



Pension microsimulation model used for projections

Project VS/2018/0380
Development of microsimulation
tools for social insurance
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For further information please
consult:

<http://ec.europa.eu/social/easi>.

The information contained in the
materials for this seminar does
not necessarily reflect the
official position of the European
Commission.

Jan Škorpík
Ankara, 2nd November 2021



Content

- **Czech dynamic microsimulation model – NEMO**
- **Data used**
- **Set of indicators for analysis**

Model description

- Actuarial software Prophet
- Stochastic modeling
 - Statuses
 - Events
 - Salaries
- Individual „modelpoints“
- Family approach

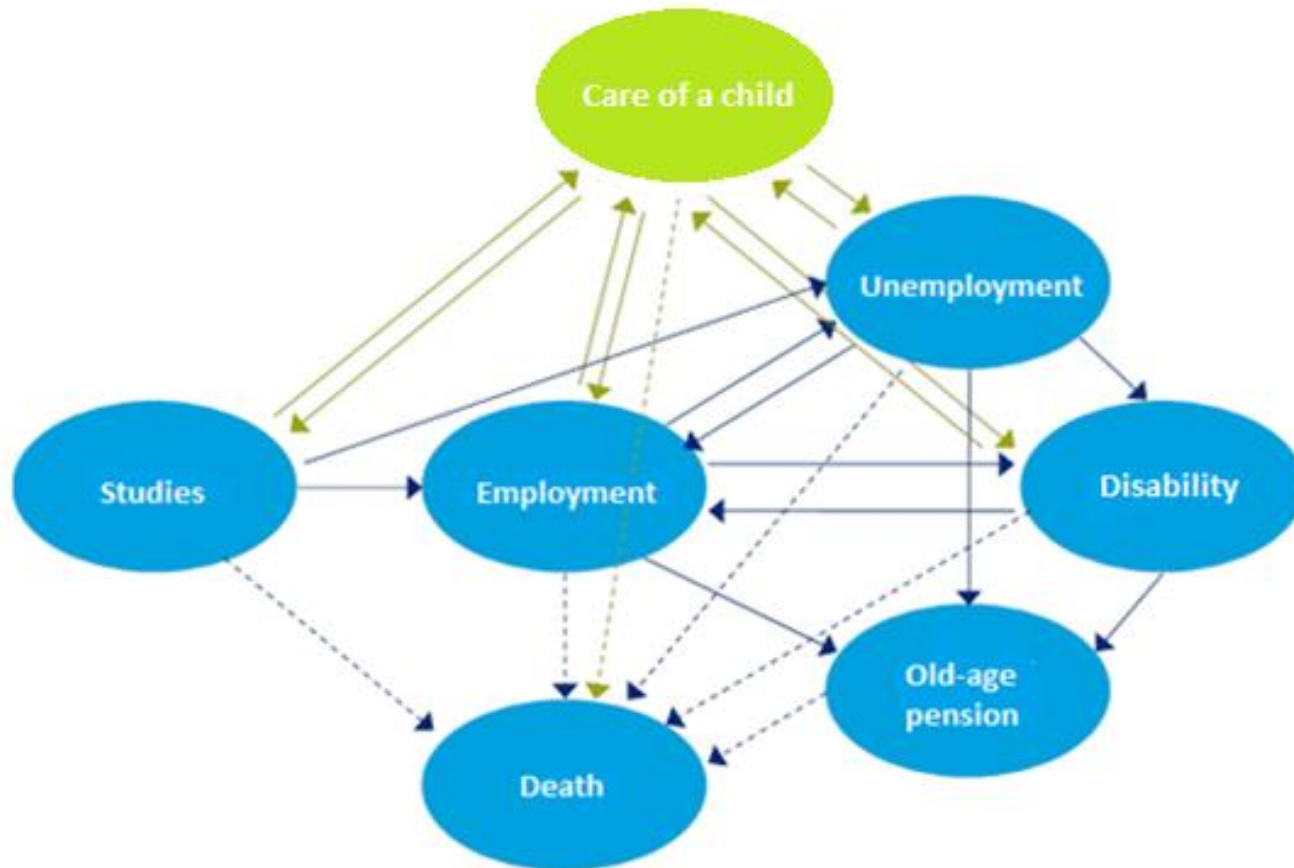
Statuses, sub-statuses and groups

- Employed
 - Healthy
 - Sick
- Unemployed
 - Registered with benefits
 - Registered without benefits
 - Unregistered
- Inactive
 - Registered with benefits
 - Registered without benefits
 - Unregistered
- Out of pension system
 - Emigrants
 - Armed forces
- Groups
 - Old age pensioners
 - Disability pensioners
 - Taking care of child
 - Care of family (in household)
 - Student

Events

EVENT_CODE	EVENT_DESCRIPTION
1,	Death
2,	Study_Start
3,	Study_Stop
4,	Invalidity_Start
5,	Invalidity_Change
6,	Invalidity_Stop
7,	Marriage
8,	Divorce/Widowing
9,	Child_Birth
10,	Child_Care_Stop
11,	Retirement
12,	Pension Option Change
13,	Salary_Change
14,	Disability_To_Pensioner
15,	Family_Care_Start
16,	Family_Care_Stop
17,	Pension_System_Enter
18,	Pension_System_Leave
19,	Birth
20,	OSVC_Start
21,	OSVC_Stop
22,	OSVC_Sickness_Ins_Start

Statuses and decision making processes



Data availability and quality

- **Data availability strongly depends on type of system**
- **Czech pension system is PAYG DB**
- **Some information is collected at retirement, esp. confirming non contributory period granted**
- **Currently using administrative dataset covers mainly contributory periods**

Data availability and quality

- **Full dataset**
 - All info collected up to 2012 - 208 mil. records for 9 mil. active individuals
 - Incomplete – some non contributory periods missing
- **Annual datasets**
 - Pensions in payment
 - Contributory periods
 - Employment
 - Self employment

Set of indicators

- Long-term fiscal sustainability
 - Primary indicators
 - *Pension system contribution to Sustainability indicator S2*
 - *Total implicit debt*
 - *Relative implicit debt for new system entries*
 - Secondary indicators
 - *Revenues from contributions, other revenues, expenditures, balance*
 - *Age structured implicit debt*
- Pension adequacy - decent life
 - *Average time spend at retirement*
 - *At risk of poverty rate (pensioners)*
 - *Benefit ratio*
 - *Benefit ratio for newly granted pensions*
 - *S80/S20 (pensioners)*
 - *Gross (net) individual replacement rate*
 - *Individual relative implicit debt*

Long term financial sustainability - primary indicators



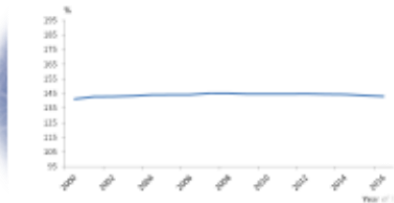
Long term financial sustainability - primary indicators

- Sustainability indicator S2 – **4,8 (pension component 2,9)**
- Total implicit debt – **425,1 % GDP**

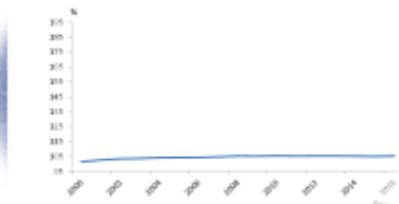


Relative implicit debt for new entrants

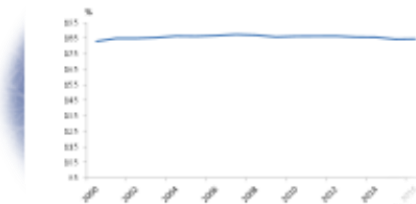
Total



Males

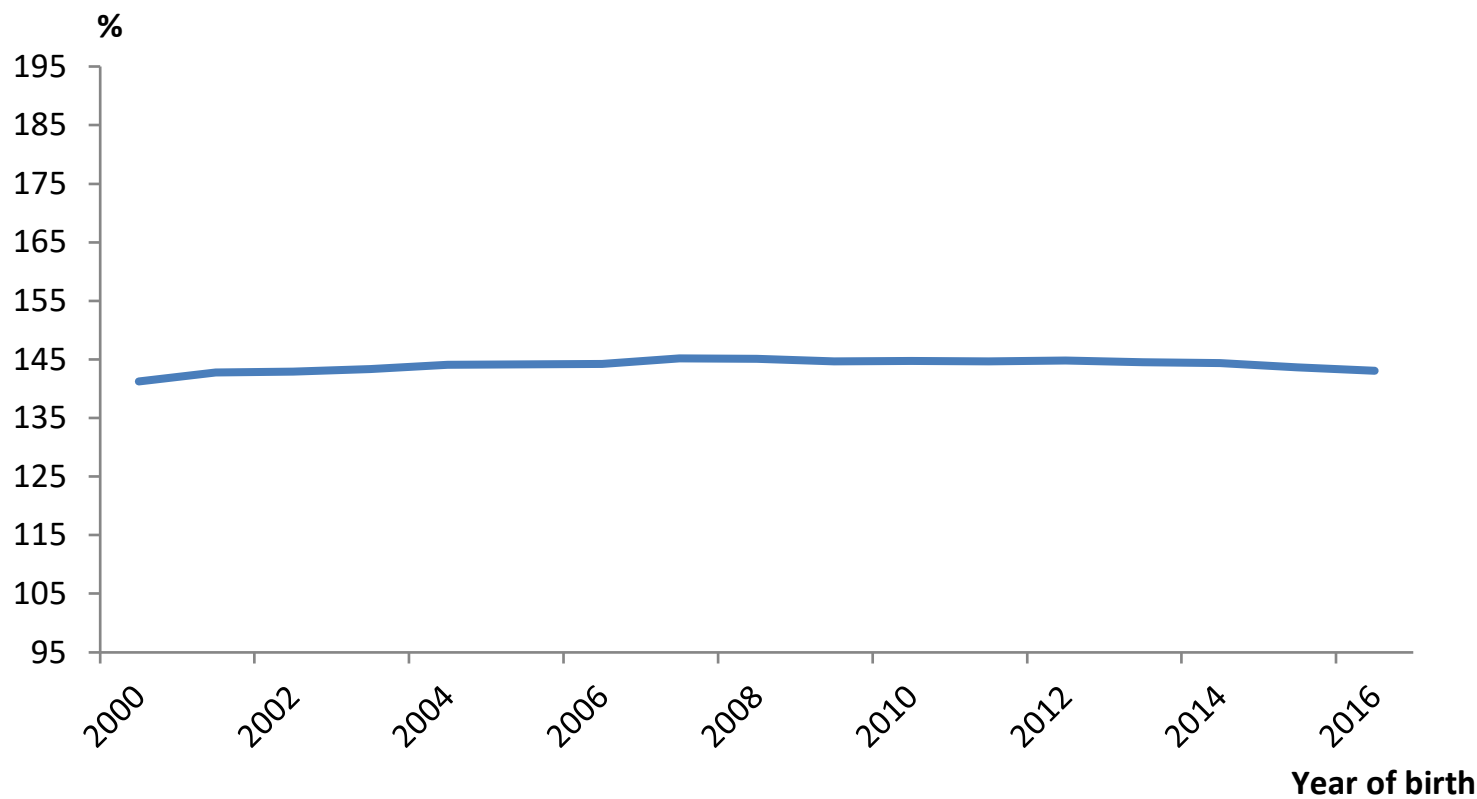


Females

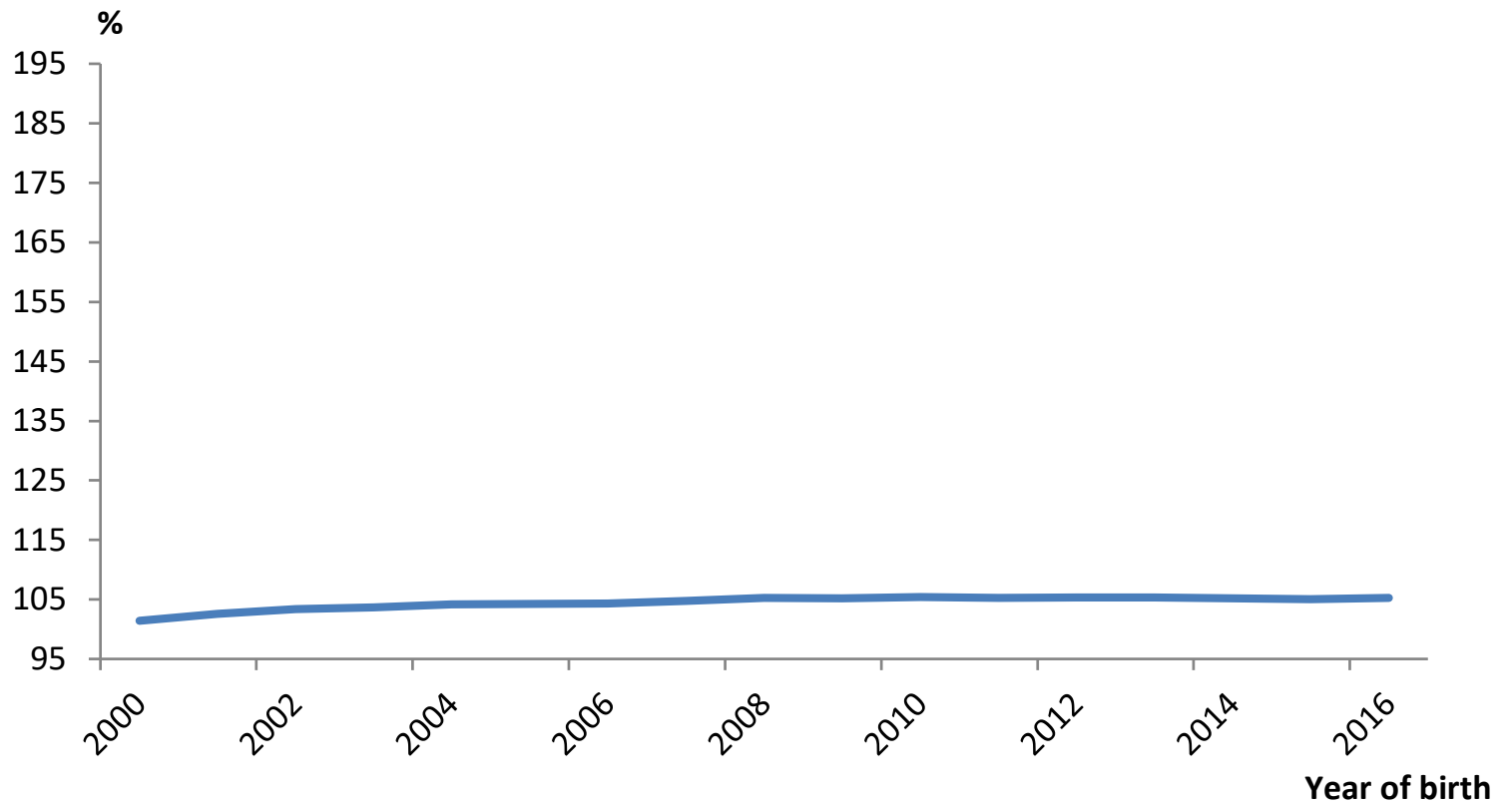




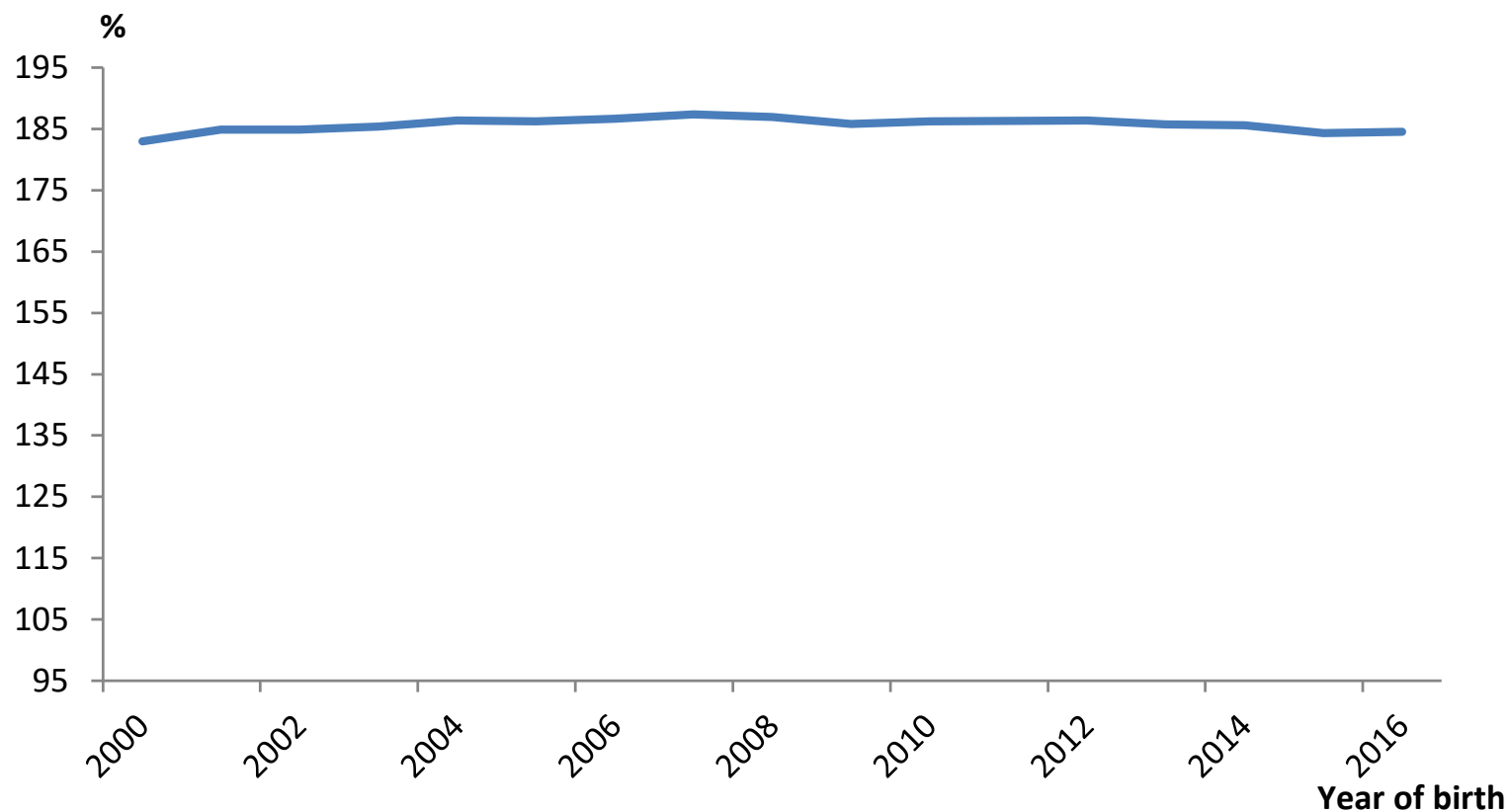
Total



Males

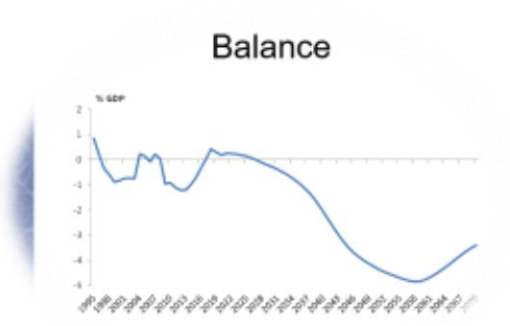
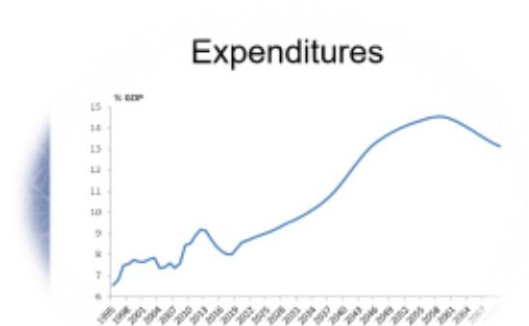
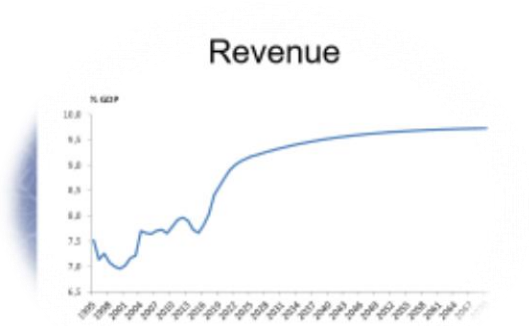


Females

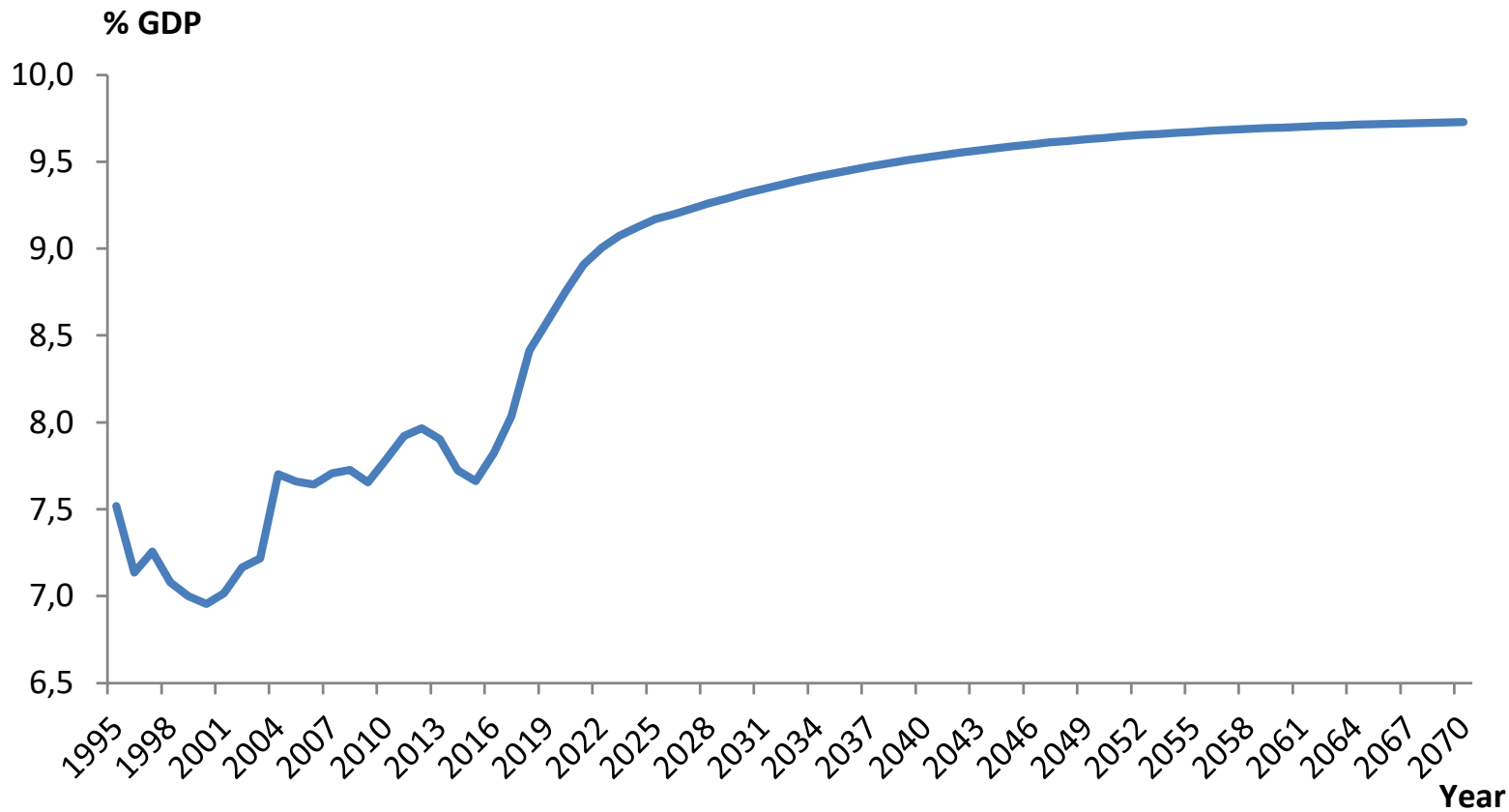


Long term financial sustainability - secondary indicators

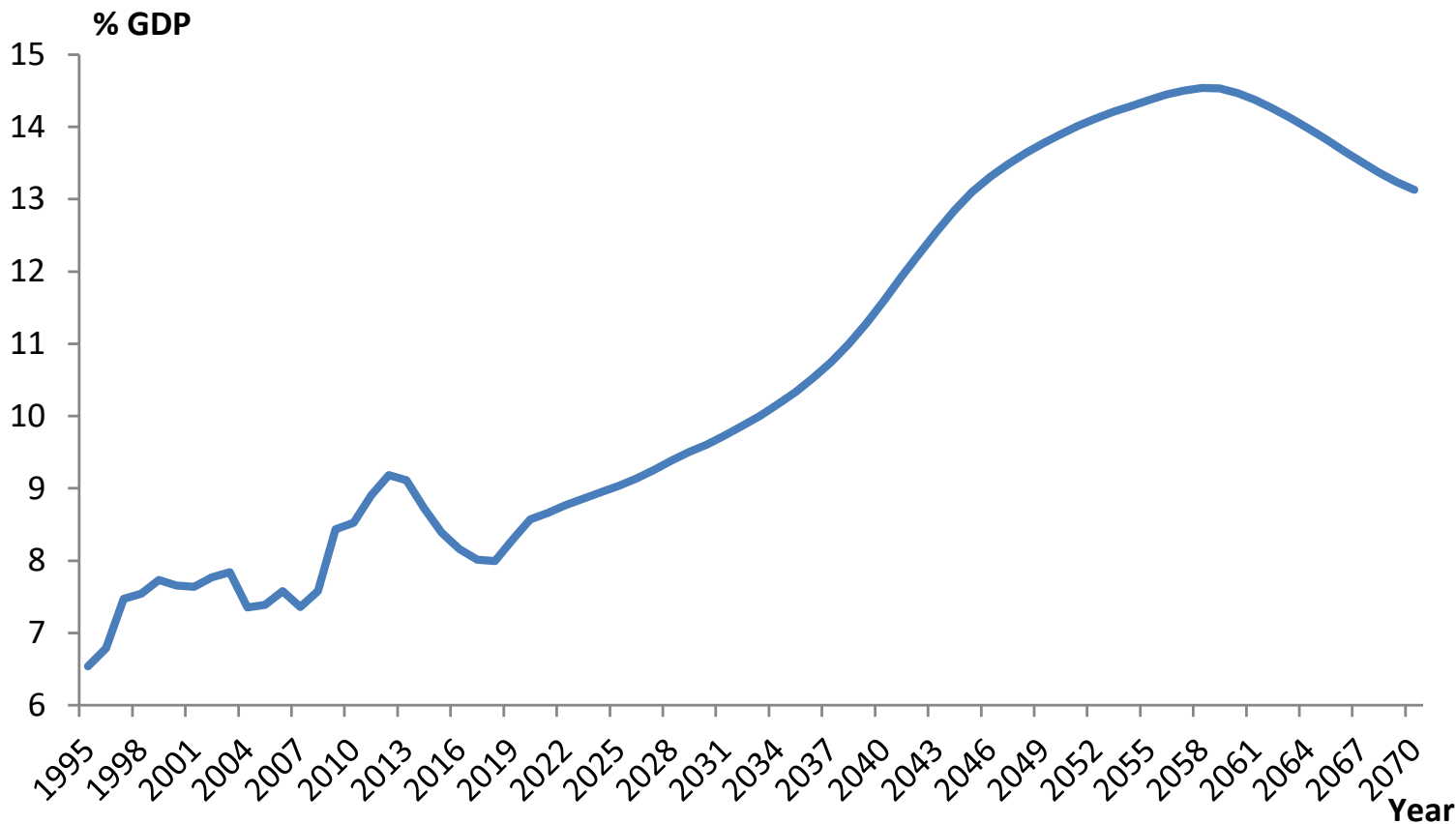
Revenue, expenditures and balance as % of GDP



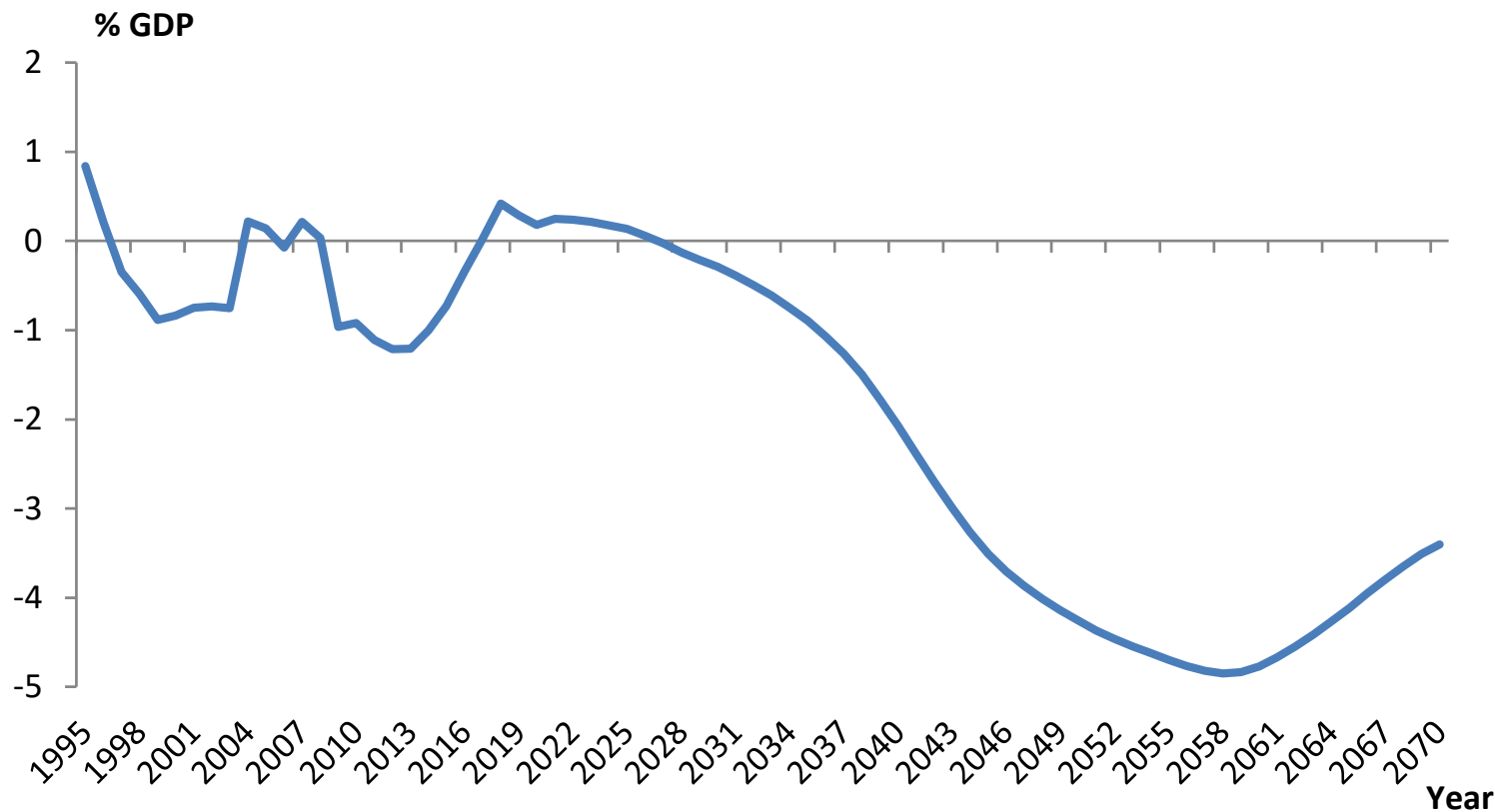
Revenue



Expenditures

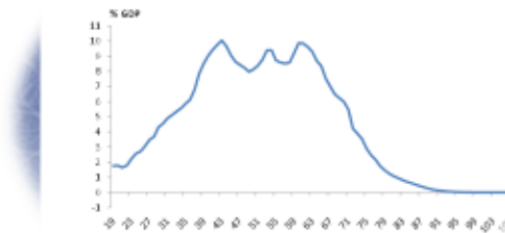


Balance

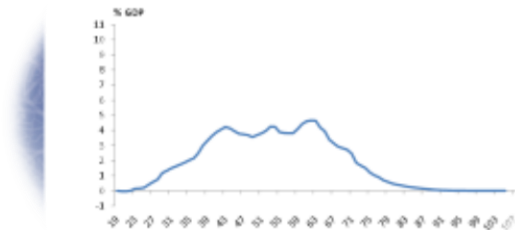


Age related total implicit debt as % of GDP

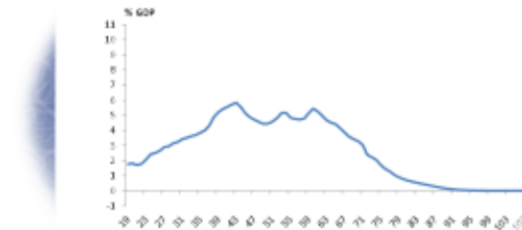
Total



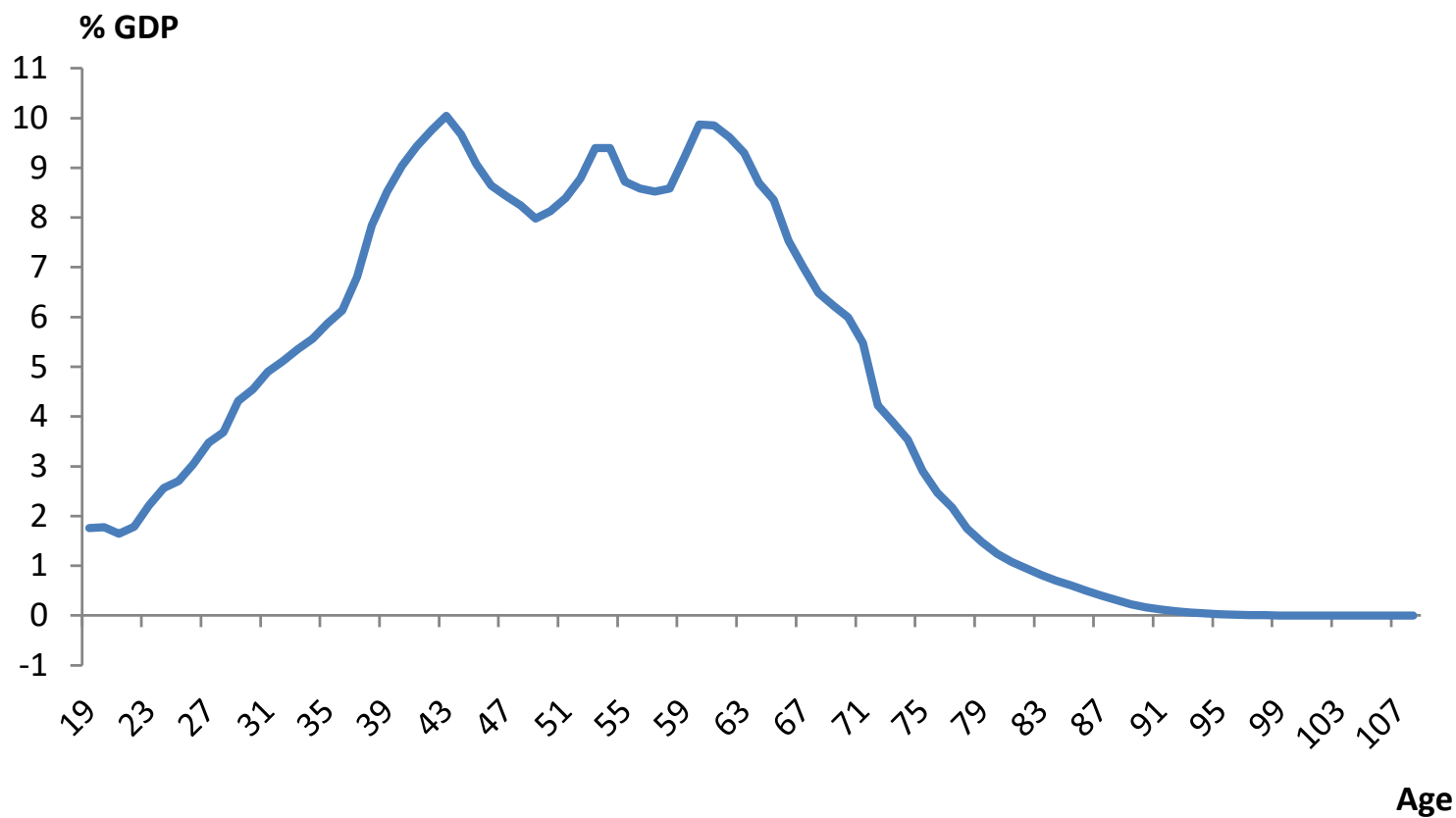
Males



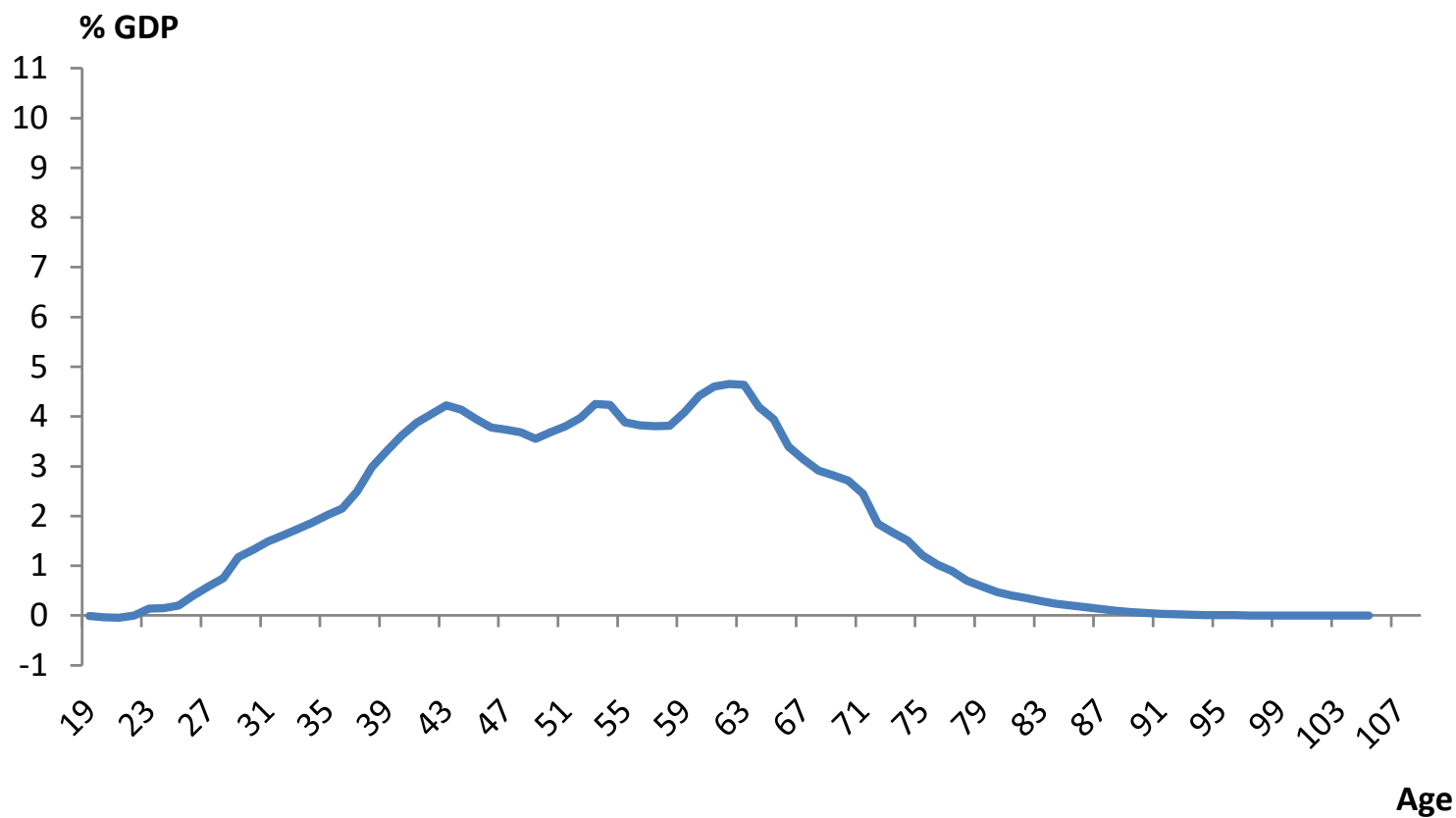
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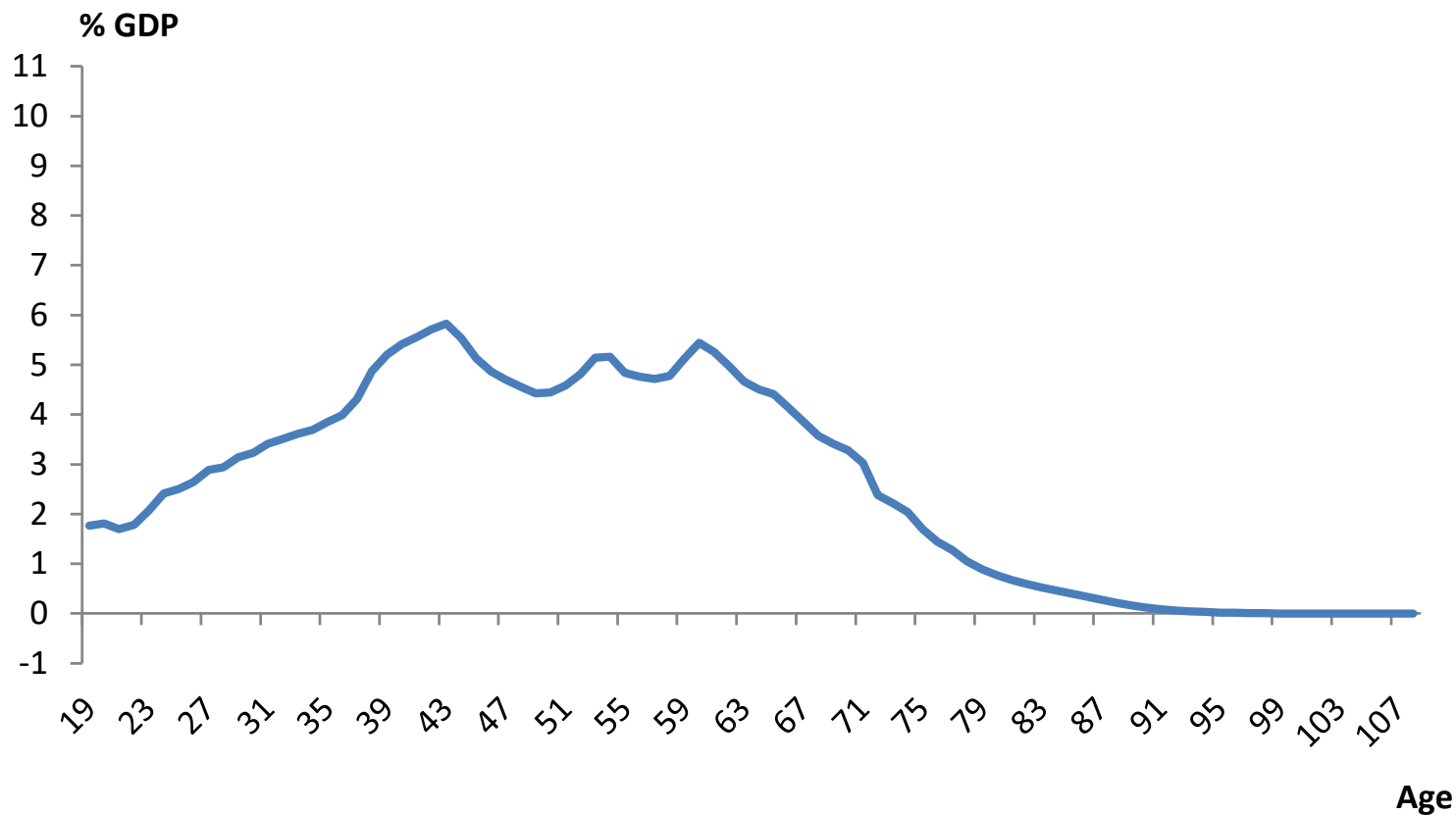
Total



Males



Females



Pension adequacy – decent life

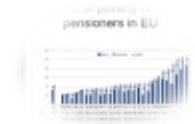
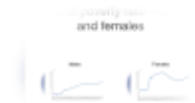
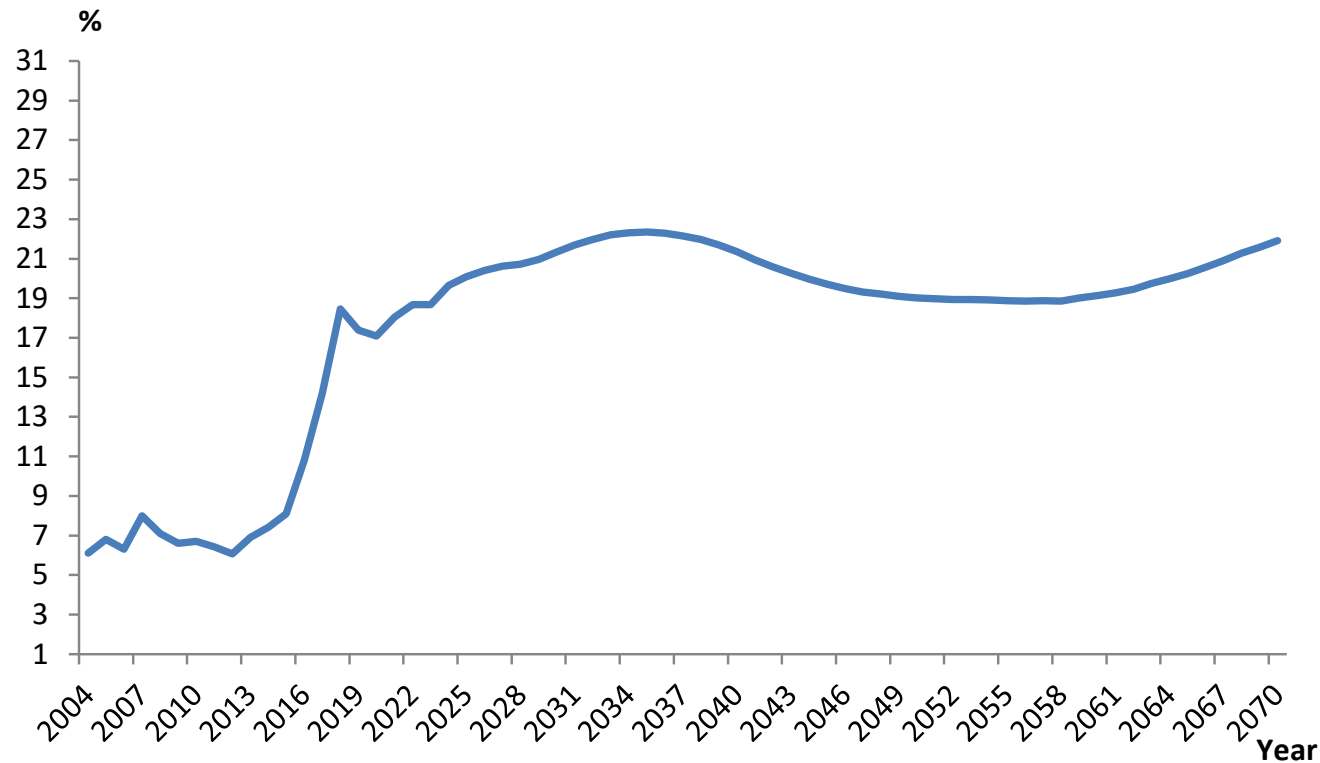
At risk of poverty
rate

Income
replacement

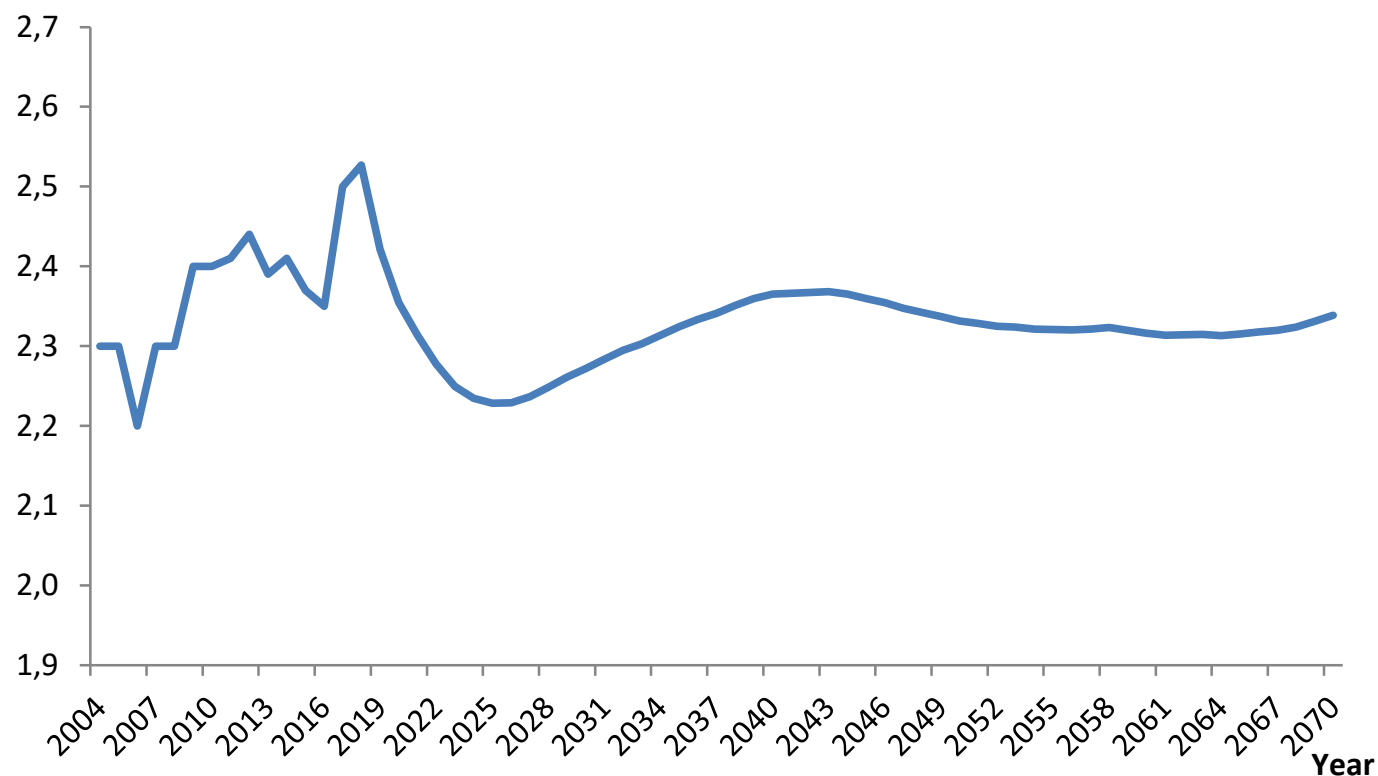
Time in retirement

At risk of poverty
rate

At risk of poverty rate

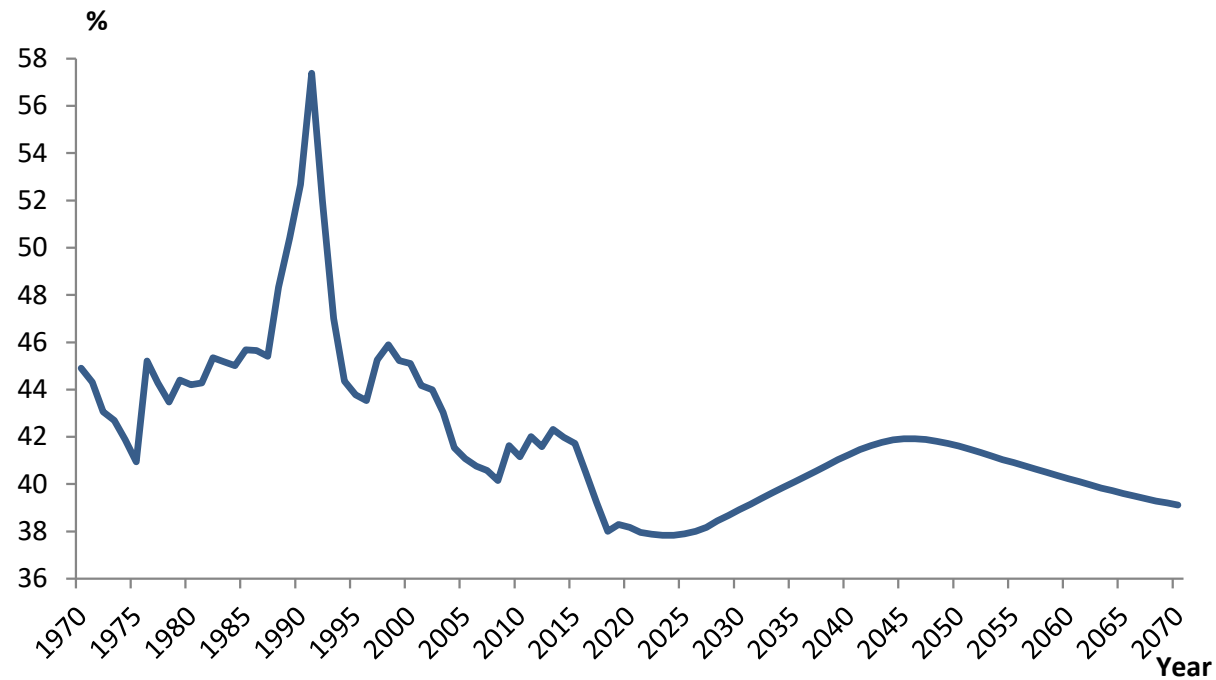


S80 / S20 (pensioners)

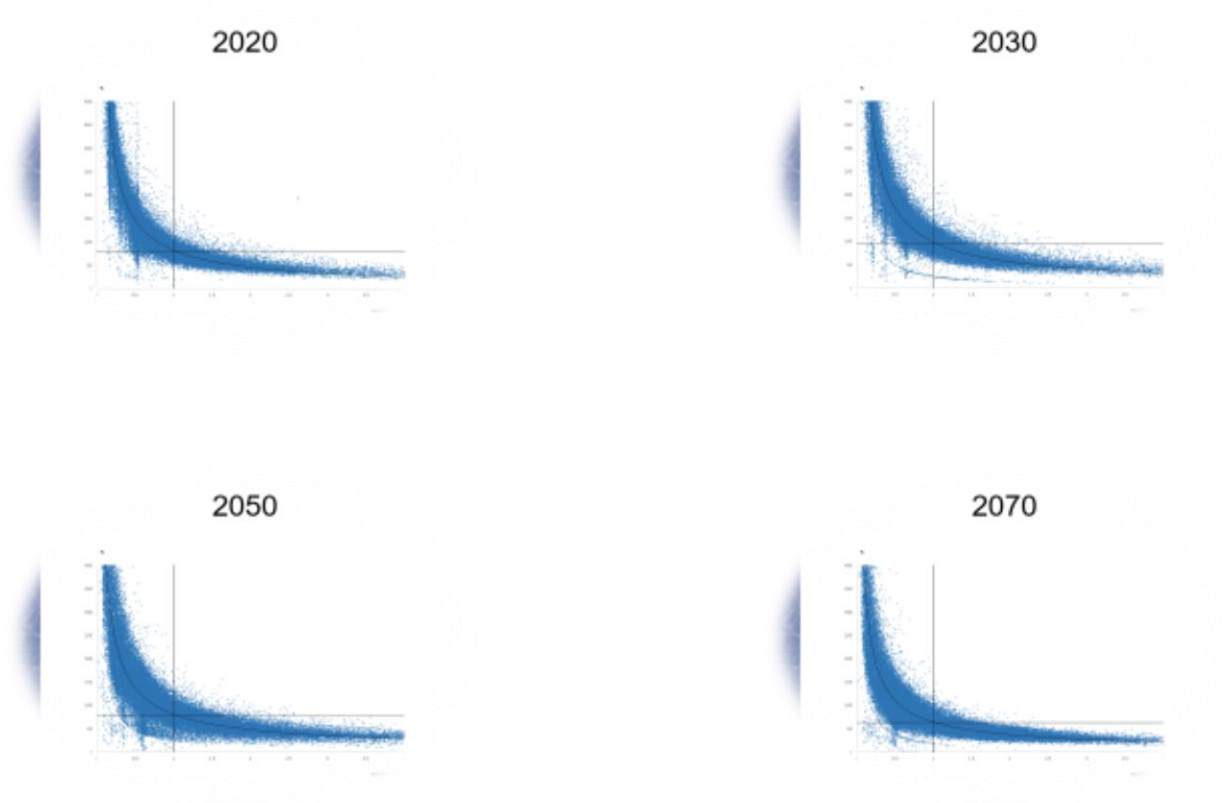


Income replacement

Benefit ratio

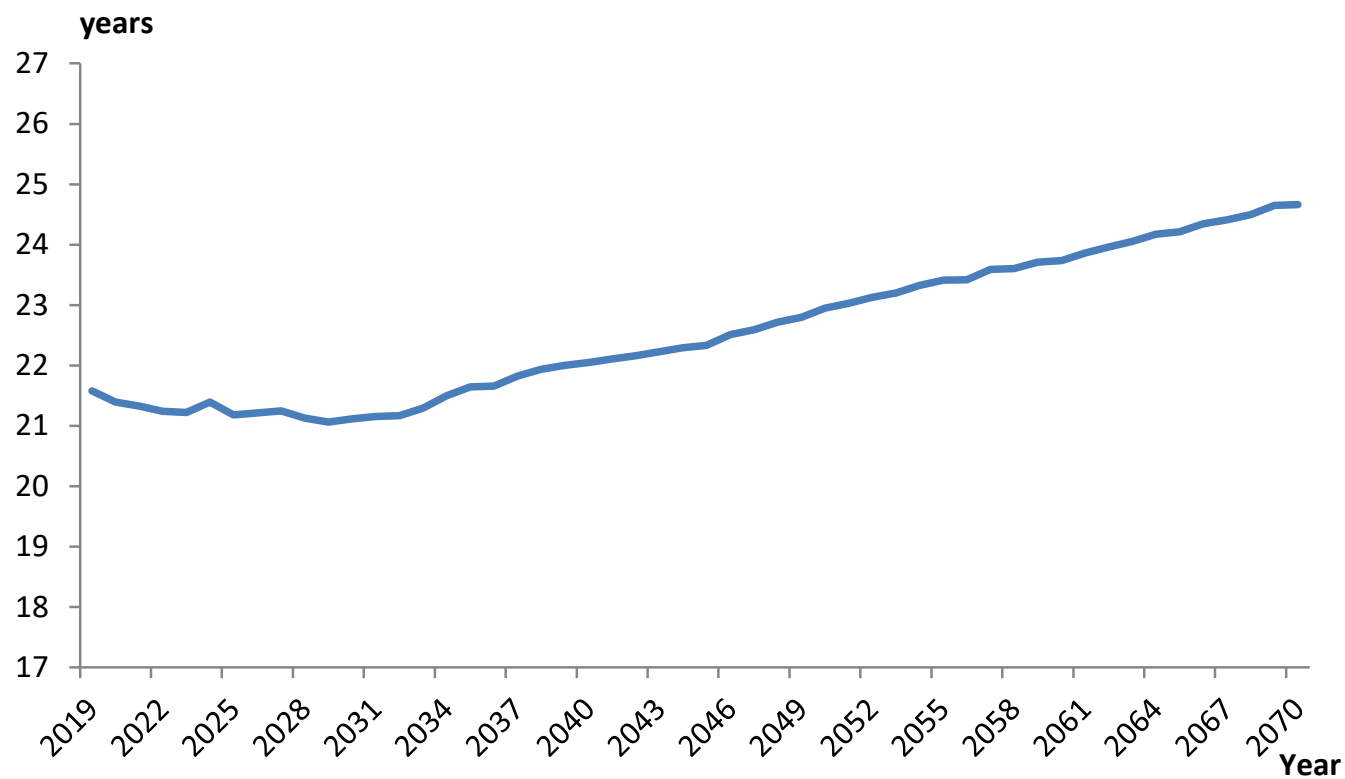


Gross individual replacement rate



Time in retirement

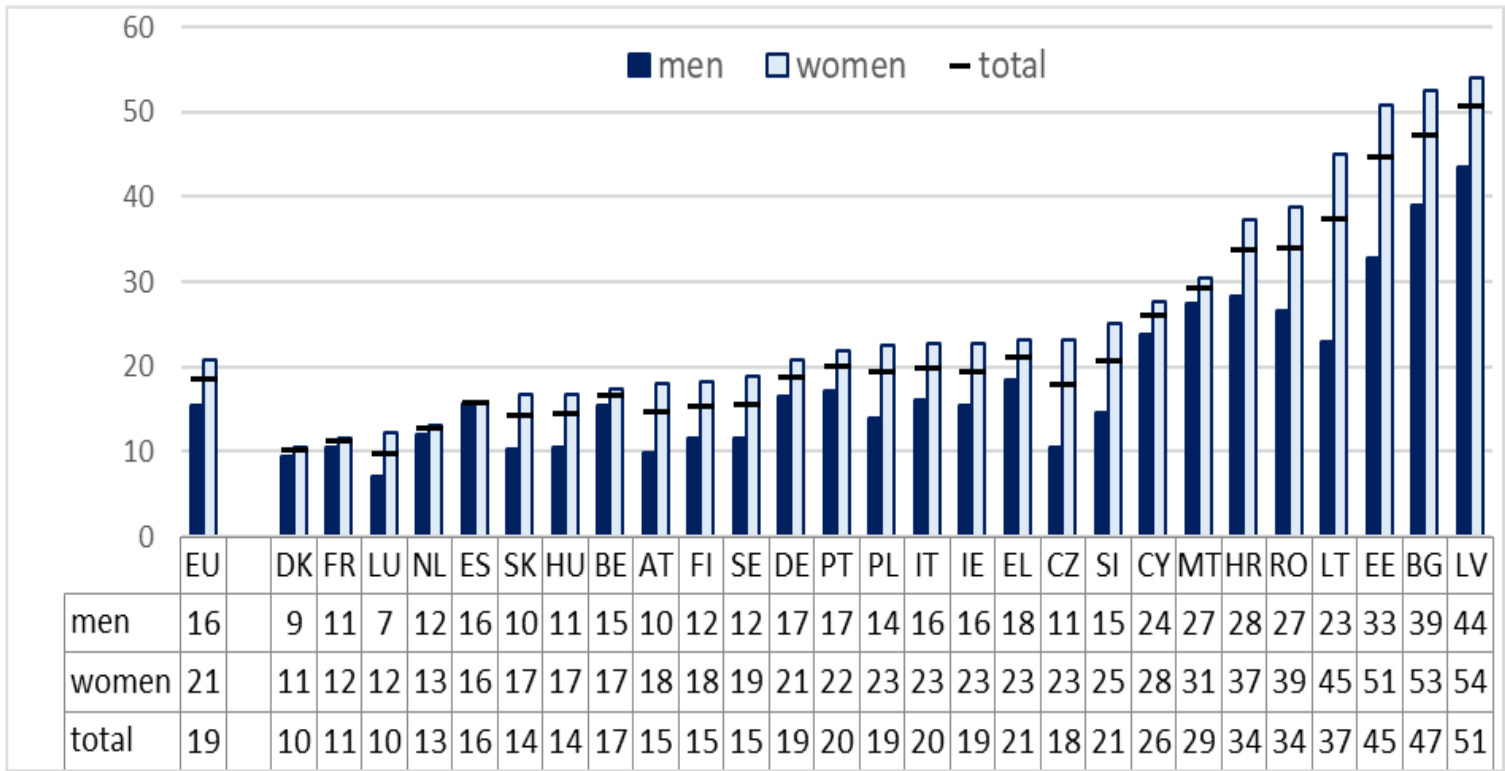
Time in retirement



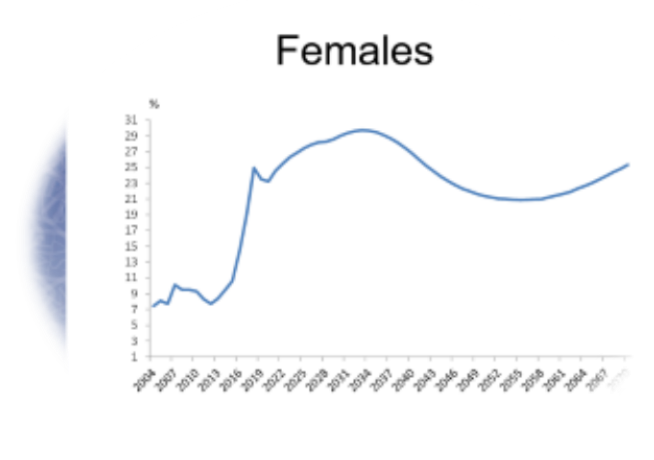
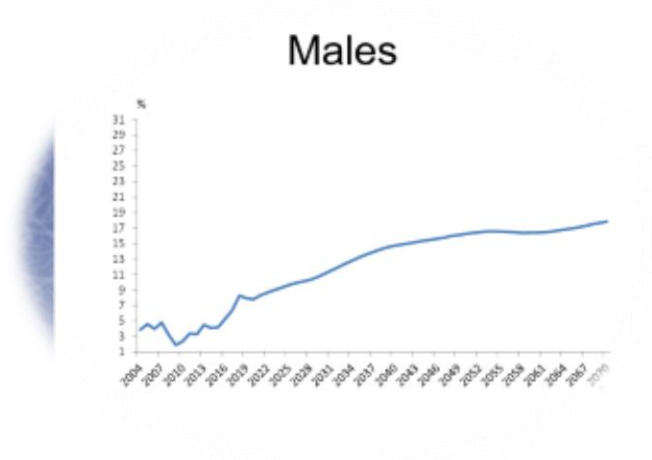


Discussion

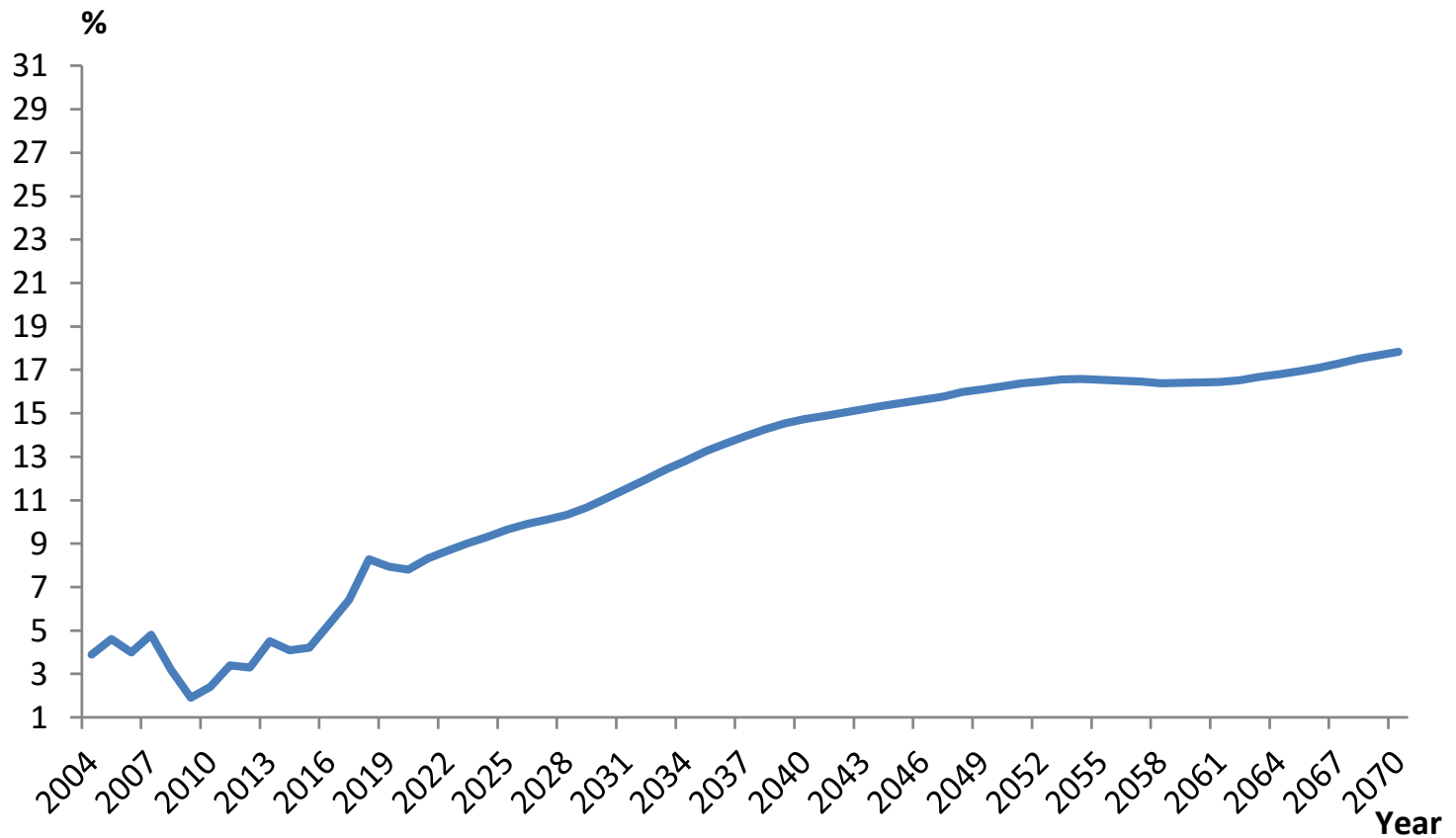
At risk of poverty rate of pensioners in EU



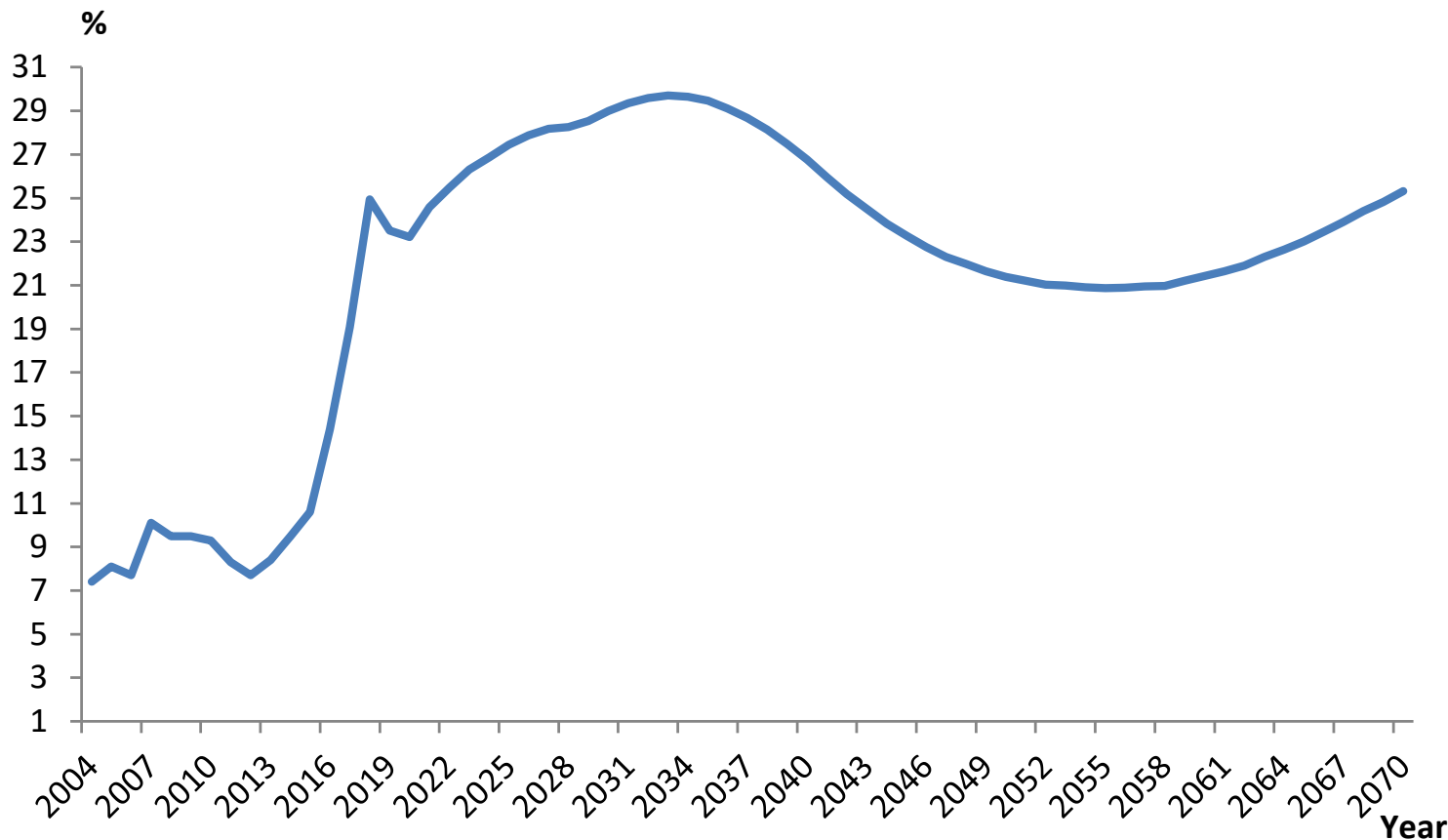
At risk of poverty rate – males and females



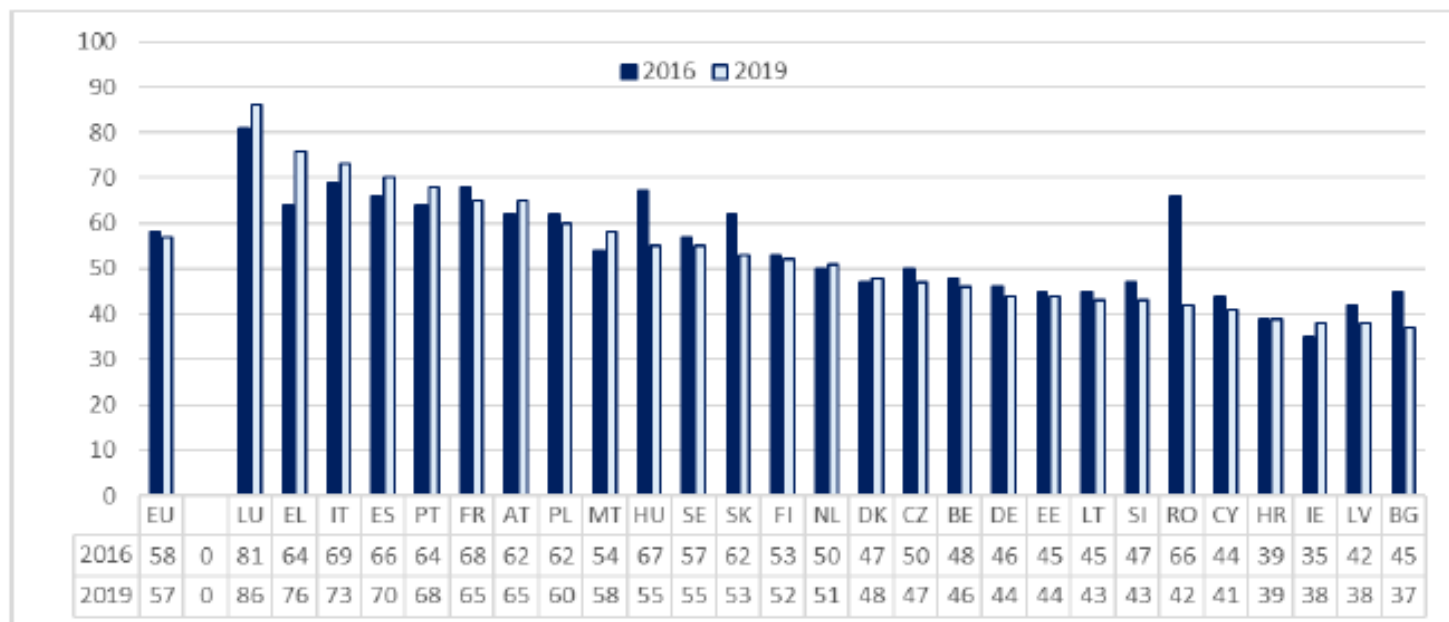
Males



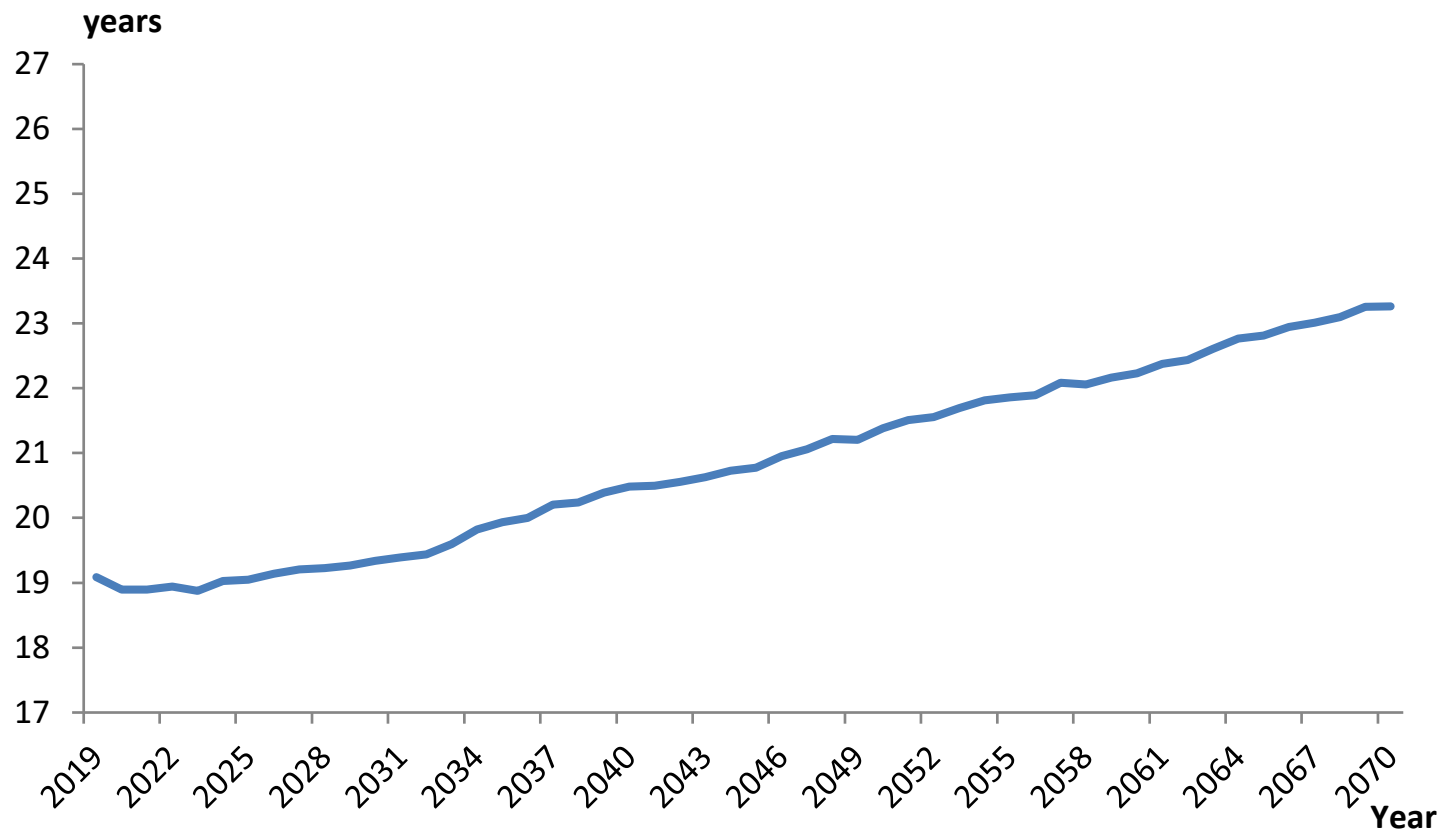
Females



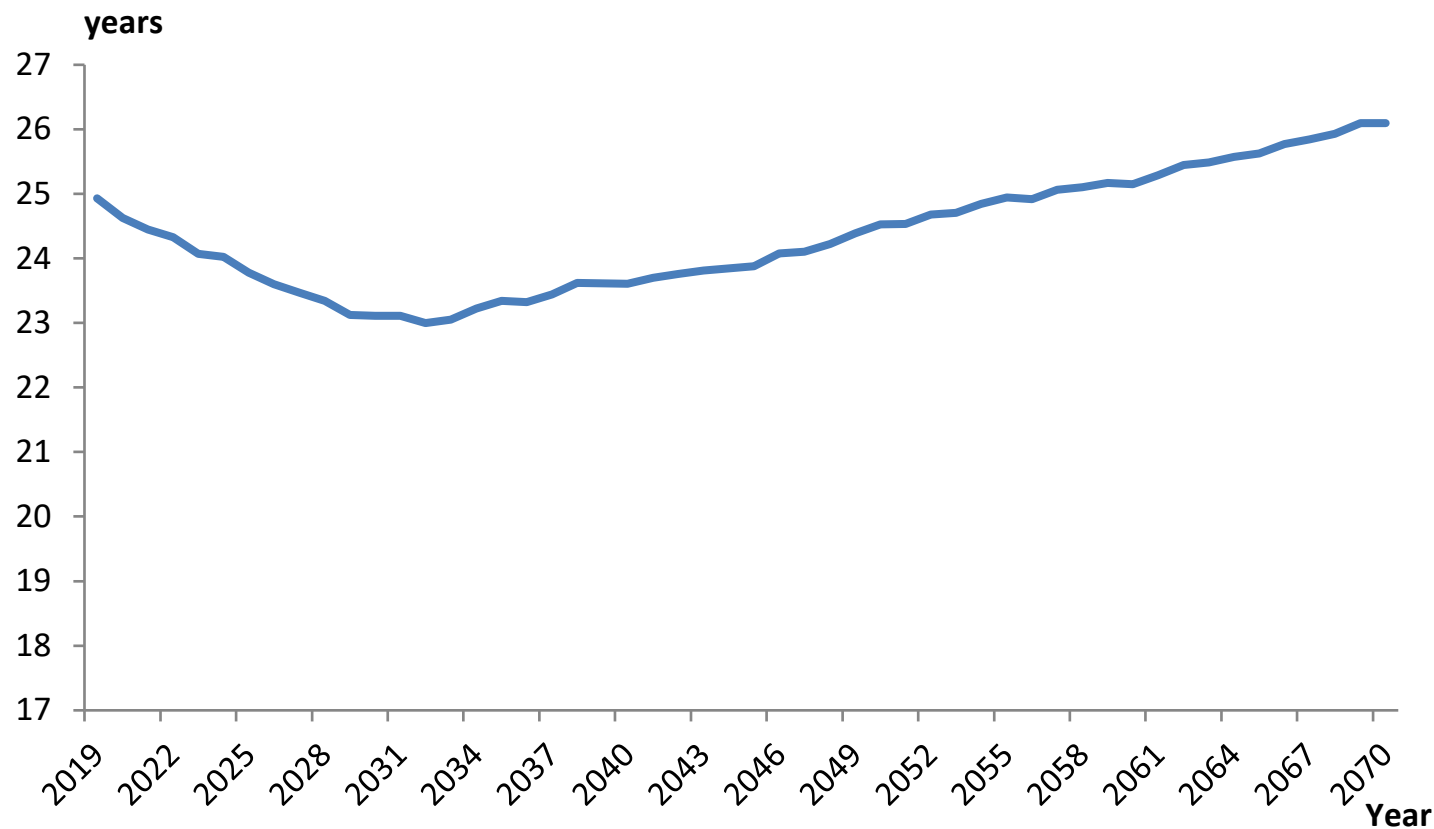
The ratio of pensions to late incomes is stable in nearly all Member States



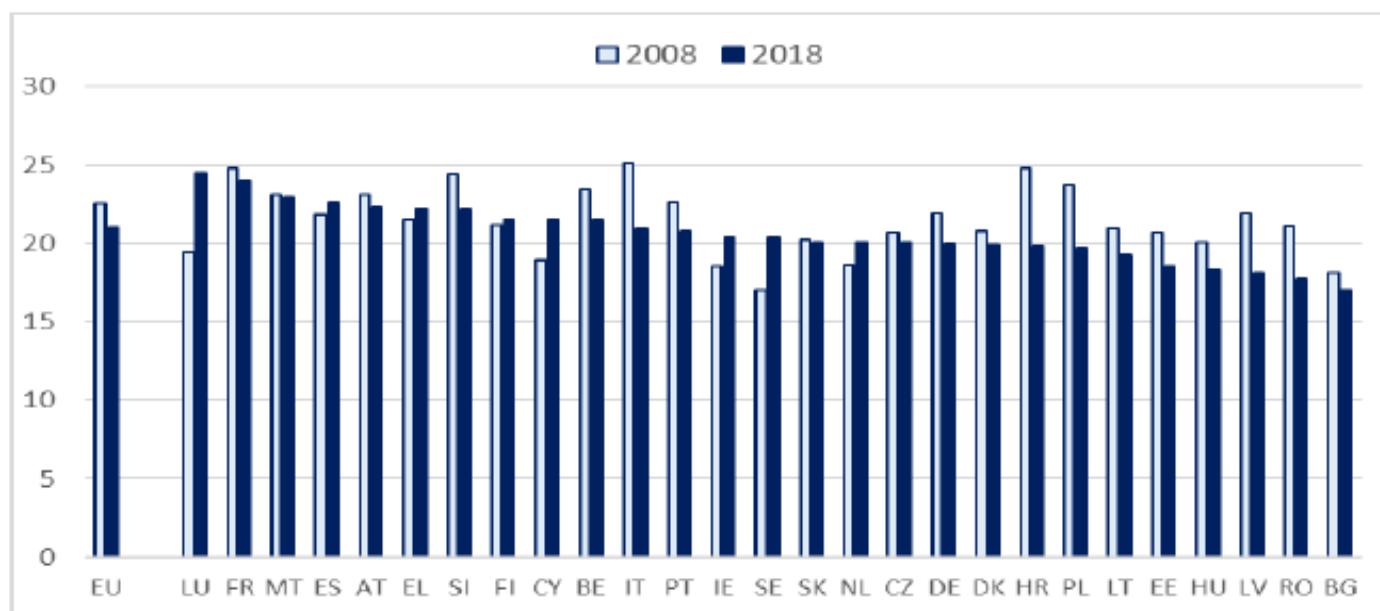
Males



Females

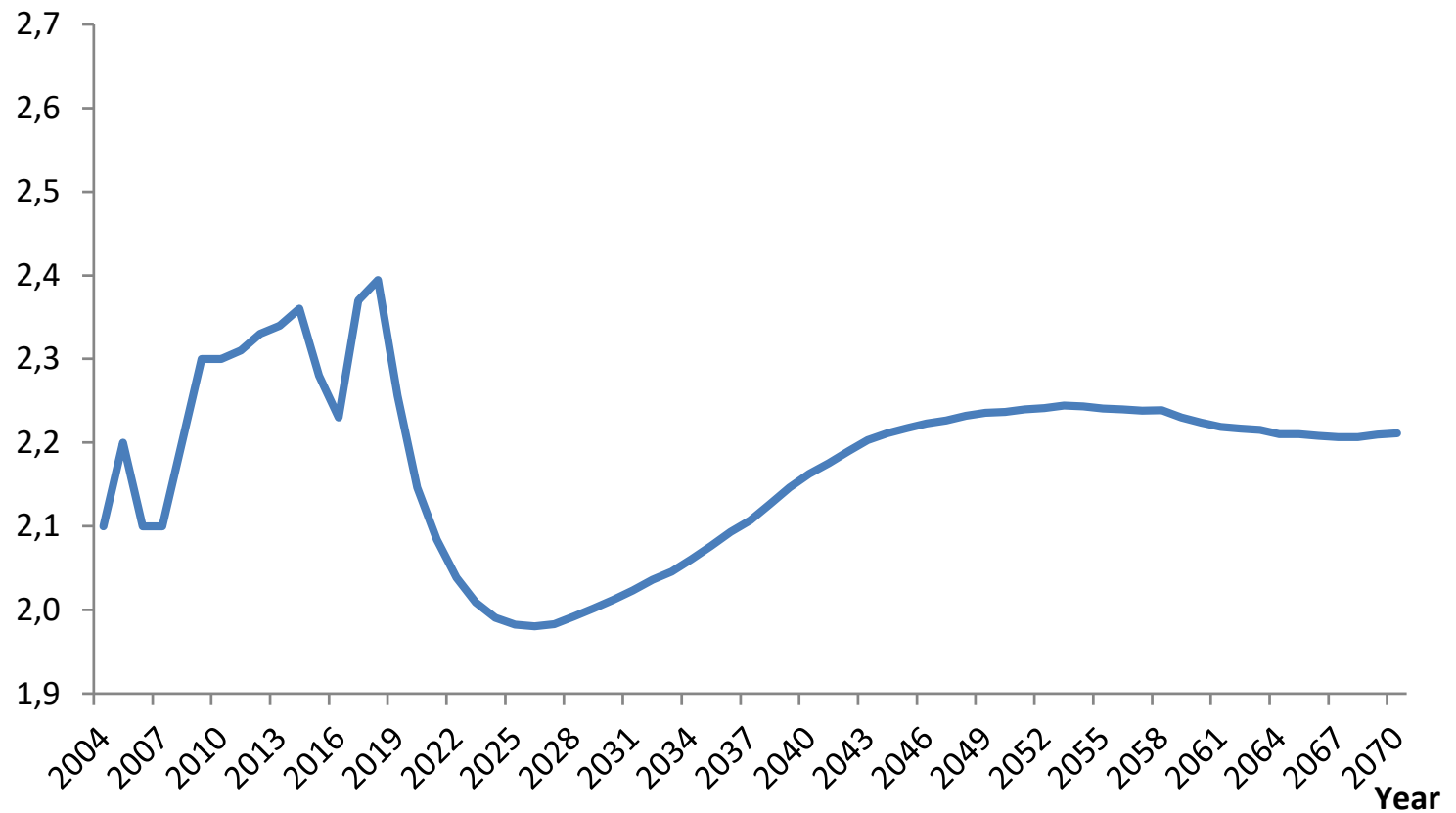


Length of retirement has decreased slightly in the past 10 years



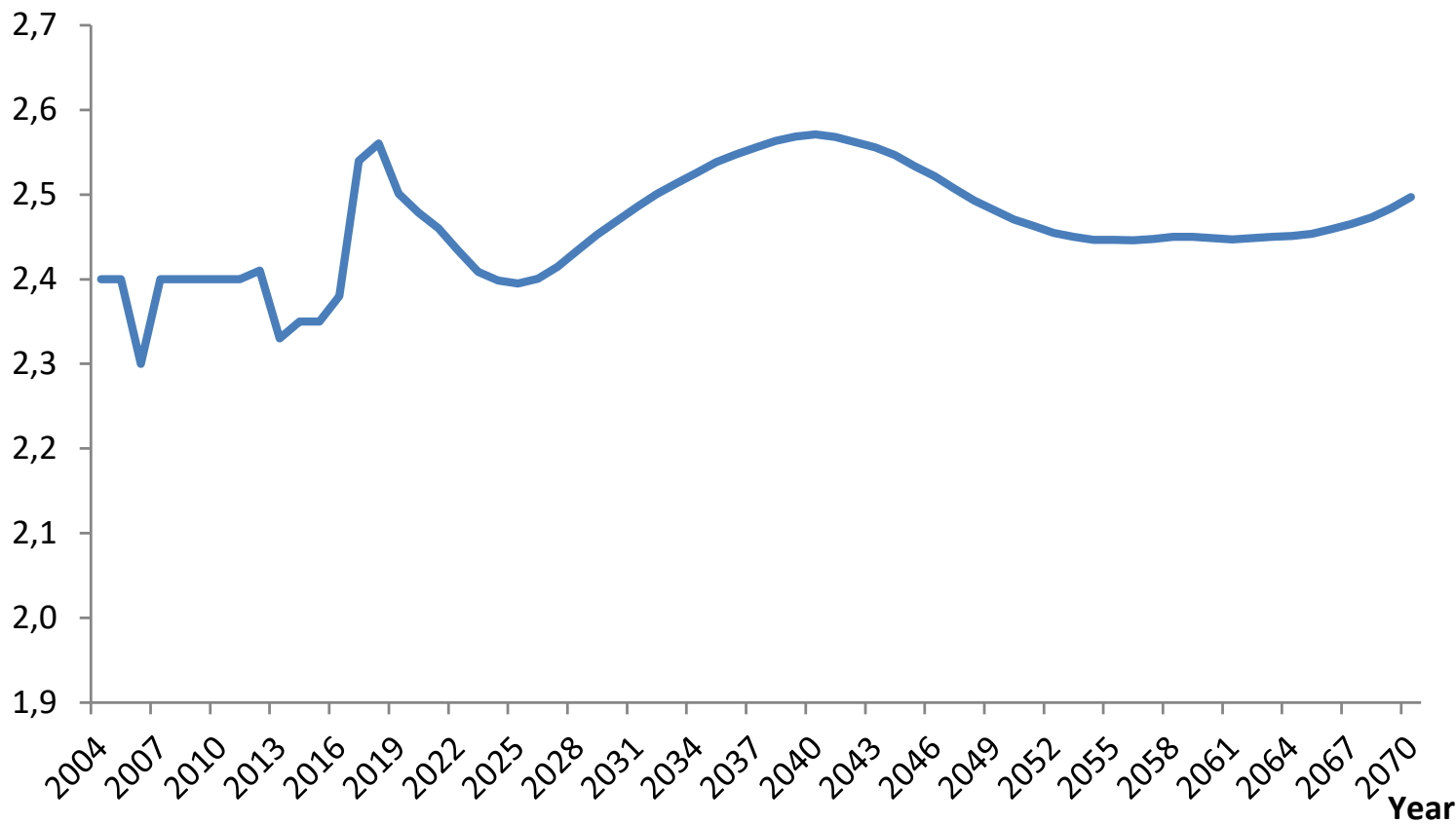


Males

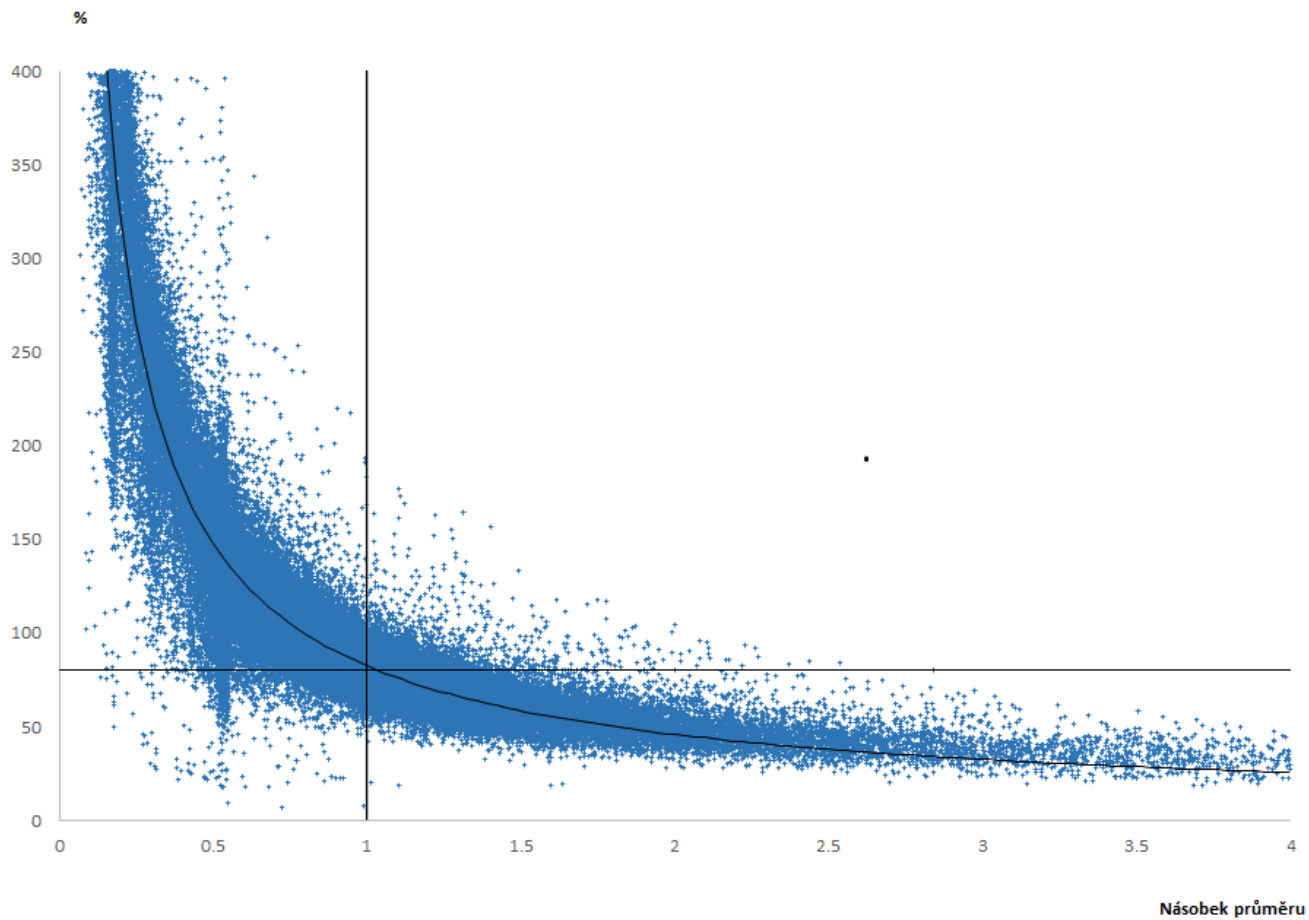




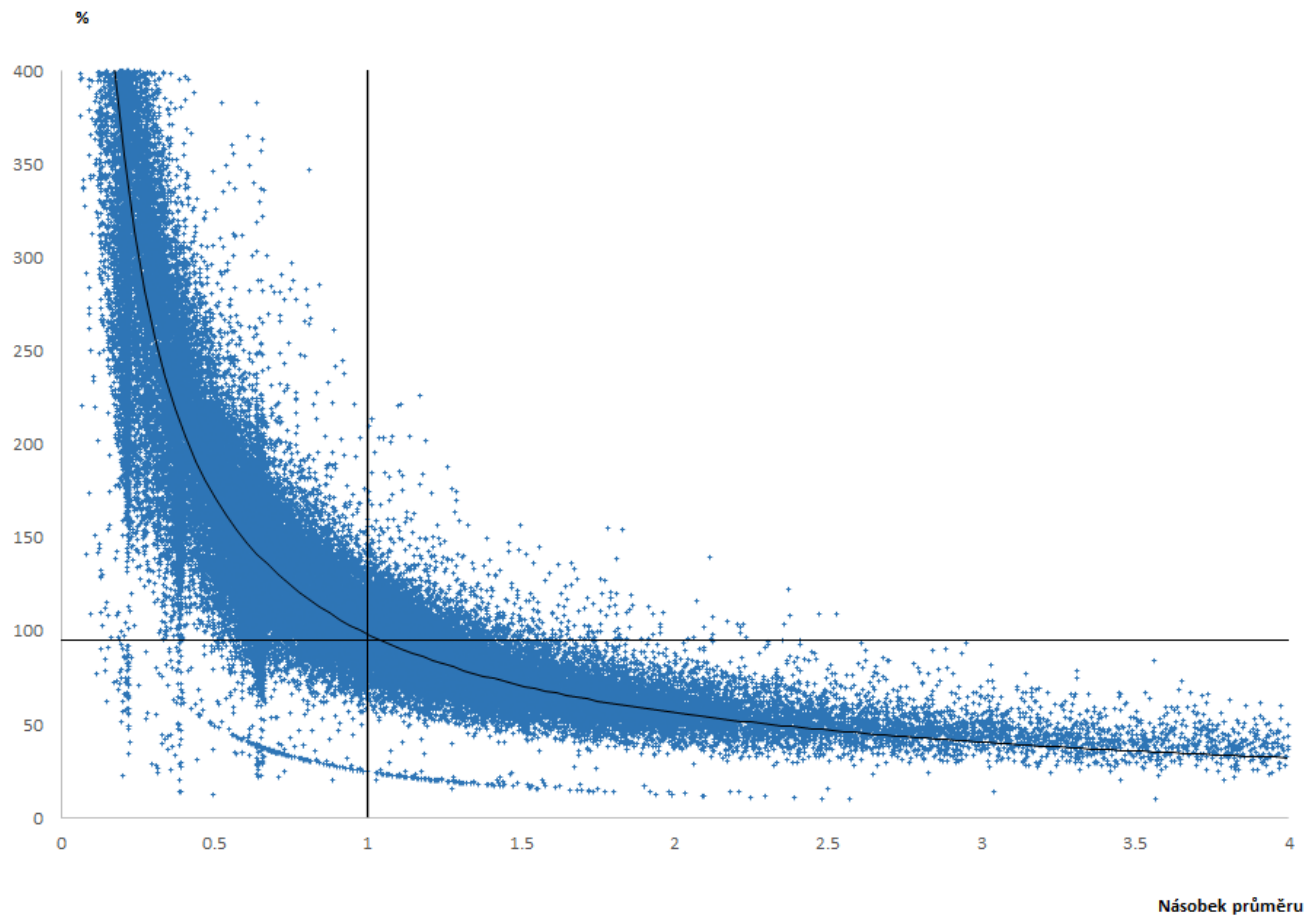
Females



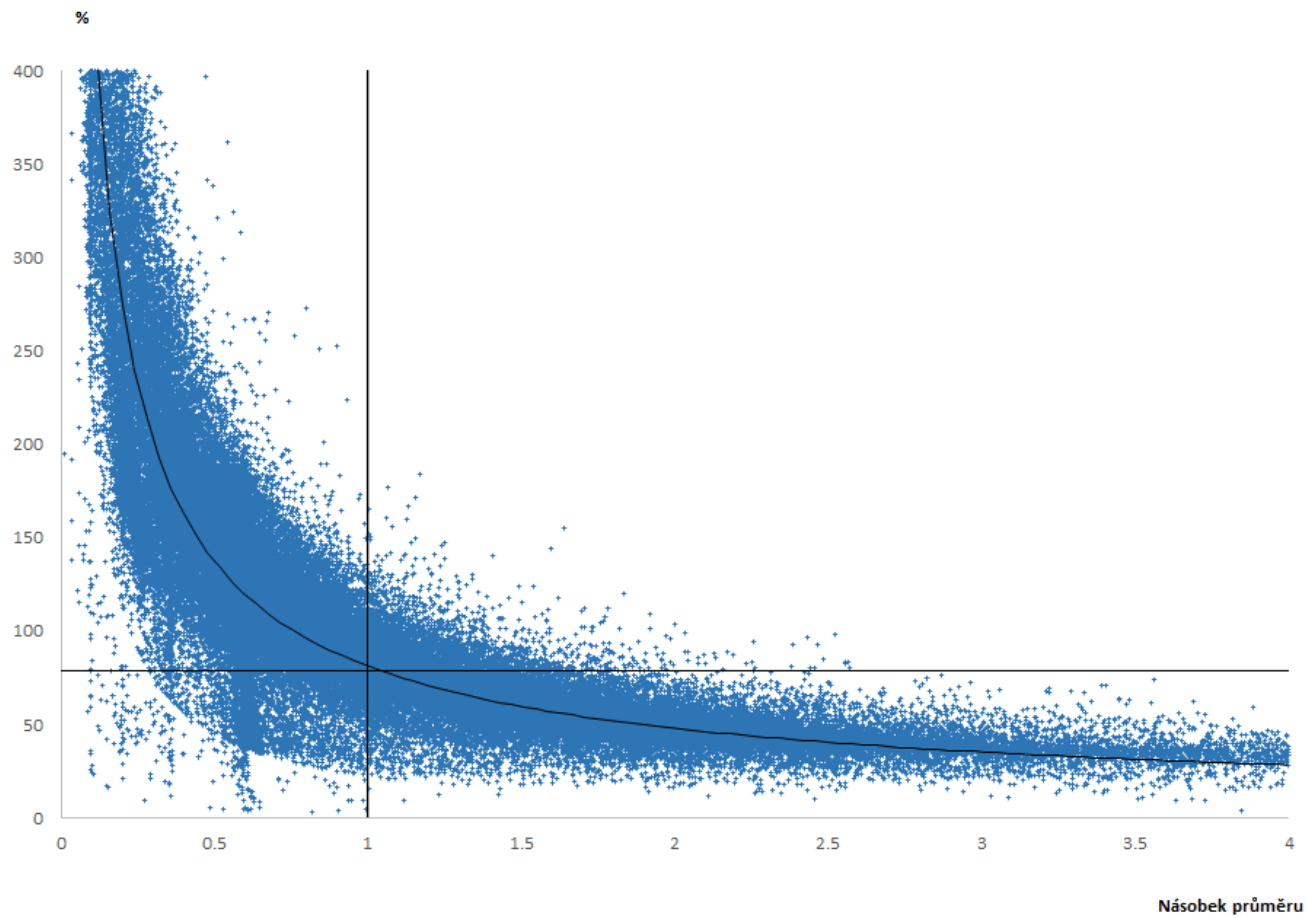
2020



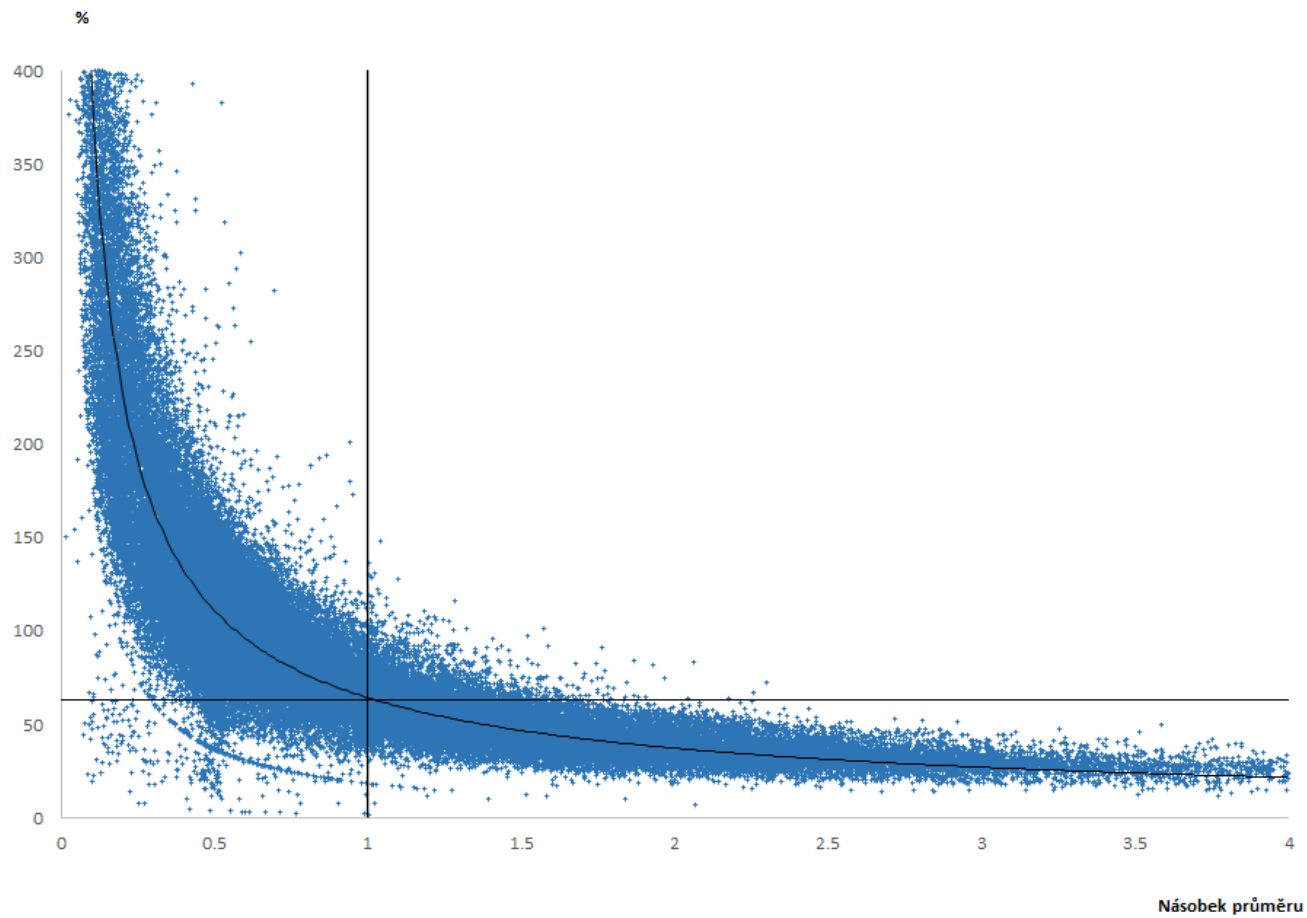
2030



2050



2070



Implicit debt and relative implicit debt

- *Implicit debt*

$$ID = \sum_{n=1}^{\infty} B_n \cdot (1 + IR)^{-n} - \sum_{n=1}^{\infty} C_n \cdot (1 + IR)^{-n}$$

- *Relative implicit debt*

$$ID_{rel} = \frac{\sum_{n=1}^{\infty} B_n \cdot (1 + IR)^{-n}}{\sum_{n=1}^{\infty} C_n \cdot (1 + IR)^{-n}}$$

where

C_n *contribution paid in period n*

B_n *benefit received in period n*

IR *discount rate*