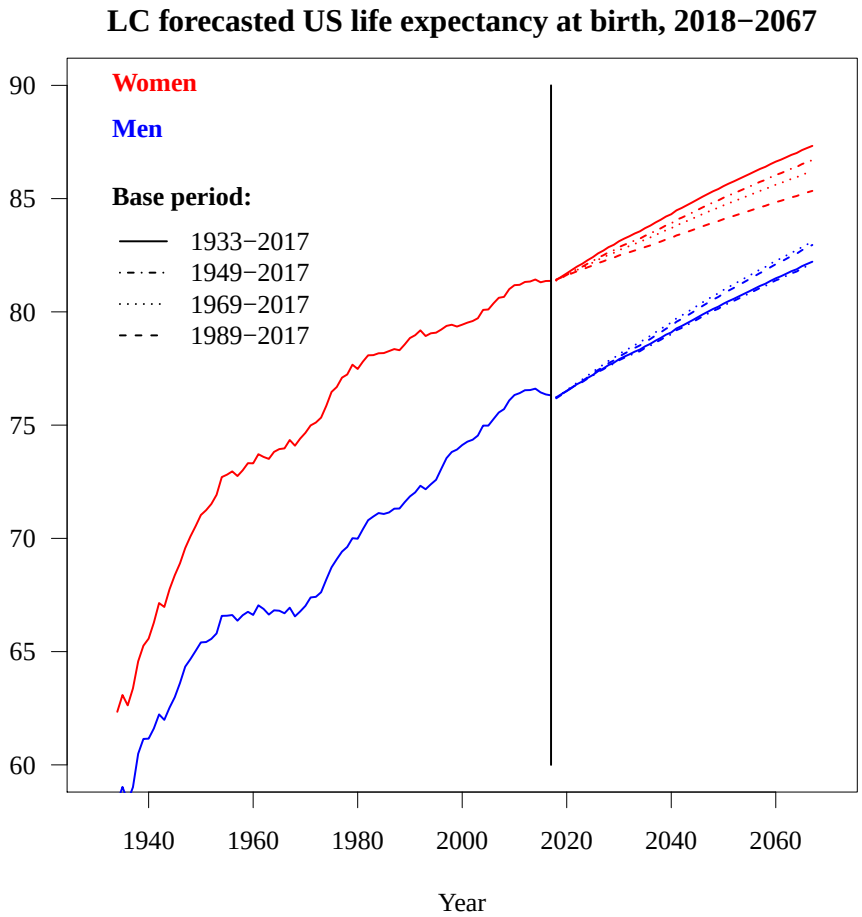
  `https://doi.org/10.1093/ije/dyaa198`

Forecast mortality 50 years ahead



- Life expectancy is increasing in many countries over time due to mortality decline at various ages.
- How much is life expectancy at birth likely to increase in Finland and in other countries in the next 50 years?
- What ages will have the largest contribution?
- Is the forecasted mortality development likely to differ between women and men?

Forecasting mortality 50 years ahead



Sources of information to start with:

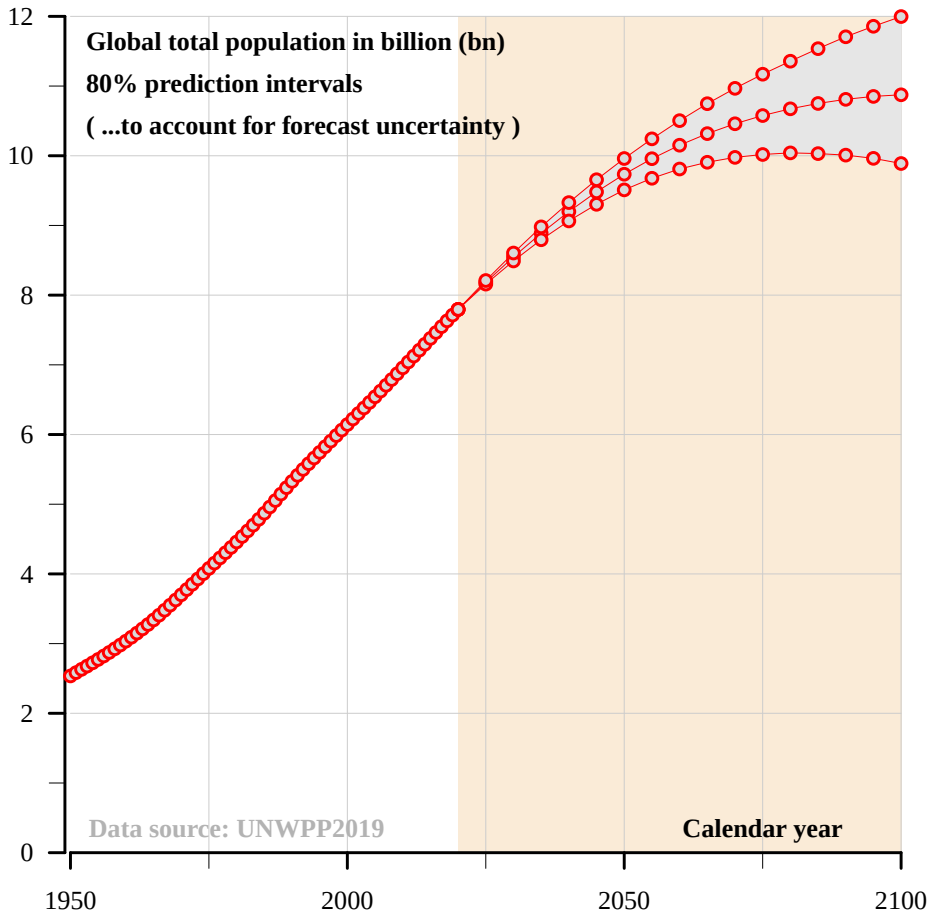
- COS-R403: Forecasting I: Introduction. Days 3–4.

  `https://github.com/christina-bohk-ewald/2020-COS-R403-forecasting-I-introduction`

- **Lee, R. D., & Carter, L. R. (1992)**
  Modeling and forecasting U.S. mortality. Journal of the American Statistical Association, 87(419), 659-671.

- **Booth, H. (2006)**
  Demographic forecasting: 1980 to 2005 in review. International Journal of Forecasting, 22(3), 547-581.

Analyze **latest** UNWPP forecasts



- Analyze latest UNWPP forecasts of, e.g., fertility, mortality, and population size and structure for countries and regions of your choice.
- In what regions is life expectancy at birth forecasted to increase stronger than in others within the next 50 years?
- In what regions is demographic ageing forecasted to become stronger than in others?
- What are societal implications of these developments?
- How do the UNWPP forecasts compare to national forecasts in Finland?

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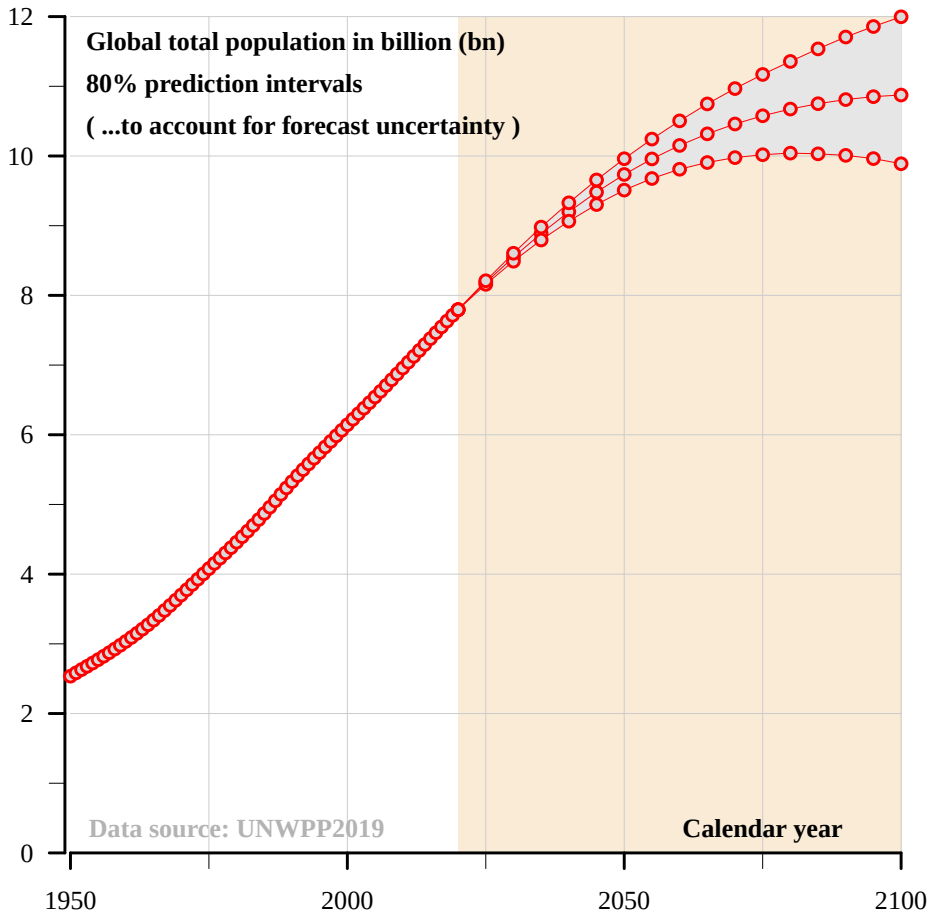

Sources of information to start with:

- COS-R403: Forecasting I: Introduction. Days 1–2.

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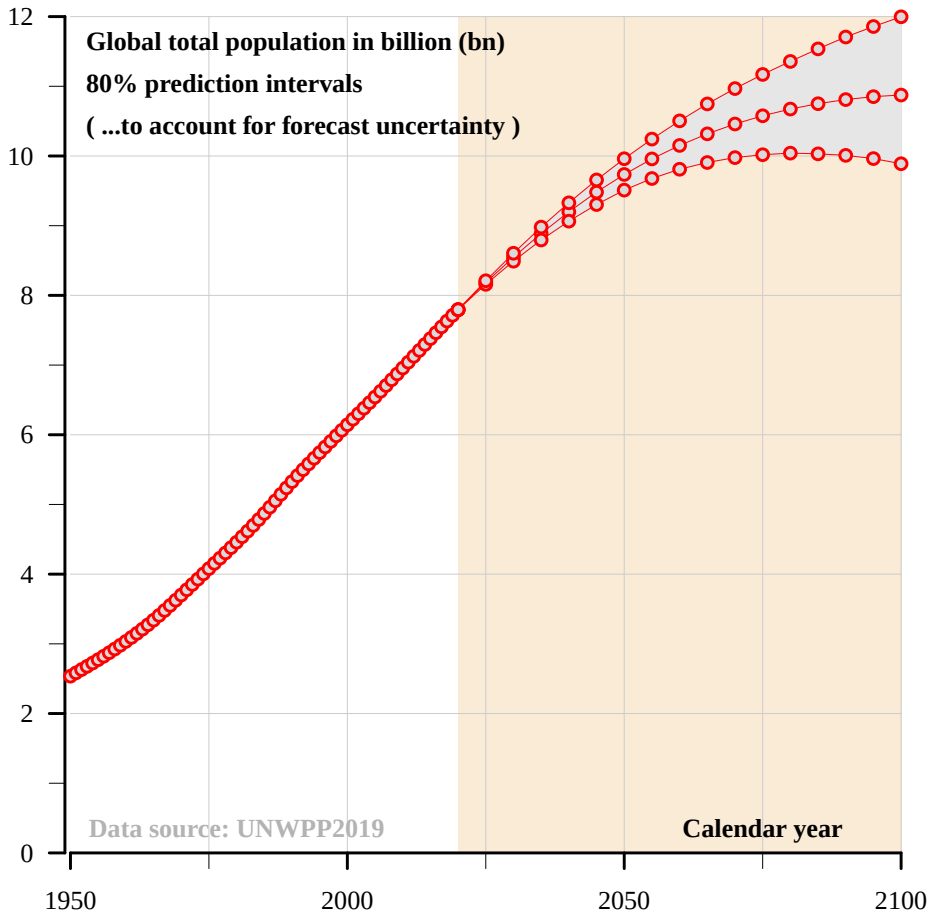
- UNWPP 2019: `https://population.un.org/wpp/Download/Standard/Population/`

- Raftery et al. (2012). Bayesian probabilistic population projections for all countries, PNAS, 109(35), 13915–13921, `https://doi.org/10.1073/pnas.1211452109`

Analyze **previous** UNWPP forecasts



- Analyze previous UNWPP forecasts of, e.g., fertility, mortality, and population size and structure for countries and regions of your choice.
- Compare the forecasts with the actual development: how accurate have previous UNWPP forecasts been?
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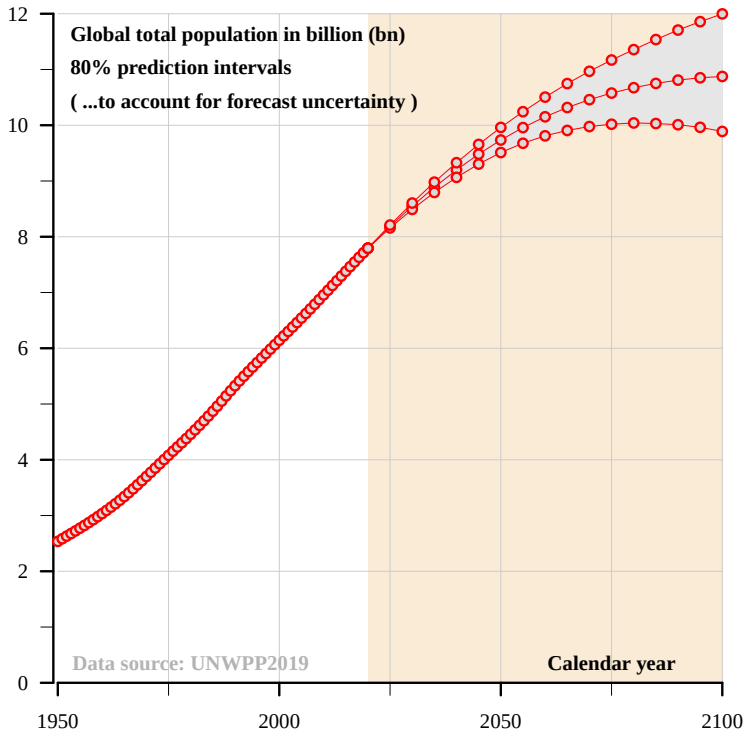

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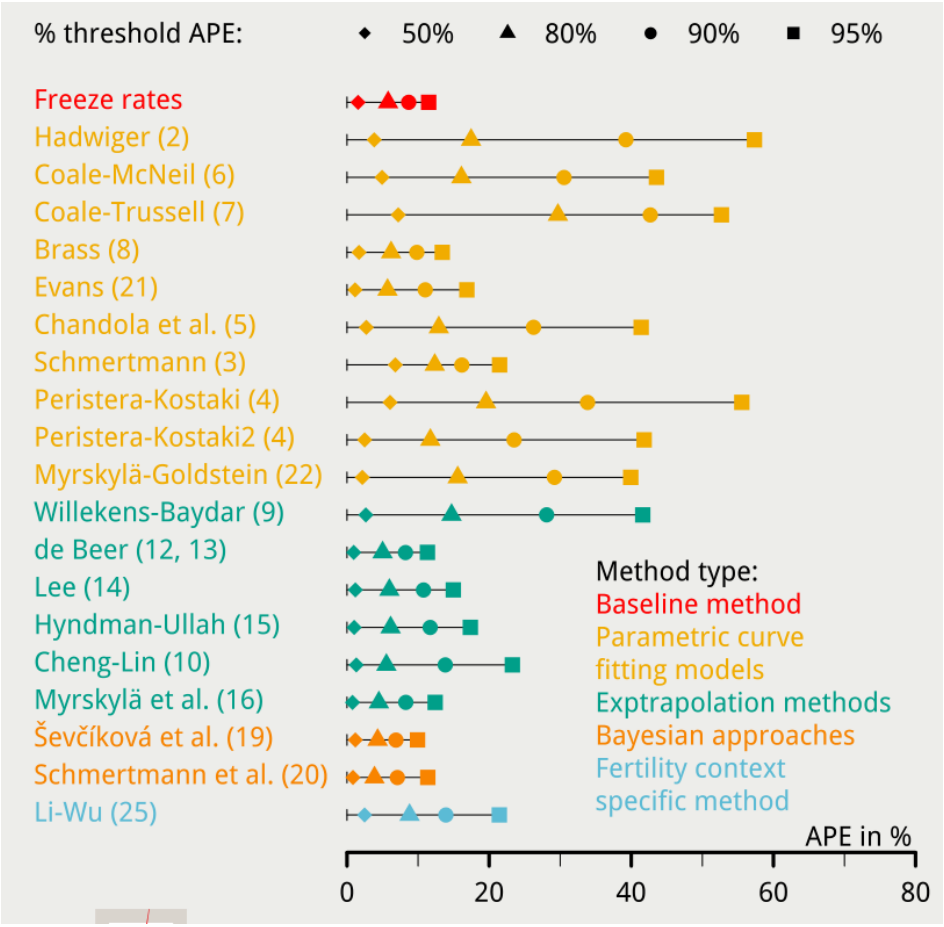
Apply and validate forecast method *Freeze rates*



- There are plenty of methods for forecasting fertility. But which on to choose? A recent paper has shown that complex methods do not necessarily outperform simple methods.
- How good does the baseline approach *Freeze rates* forecast fertility in various countries and regions?
- How well does this baseline approach *Freeze rates* forecasts fertility in comparison to national forecasts in Finland?

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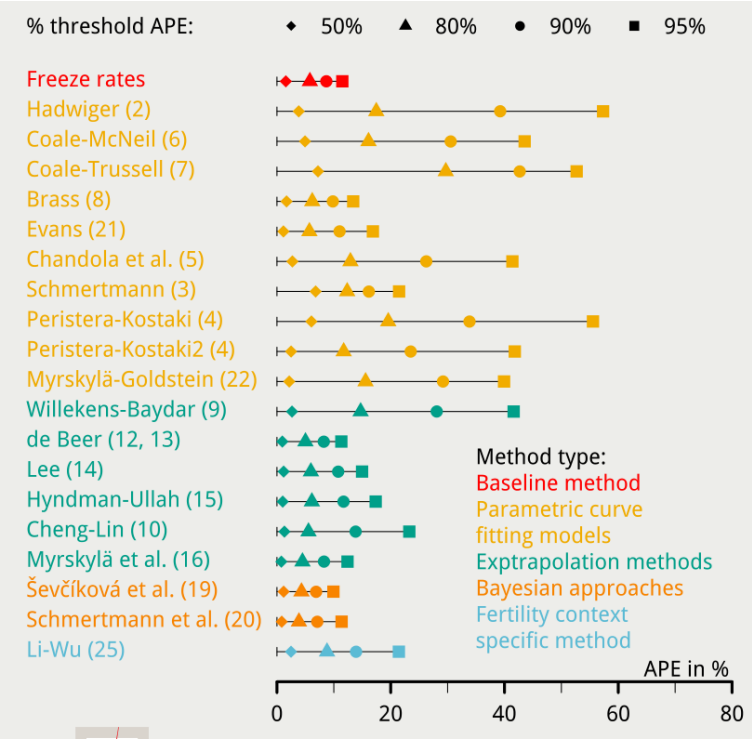

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- Bohk-Ewald et al. (2018). Forecast accuracy hardly improves with method complexity when completing cohort fertility, PNAS, 115(37), 9187–9192,

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Brainstorming

What would you like to do?

Time for you to think and discuss suitable research questions for your project.

5 broad topics that you can adjust to your specific interest, or a sixth (not yet known) topic...

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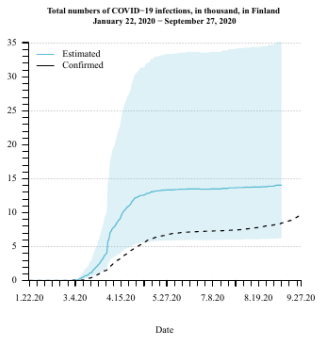

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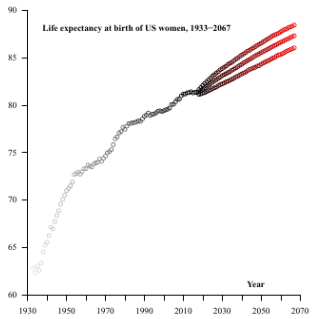

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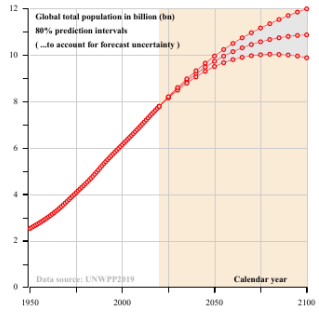

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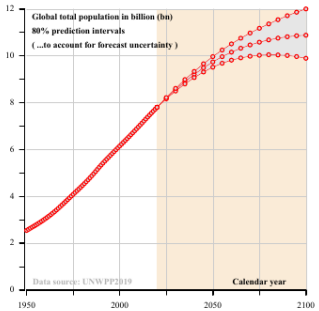

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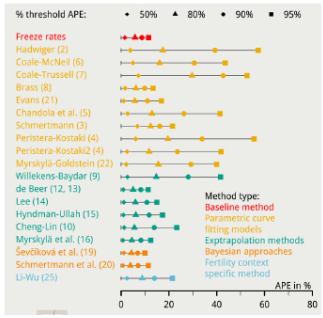

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What would you like to do?

?

What you should try to finish by this week

By this week, you should try to:

- Select a broad research topic for your own project
- Create a plan for your own project including weekly goals

Create pairs of *project leaders* and *student reviewers*

Roll the dice?

Please prepare for next Monday

For next Monday, please prepare a short report regarding:

- Your progress made this week ($\rightarrow$ topic & plan for project)
- Your problems encountered this week & what you are going to do in order to overcome them ($\rightarrow$ open questions?)
- Your goal for next week and what you are going to do in order to achieve it ($\rightarrow$ steps / activities)

Course learning materials

Course learning materials on GitHub:

`https://github.com/christina-bohk-ewald/2021-COS-D409-forecasting-II-applied-research-project`

Thank you for your attention!

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