Pension Microsimulation Model ELSI

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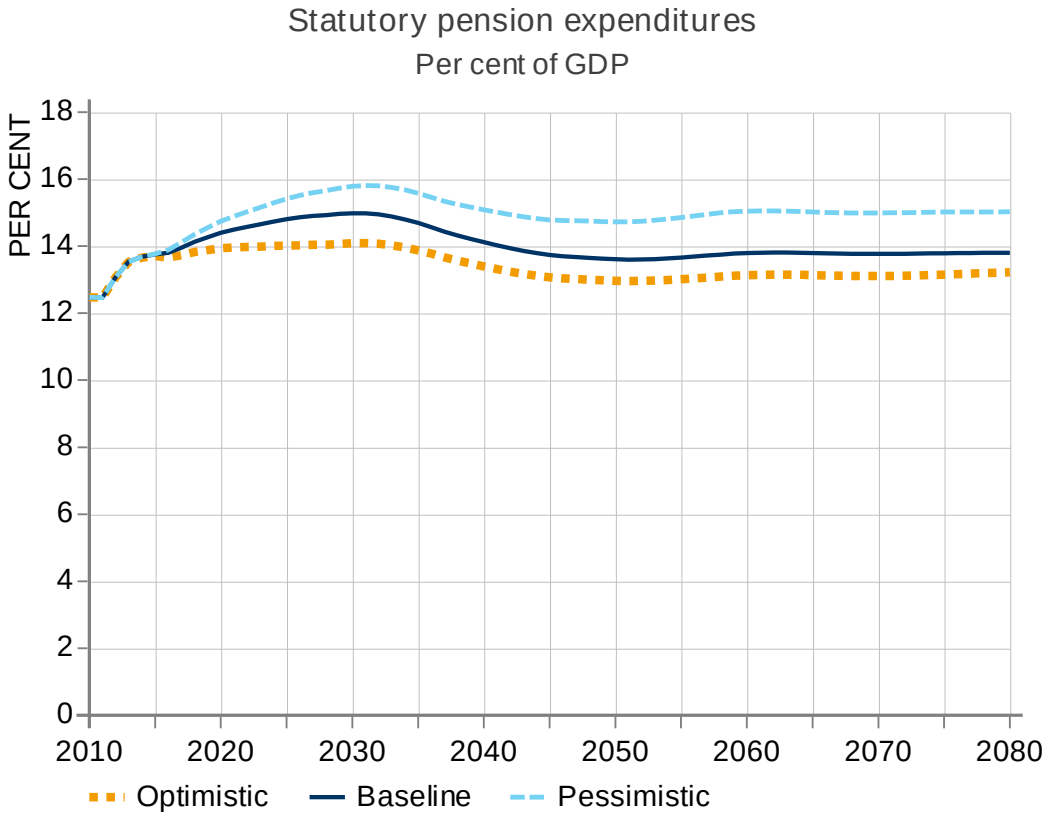
ELÄKETURVAKESKUS

Background

- In Finnish Centre for Pensions we have long tradition in doing long term pension projections with PTS macro model
  - Implemented using Dyalog APL
- The macro model gives good insight on pension expenditure and funding on system level
- No individual modeling
  - Not possible to get any distributional results on pension benefits

Hence, the need of microsimulation

Nice picture (PTS macro model)



Microsimulation

- (Harding & Gupta 2007):
  - *"The defining characteristic of microsimulation models is that they analyse the likely behaviour of and the impact of policy change upon **persons**"*
  - *"the microdata usually contains thousands of individual or micro-unit records, with a host of variables describing the demographic, labour force, income and other characteristics of each individual"*
- *In dynamic microsimulation*
  - *The persons get older*
  - *Life events (death, working, retiring, education etc.) are simulated annually*

Finnish pension system (the boring slide)

- Partially funded earnings related pension system (~90% of the pension expenditure)
- Pension accrues according to a fixed (age specific) percent of the earnings
  - Typically 1.5% of the earnings
  - No ceiling
- Various types of pension benefits:
  - Old age pension
  - Disability pension
  - Etc.
- Undergoing a major reform

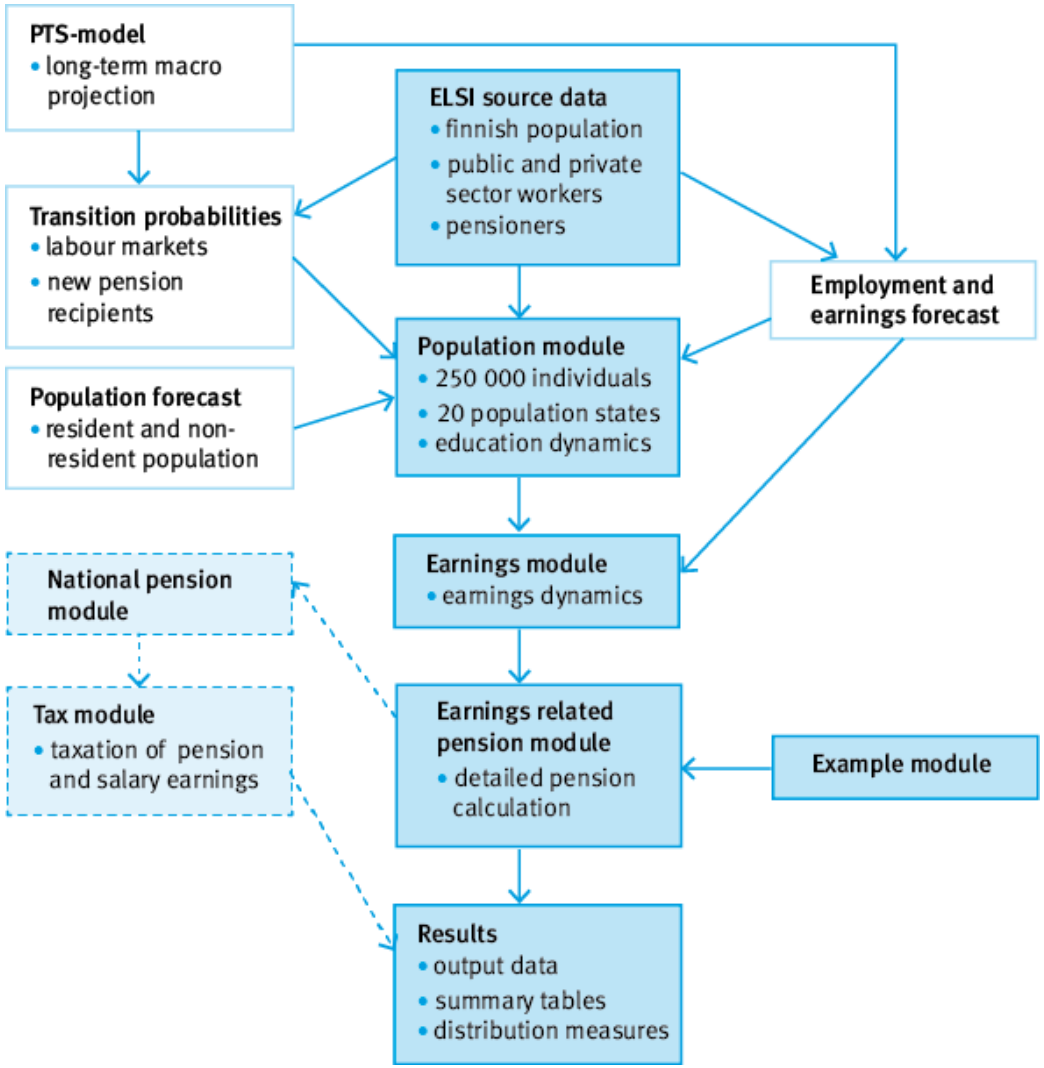
ELSI model (1)

- A dynamic microsimulation model of the Finnish pension system
  - Based on register data
- Simulates 5% sample of the Finnish adult population 2009-2080
- 250 000 individuals in the starting year 2008
  - New eighteen-year-olds and immigrants added annually
  - Around 560 000 individuals in the whole simulation run
- Simulates working careers, earnings and finally pensions for each individuals
- One year time step

ELSI model (2)

- Results on pension benefits
  - Pension distributions
  - Replacement rates
  - Results on subpopulations

The model structure



Why APL?

- Tradition
  - Compatibility with
    - » The macro model
    - » Population projection
    - » Employment projection
- Flexibility
  - Modeling various proposals for a new pension scheme
  - Various results

On implementation

- The key modules are implemented using Dyalog APL
  - 12.1 and 14.0
- Some steps with start data and results also with SAS
  - SQAPL, ODBC
- The modules as independent as possible
- Macro results aligned to the PTS macro model
  - Micro-macro link

APL implementation (1)

- ¨module is implemented as a separate workspace
- The simulation data in compoment files
  - The output of a module is used as an input for the next module
  - No other links between the modules
- Each component file contains a component for each year (typically 77 years)
  - Each individual has 22 attributes each year
  - Alltogether more than 500 000 individuals in the simulation data
  - The size of a component file around 5GB
- The micro-macro link is also implemented using component files

APL implementation (2)

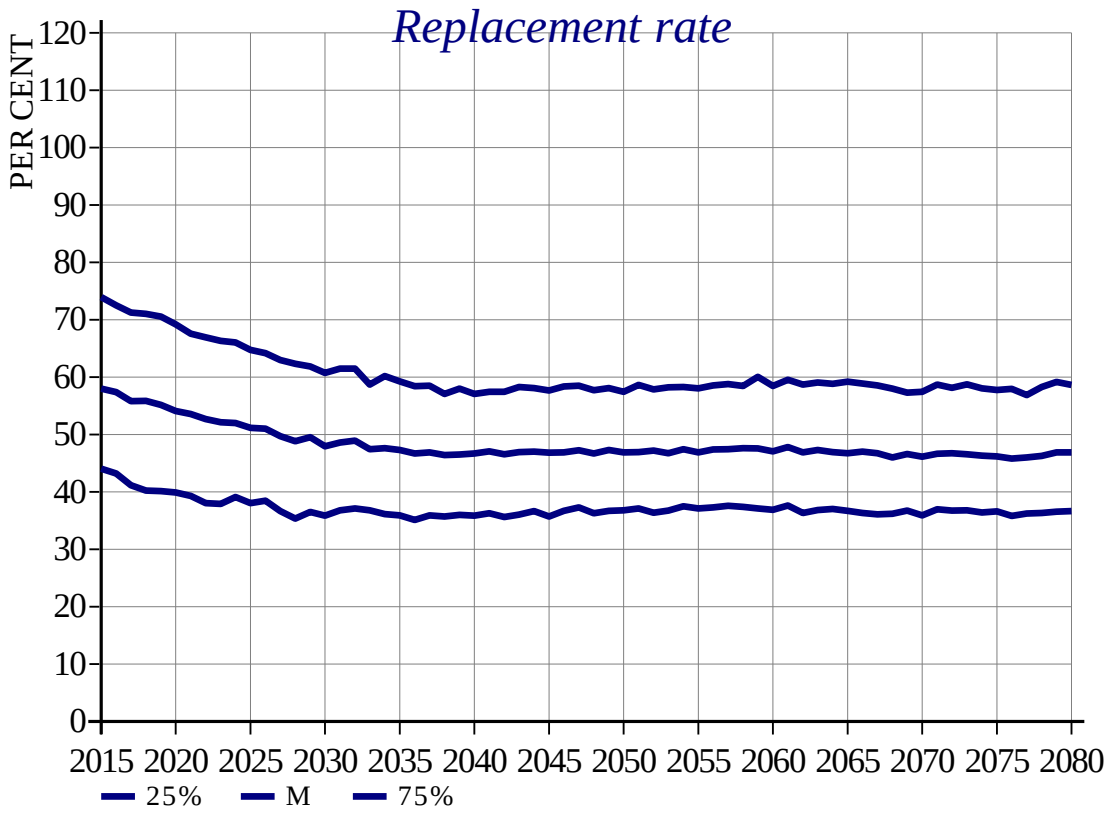
- Each module can be run separately
  - given the corresponding start data
- Each module run takes 10-40 mins (version 12.1)

Version 14.0

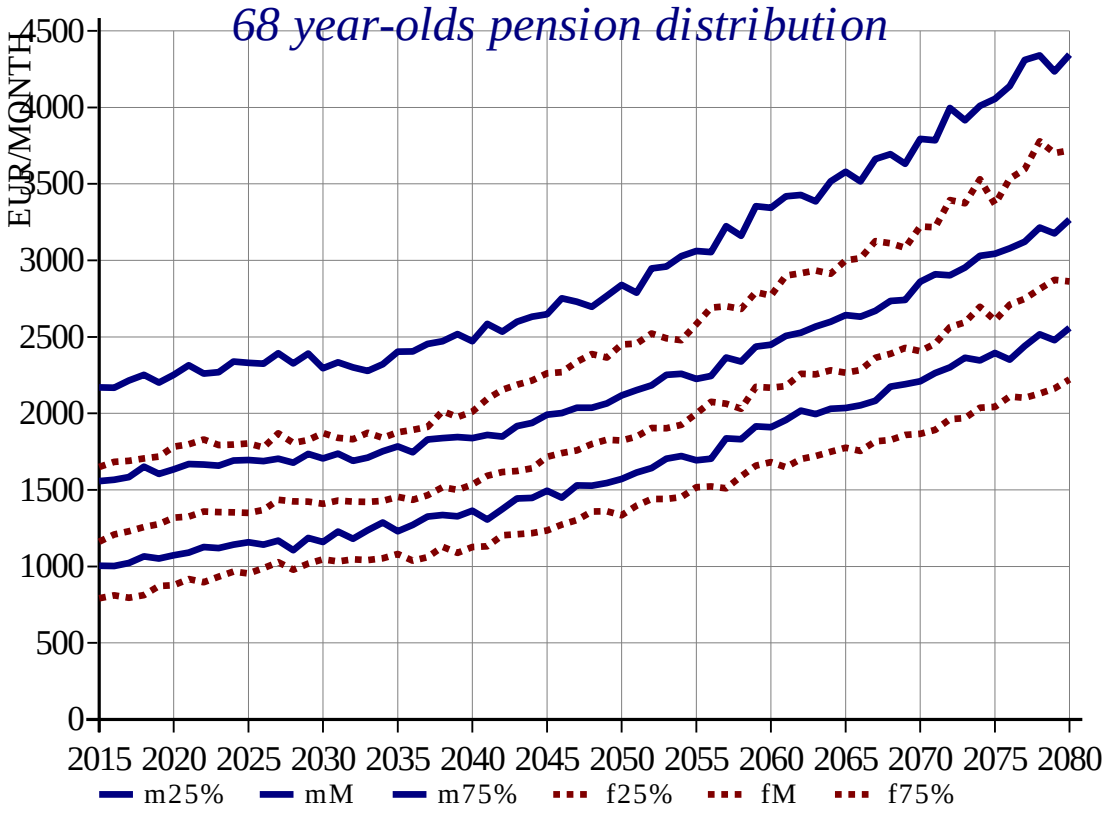
- Transition from 12.1 to 14.0
- Useful features
  - Compressing the components (to 16% of the original 5GB size)
  - Interpreter optimisation
  - Parallelisation (not yet implemented)

Examples of results

Replacement rate



68 year-olds pension distribution



In the near future

- Transition to version 14 completed
- Optimisation of the implementation
- Extending the model

Thanks for your attention!