Population Projections by Microsimulation at Statistics Austria

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Background: Microsimulation in Official Statistics

- Microsimulation is not new (Orcutt, 1957)
- Neither is its use for population projections (Van Imhoff and Post, 1998)
- Several NSOs use microsimulation models (e.g. Demosim (Statistics Canada, 2022), MOSART (Andreassen et al., 2020), DESTINIE (Blanchet et al., 2011), MikroSim (Münnich et al., 2021))
- Still, **official population projections** are **rarely computed** using **microsimulation**
- **Cohort component method (CCM)** remains **standard model**

Motivation

The **cohort-component method** is the standard tool for the production of **population projections** in official statistics

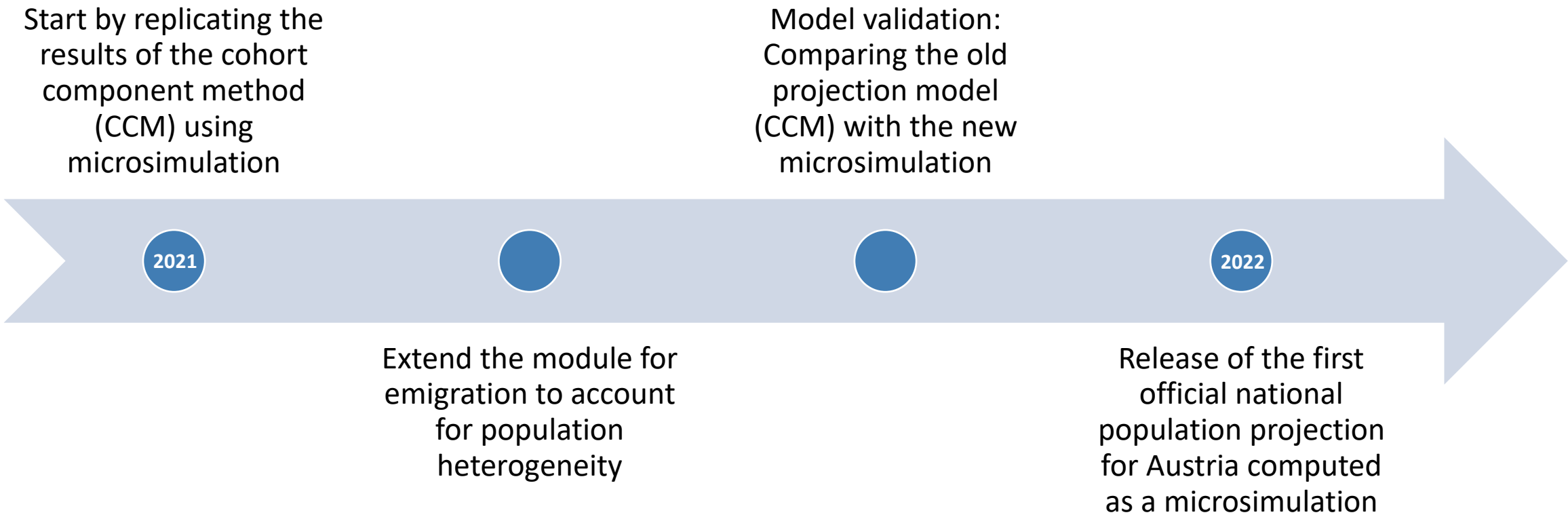
- computationally simple
- does not require a broad range of input data
- well established in the literature

However, it cannot:

- capture complex and dynamic demographic processes
- account for (additional) population heterogeneity
- produce results for a variety of individual-level characteristics (only aggregates)

→ **Microsimulation presents a solution to these issues**

Moving towards microsimulation



Replicating CCM results using microsimulation

- The cohort-component method uses **event rates** to determine the projected paths of fertility, mortality and migration (e.g. mortality rates by age, sex, domestic/foreign-born)

- In the microsimulation, these rates are converted into **waiting times** using the inversion method (inverse transform sampling)

- **Simulate births, deaths** and **migration events** using these waiting times

Statistics Austria‘s microsimulation model: Status Quo

- Dynamic competing risk microsimulation with continuous time
- Characteristics: age, sex, province, country of birth, duration of residence
- Regional breakdown: Austria and federal provinces (NUTS-2)
- Data: Administrative (micro) data for the Austrian resident population
- Programming language: Modgen[1]

→ More on this in the session on Population Projections (Tuesday 9:00-10:30, Ceremonial Hall)

[1] https://www.statcan.gc.ca/en/microsimulation/modgen/modgen

Outlook

✓Microsimulation of core demographic events to produce the population projection

- Gradually develop and extend individual model elements, in order to:
  - enhance the population projection
  - produce projections for other demographic and socio-economic characteristics

- Focus on applications in demography, education, health, labour market

- Develop a microsimulation infrastructure for Statistics Austria

Outlook

- Enhance the population projection:
  - Account for heterogeneity among migrants in fertility and mortality, in addition to emigration
  - Model demographic processes dependent on individual-level education
- Project educational attainment/enrollment and labour force participation
- Project health characteristics and incidence of disease, e.g. cancer incidence and mortality

Challenges along the way

- Moving from CCM to microsimulation represents a fundamental methodological change, requiring:
  - a deeper understanding of model building
  - advanced statistical programming and data analysis skills
  - more resources and computation capacities

- Model extensions require additional data and assumptions for future developments

- Managing different objectives while developing a model for a range of applications and organisational units within Statistics Austria

Concluding remarks

- Unlike the standard cohort-component method, microsimulation can produce results for a variety of individual-level characteristics and account for additional population heterogeneities

- Flexibility to implement new modules and integrate different demographic and socio-economic processes in a comprehensive modelling infrastructure

References

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