



Leibniz Institute for  
**EAST AND SOUTHEAST  
EUROPEAN STUDIES**



# Income and Consumption approach in the estimation of the premature mortality economic burden within Covid-19 pandemics. Evidence from Post-Soviet space

**Vladimir Kozlov (IOS, Regensburg)**

[kozlov@ios-regensburg.de](mailto:kozlov@ios-regensburg.de)

\*The results for NTA distribution and demographic projections are achieved in cooperation with Russian NTA team (M. Denisenko and A. Nazarova),

Moldova NTA team (Centre for Demographic Research - CDR: O. Gagauz, V. Prohnițchi), Kyrgyzstan team (Ch. Seitov, G. Samohleb et. al), Serbian UNFPA country office (T. Anicic) in 2022-23

**HEALTH, MORBIDITY, AND MORTALITY WORKING GROUP**

European Association of Population Studies

21.09.2023

## Countries of our analysis and sources

### Post-Soviet space:

- 🔗 Russia (population: 146.8 mln.) data from Rosstat and RusFMD + projections from InDem
- 🔗 Moldova (population: 2.6 mln.) data from CDR
- 🔗 Kyrgyzstan (population: 6.6 mln.) data from NSC of the Kyrgyz Republic

### Balkans:

- 🔗 Serbia (population: 6.9 mln) data from Stat Office of the Republic of Serbia + UNFPA Serbia

## What indicators do we need?

### Excess mortality:

- ✂ Based on the discrepancies between projected and actual population (Russia)
- ✂ Based on the discrepancies between projected and actual mortality levels (Moldova)
- ✂ Based on the differences between simple trend projected (trend for 2015-2019) and actual ASDRs: Kyrgyzstan and Serbia

### Economic costs of additional deaths:

- ✂ Based on national transfer accounts (each age has its own cost)
- ✂ In this presentation we use data for consumption and income (the whole project works with transfers)
- ✂ Additionally data from non-paid labour (wages assigned to the time spent for the labour within a household)

## Mortality burden estimation for the Covid-19 period (2020-2021)

### Russia:

- ✂ The life expectancy -3.8 (women), -2.7 (men)
- ✂ Absolute numbers: -465 th. (women), -515 th. (men)

### Moldova:

- ✂ The life expectancy -2.1 (women), -1.6 (men)
- ✂ Absolute numbers: -5,44 th. (women), -5,15 th. (men)

### Kyrgyzstan:

- ✂ The life expectancy +0.3 (women), -0.1 (men)
- ✂ Absolute numbers: 8,9 th. (women), 9,6 th. (men)

### Serbia:

- ✂ The life expectancy -2.4 (women), -3 (men)
- ✂ Absolute numbers: 55,5 th.\* incl 19,1 th. (women), 36,4 th. (men)

\* - for Serbia we do not have data for the economic burden by gender

## Data from 'Our World in Data' and other sources (2020-2021)

### 🔗 Absolute figures:

Russia - 1080 th.

Moldova - 16.4 th.,

Kyrgyzstan - 13.9 th.

Serbia - 52.2 th. (49.5 based on Arsenović, 2023)

### 🔗 Per 100 000:

Russia - 744

Moldova - 502

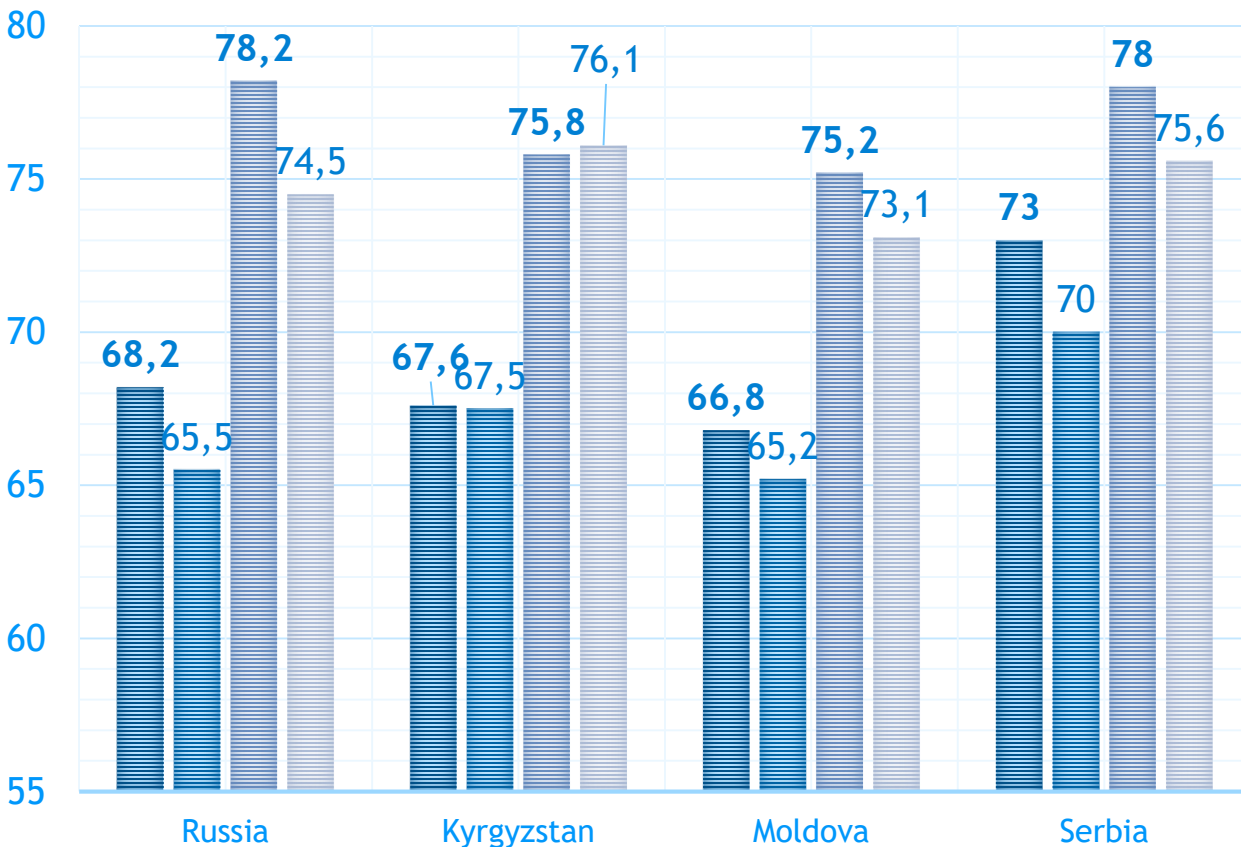
Kyrgyzstan - 210

Serbia - 757

# Discrepancies

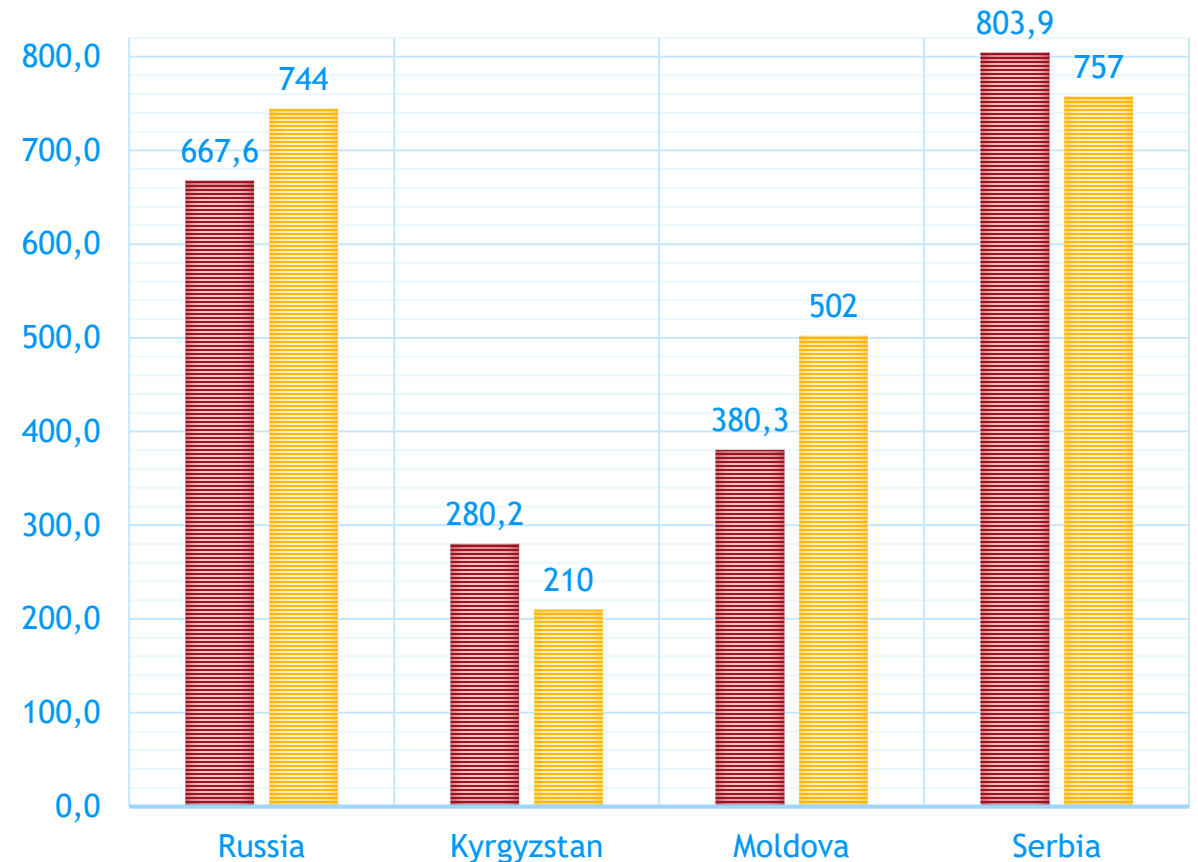
LIFE EXPECTANCY

■ male 2019 ■ male 2021 ■ female 2019 ■ female 2021



ABSOLUTE FIGURES

■ Self ■ OWinD



## The possible explanation of differences?

### Methods:

- ❧ For Russia and Moldova: compared the expected and real population after C-19
- ❧ For Kyrgyzstan and Serbia: compared the trend and observed mortality (close to OwinD)

### Differences in statistical data by sources:

- ❧ For Moldova the problem could be in denominator (local specialists use 2.6 mln., international organizations up to 4 mln.)
- ❧ For Kyrgyzstan it looks like a system error with denominator estimations

The life expectancy in Kyrgyzstan by the “official” life tables is debatable

# Mortality burden

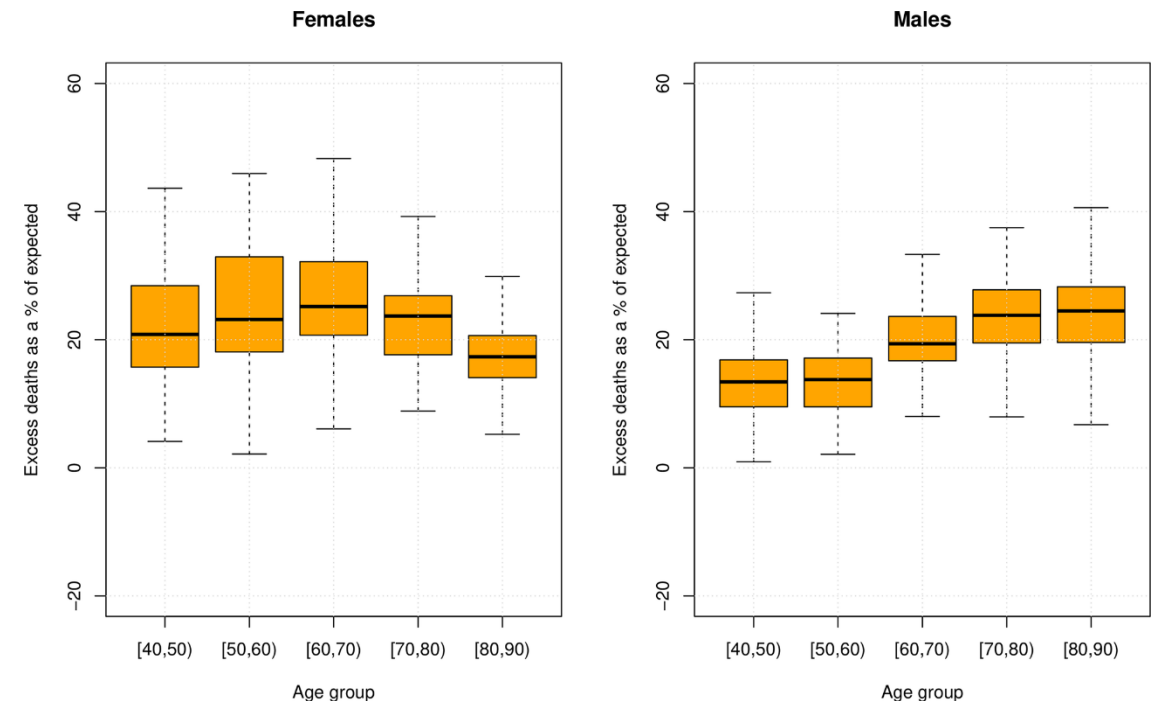
Russian case as a master-class



## How was the „excess mortality” measured?

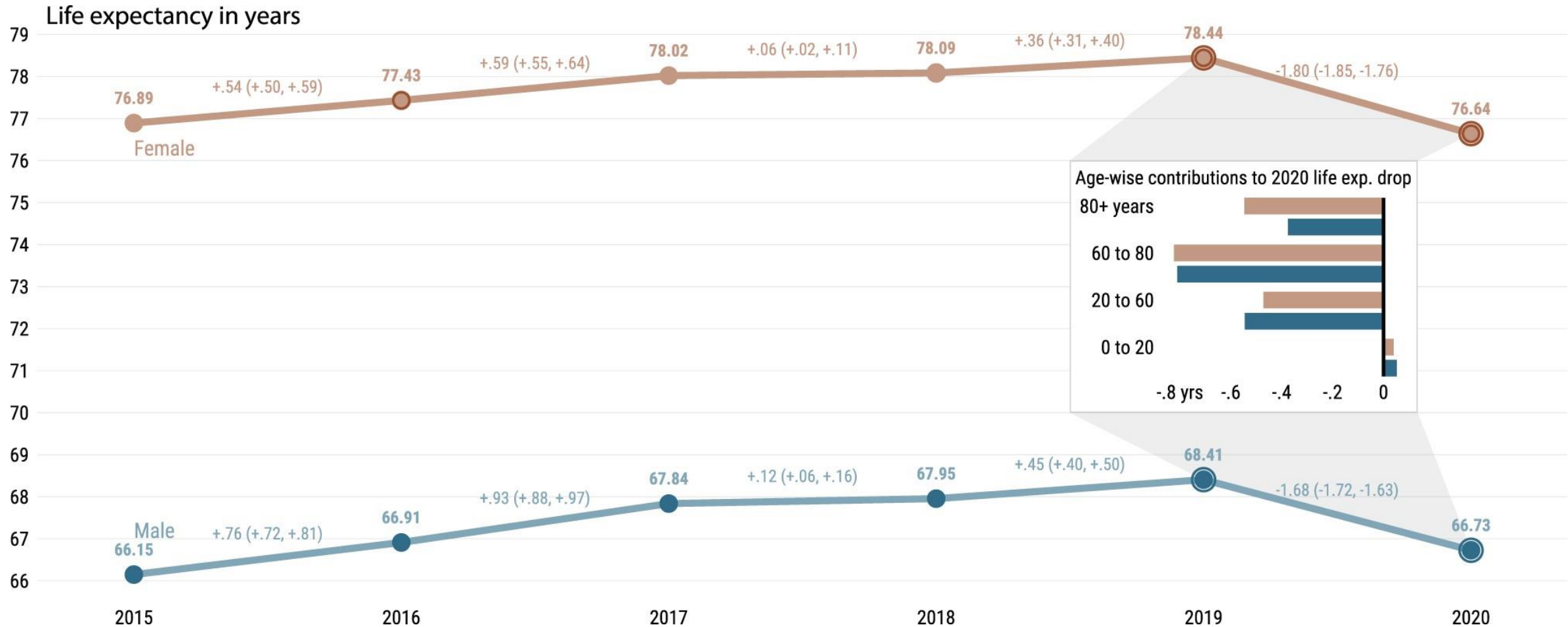
- 🔗 Literature see e.g. in Ourworldindata resource or Karlinsky & Kobak (2021) papers
- 🔗 In Russia the estimations made by different teams are close (Kobak (2021), Timonin et. al (2022), Scherbov et. al (2022), Aburto et. al (2022), Schöley et. Al (2022)):
  - in abs. figures about 1 mln. for the period 2020-21
  - in life expectancy for both sexes -3.3: -1.8 and -1.5 years, or (*from 73.3 to 70*), the mortality occurs in economic active age as well:

The excess mortality distribution (from Scherbov et al. 2022)

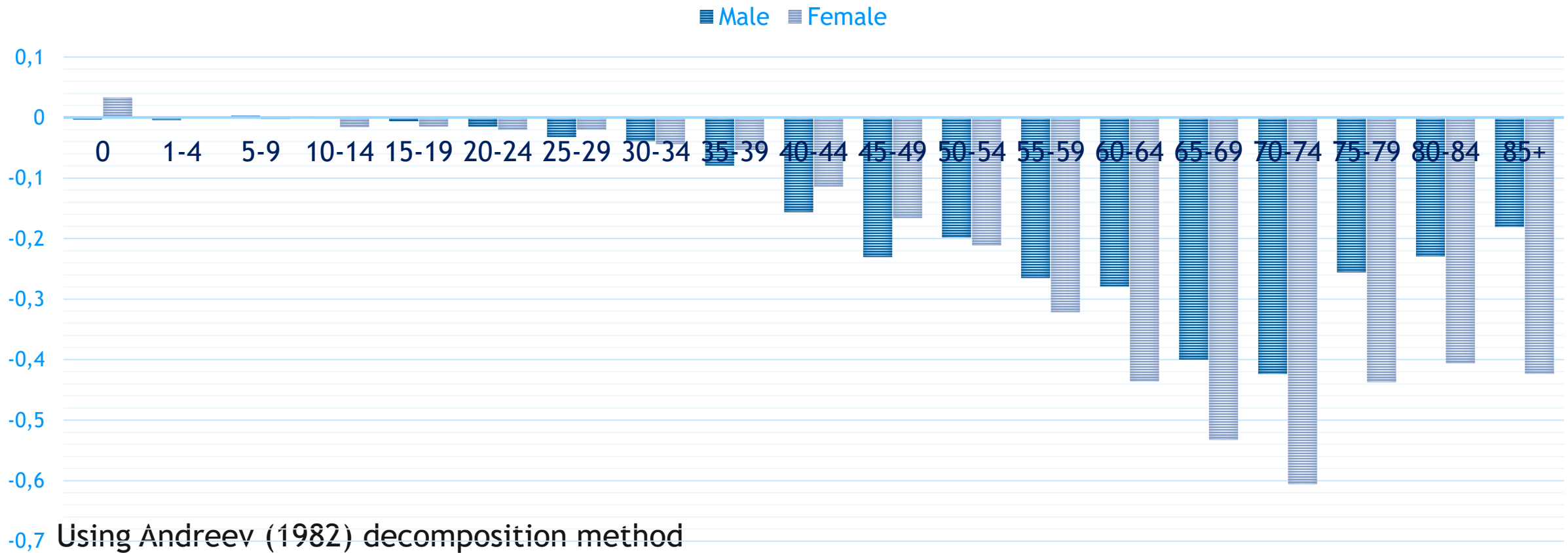


# The „excess mortality” by age groups? Potential economic

Life expectancy graph from Aburto et al. (2022) losses



# The decomposition of the life expectancy changes (2019 vs. 2021)



## How did we estimate C-19 losses for Russia?

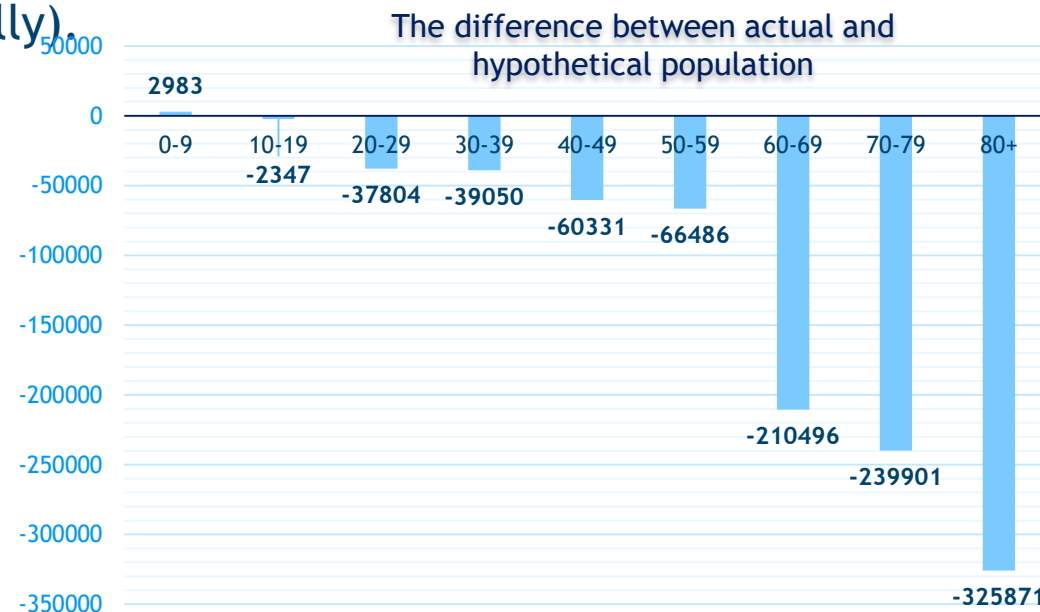
We use the difference between the demographic forecast in the beginning of 2020 for the 1.1.2022 time point (without C-19 estimations)

And

the **actual population** for the 1.1.2022 period of time (after C-19 waves)

The difference between the middle variant of the forecast and the actual population is about **1 mln.**, that is close to the estimated excess mortality figures.

Not only deaths but the other demographic processes are involved in the estimation (but fertility and migration did not change dramatically)



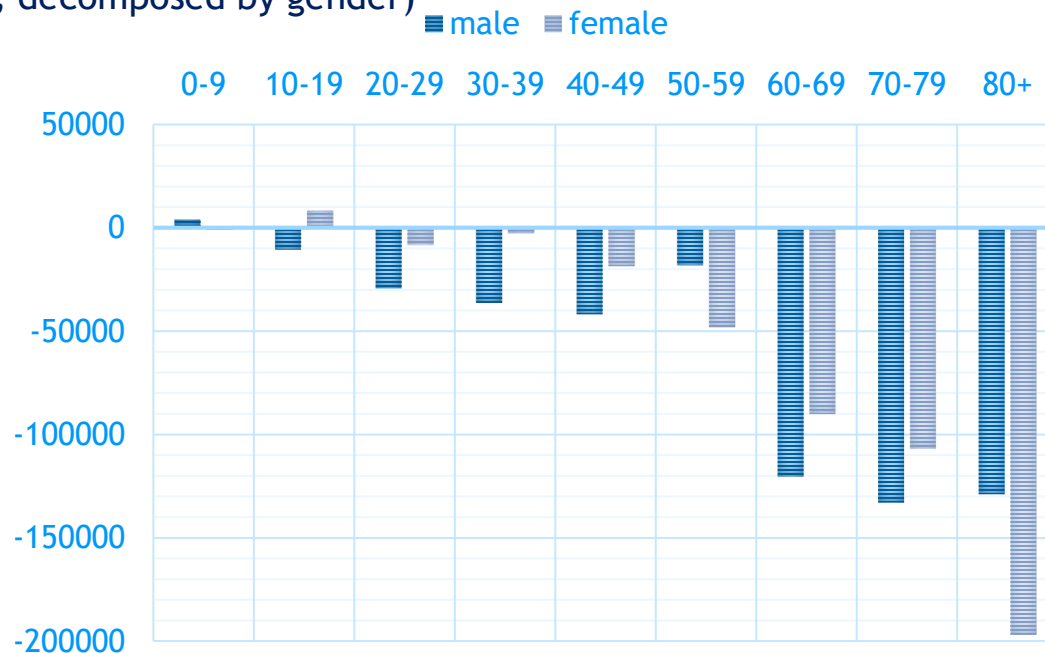
## C-19 losses estimation comments

- & Not only mortality, but possibly some fertility and migration changes (not the Russian case for 2020 and 2021)
  
- & We take into consideration the demographic forecast at the eve of coronavirus for the short-term projection
  
- & And (estimating the effect of the population structure change) differences between pre-covid and post-covid projections - middle term effect

# Further steps. Gender inclusion, and long-term perspectives

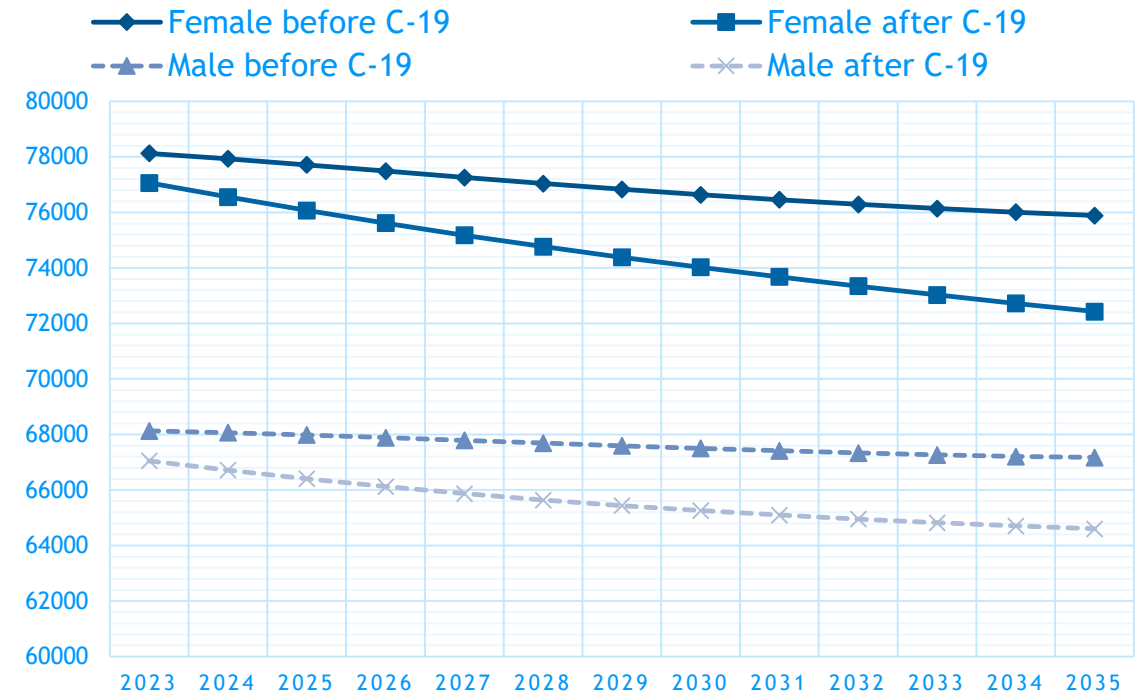
🔗 The Economic losses  $(ST)_i = (\text{Population actual}_i - \text{Population expected}_i) * \text{NTA Indicator per capita}_i$

The difference between actual and hypothetical population (ST, decomposed by gender)



🔗 The Economic losses  $(LT)_i = (\text{Population forecasted before C-19}_i - \text{Population forecasted after C-19}_i) * \text{NTA Indicator per capita}_i$

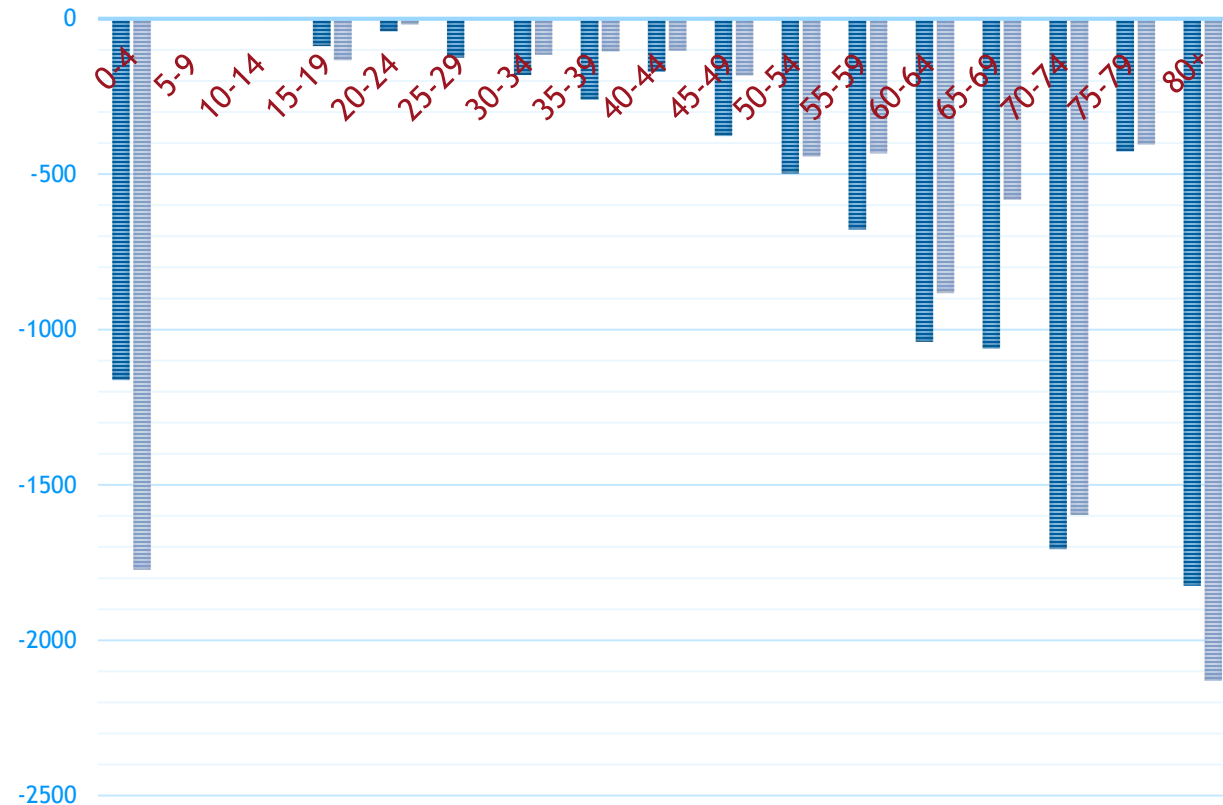
The difference between projections (LT, decomposed by gender)



## Visualisations for the other countries

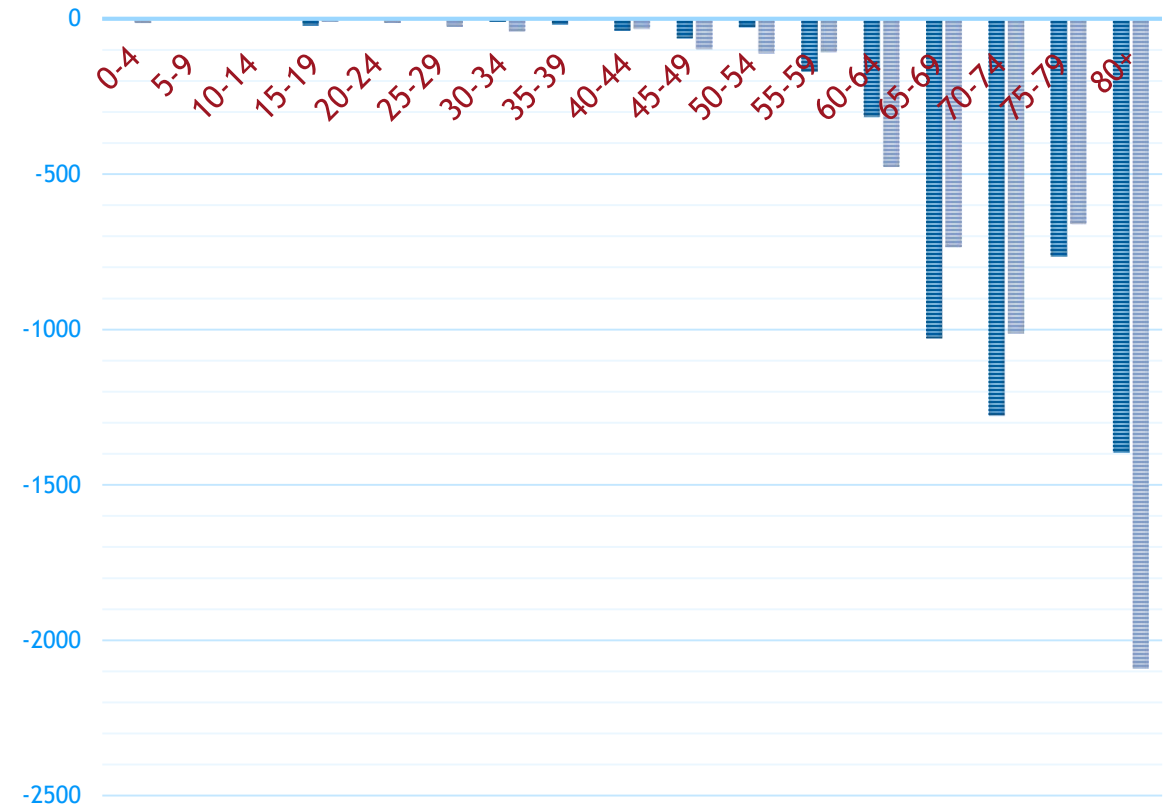
### KYRGYZSTAN

■ male ■ female

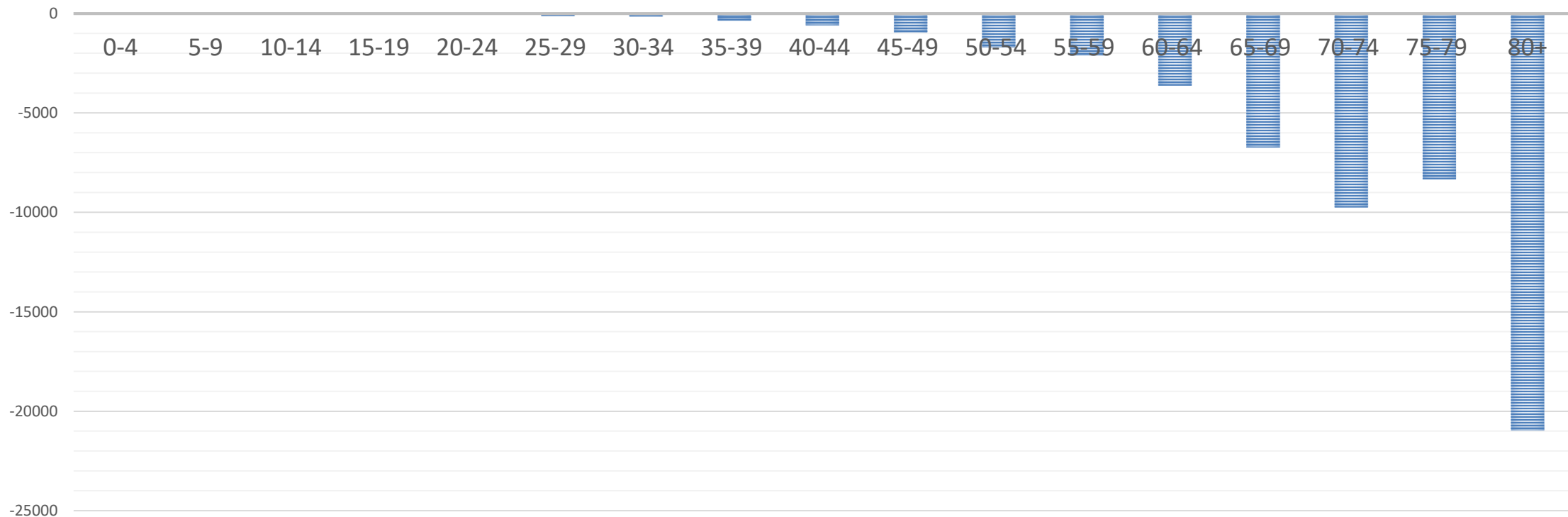


### MOLDOVA

■ male ■ female



# Serbia





## How were these economic losses calculated?

- 🔗 **National transfer accounts (NTA)**
- 🔗 **Years of potential life lost (YPLL)**
- 🔗 **Time used for the household production lost**

# National transfer accounts approach

## Current methodology:

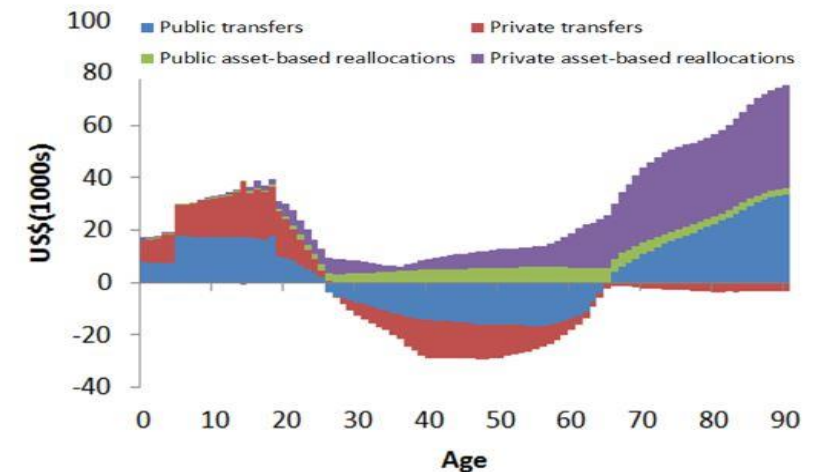
- ✂ Mason, Lee (2009, 2010, 2011) and Mason, A., Lee, R., Tung, A. C., Lai, M. S., & Miller, T. (2009) - based on the problem of ageing

## Previously:

- ✂ International transfers and savings and family as an investment (Kotlikoff 1989; Kotlikoff & Spivak 1981; Kotlikoff & Summers 1981)
- ✂ Life cycle and finance Ando & Modigliani (1963) + intergenerational transfers Modigliani (1986)
- ✂ Valkowich (1971) - economic-demographic pyramids
- ✂ Samuelson (1975) - optimal social security
- ✂ Lee (2001) - historical prospective

## DATA

Age reallocations, per capita, United States, 2011



<https://www.ntaccounts.org/web/nta/show/>

NTA Project for more than 100 countries

## Basic equation

$$C(x) - Y^l(x) = \tau^+(x) - \tau^-(x) + Y^A(x) - S(x)$$

$C(x)$  - Consumption at the age  $x$ ;

$Y^l(x)$  - Yield (Income) from the labour at the age  $x$ ;

$C(x) - Y^l(x)$  - *Life cycle deficit (LCD)*

$Y^A(x)$  - Yield (income) from the assets at the age  $x$ ;

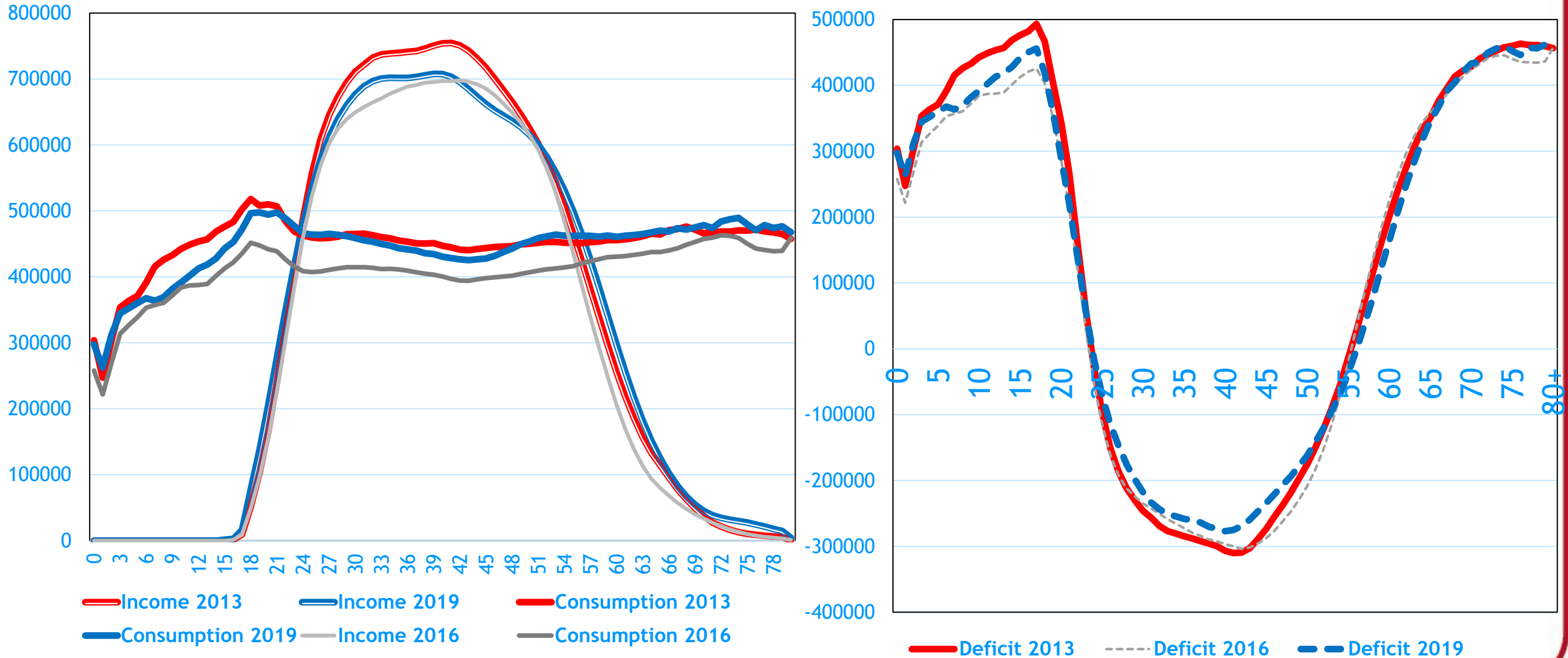
$S(x)$  - Savings at the age  $x$ ;

$\tau^+(x)$  - Transfers received at the age  $x$ ;

$\tau^-(x)$  - Transfers sent at the age  $x$

For the burden estimation we use *LCD*

# Example: Russian profiles (dynamics) IN 2019 RUBLES



## The calculations of economic losses is based on the simple assumption

- ❧ The Economic losses<sub>i</sub> = (Demographic losses<sub>i</sub>) \* NTA Indicator per capita<sub>i</sub>
- ❧ Calculated for each 10-year group (i), afterwards summarized
- ❧ NTA indicators are taken from „preCovid-19“ 2019 year (losses as a % of the NTA indicator before C-19)
- ❧ The NTA Indicators used are: Income, Consumption
- ❧ Losses by sex (apart from Serbia)
  
- ❧ More important are relative figures, we use them for the comparisons with the alternative estimations (% of GDP)
- ❧ We do not use discounts (unless it is specified)

## Cross-countries comparisons (Russia, Moldova, Kyrgyzstan, Serbia)

- ✂ We do not have the detailed figures about the demographic projections apart from Russia
- ✂ We have only macroeconomic data (SNA, 2019) and profiles (Moldova 2019 and Kyrgyzstan 2017)
- ✂ For Moldova we have fully distributed gender-based NTA, for Kyrgyzstan - only for Income and private Consumption (in future we can fully distribute)

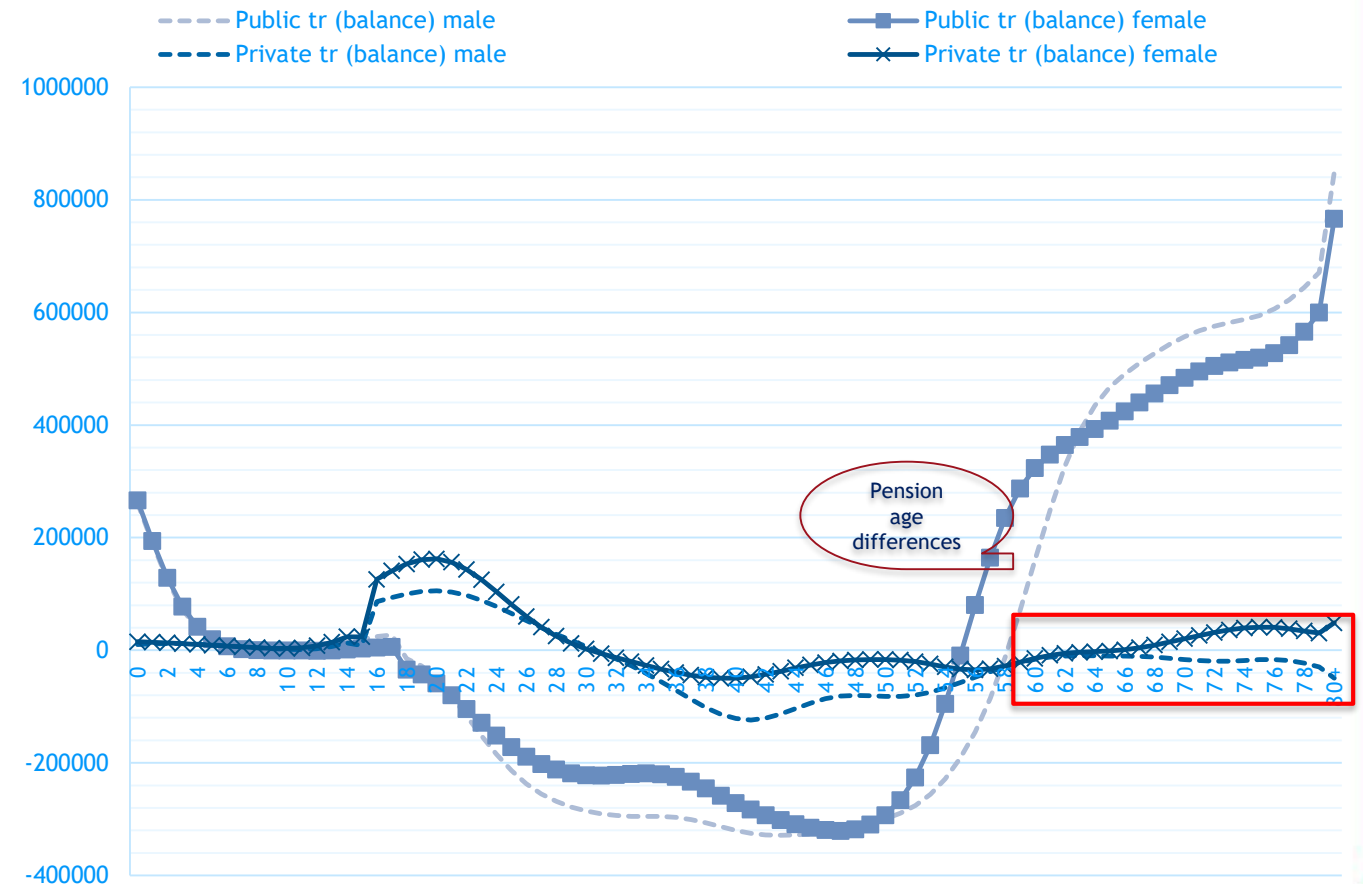
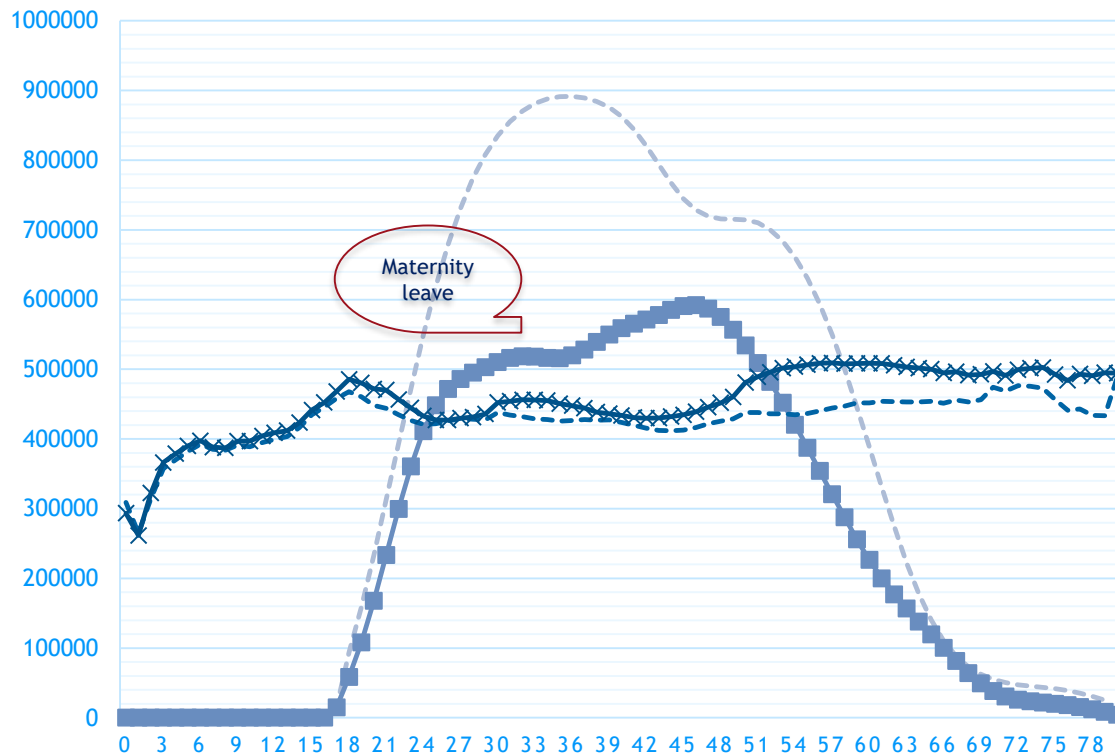
So we calculate: the losses in NTA indicators (Income, Consumption, Private and Public transfers) within pandemics (2020-21) as % from the Aggregated indicator in 2019:

$$\frac{\Sigma(\text{Excess deaths}_i * \text{NTA indicator per capita}_i)}{\text{Aggregate NTA indicator}^{2019}}$$

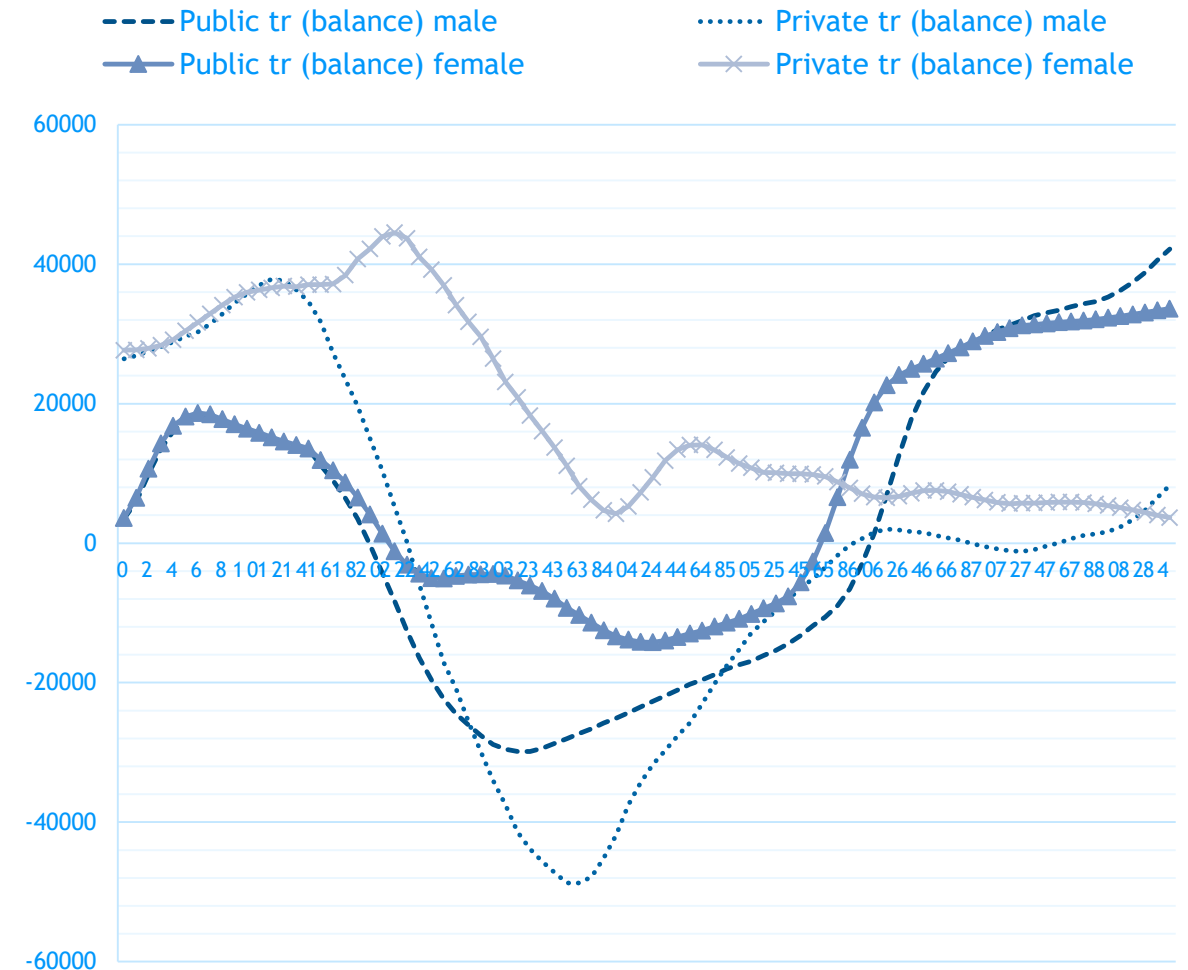
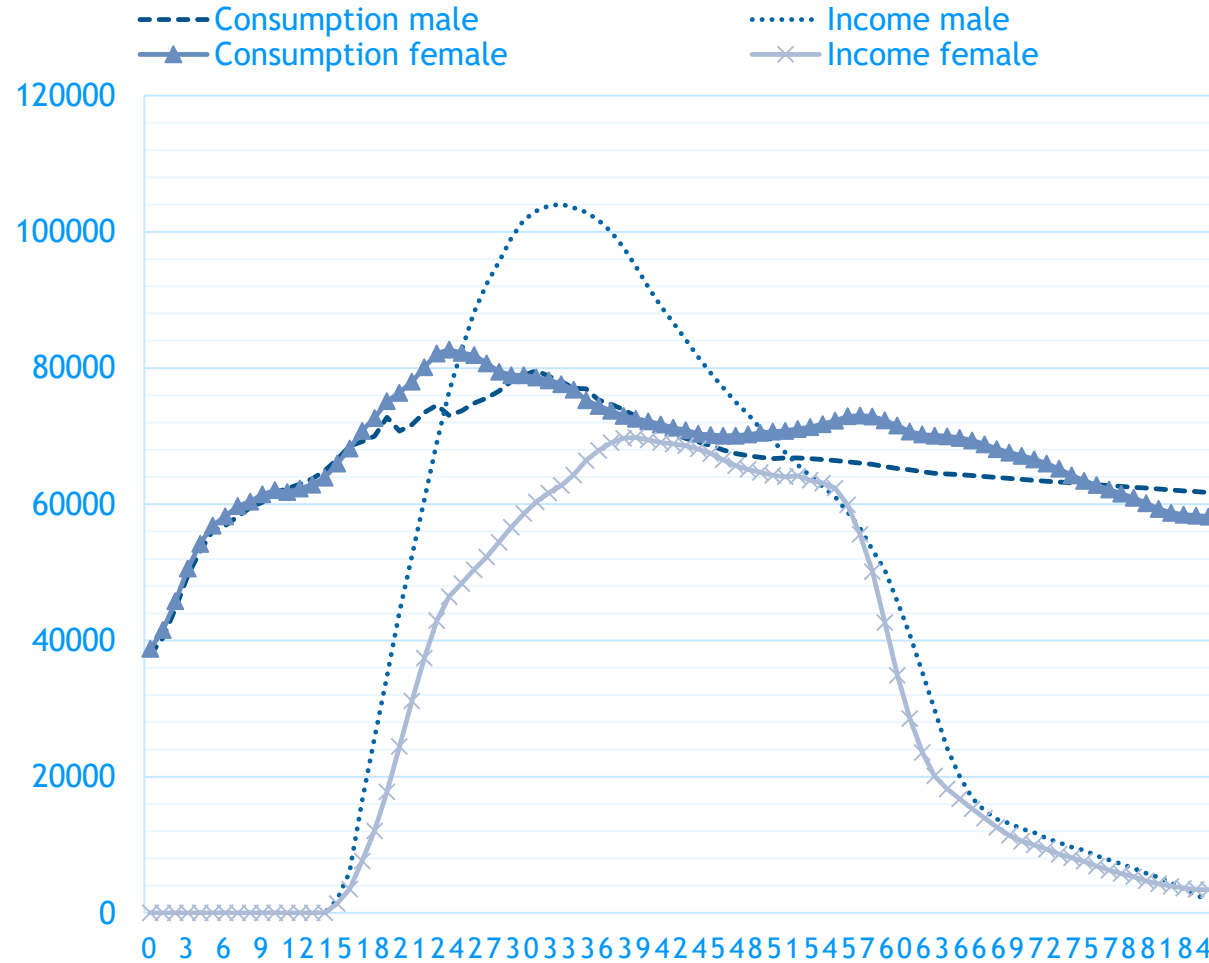
# Example: The results based on NTA (gender based), Russian profiles (2019), per capita, Rubles

We calculate the same indicators, but separately for the genders !Limitation: the public tr (sent) is equally distributed

Income male    Income female  
Consumption male    Consumption female

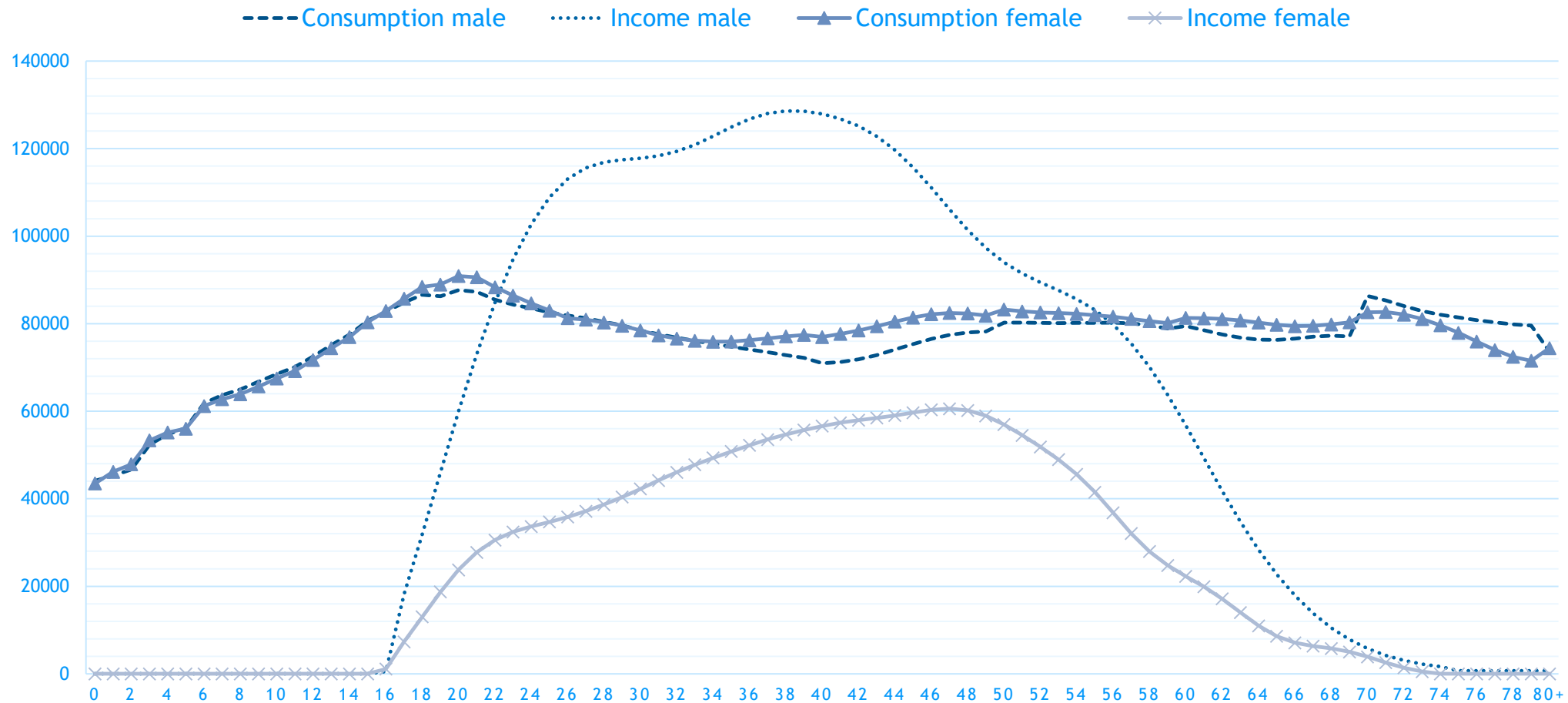


## Moldova NTA gender profiles

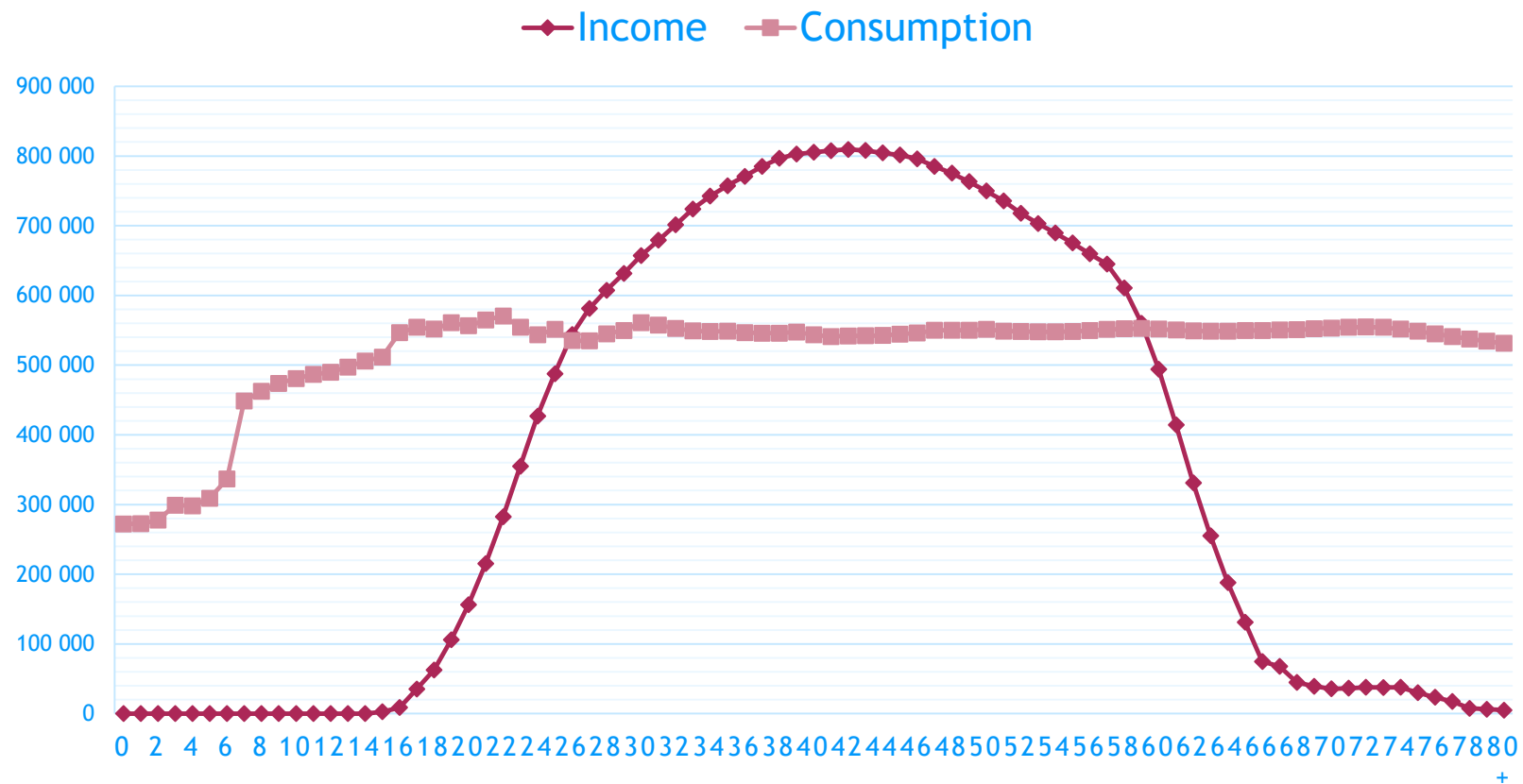




## Kyrgyzstan NTA gender profiles (LCD only)



## Serbia NTA profiles (LCD only)

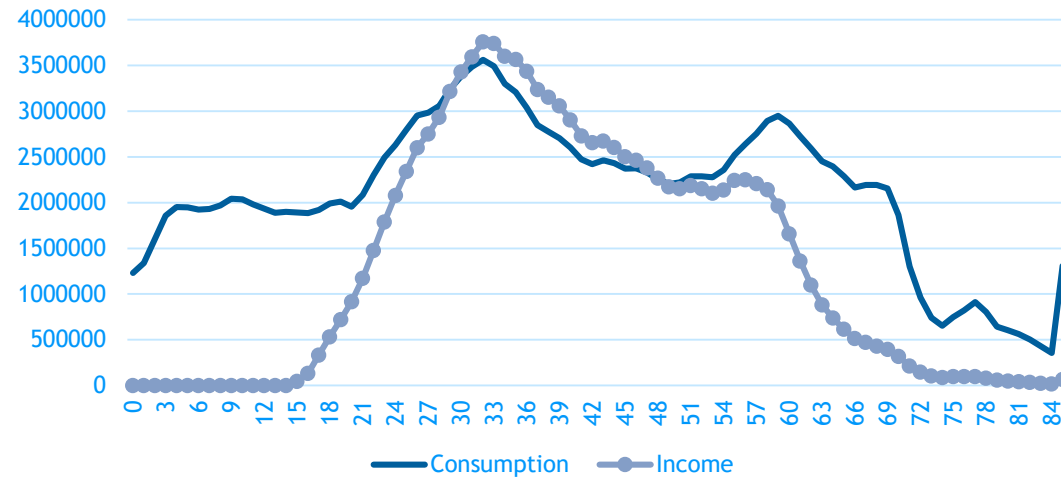


## Why is it important to measure losses based on NTA (sex based)?

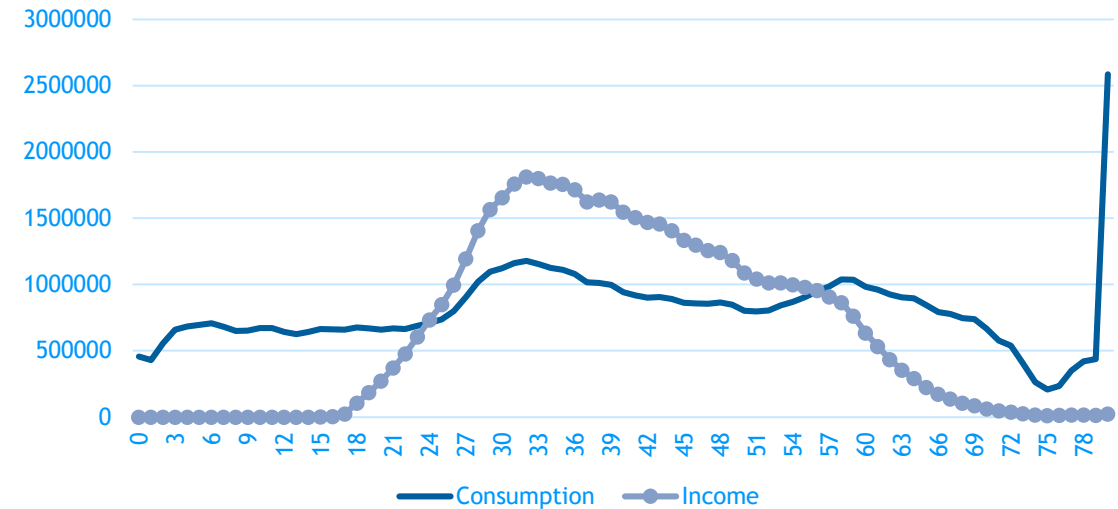
- Income and especially consumption are not equal to 0 at the older ages
- Consumption could be the highest at the older ages (consumption is an important part of GDP), by SNA it is higher than Income
- Due to the macro-controllers usage, the NTA methodology is closer to careful economic burden estimation
- Covid-19 “excess mortality” changed a population structure, so the middle and potentially long-term economic effect can be visible

## The population structures are different (Income & Consumption aggregated)

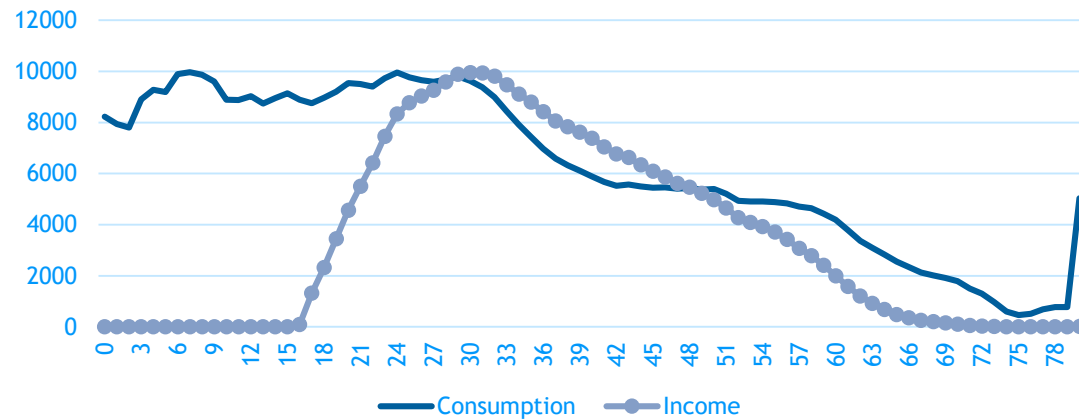
Moldova



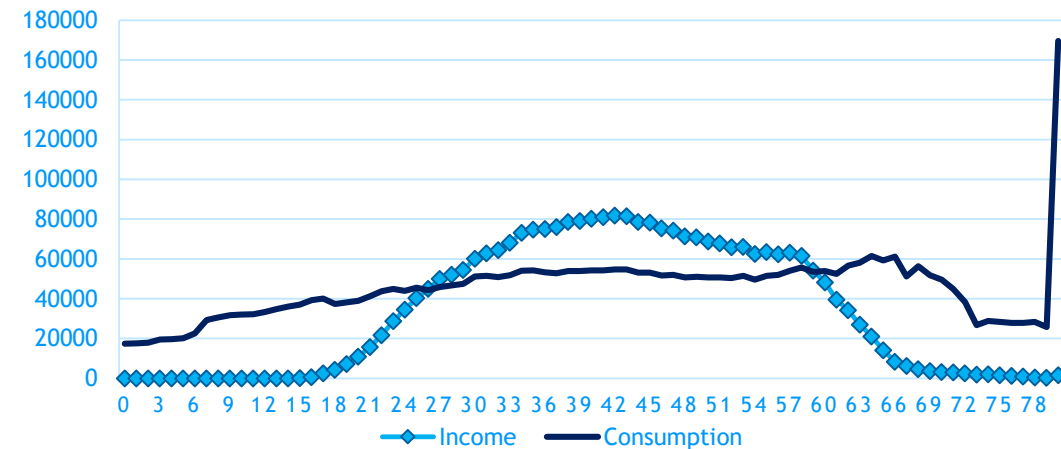
Russia



Kyrgyzstan



SERBIA



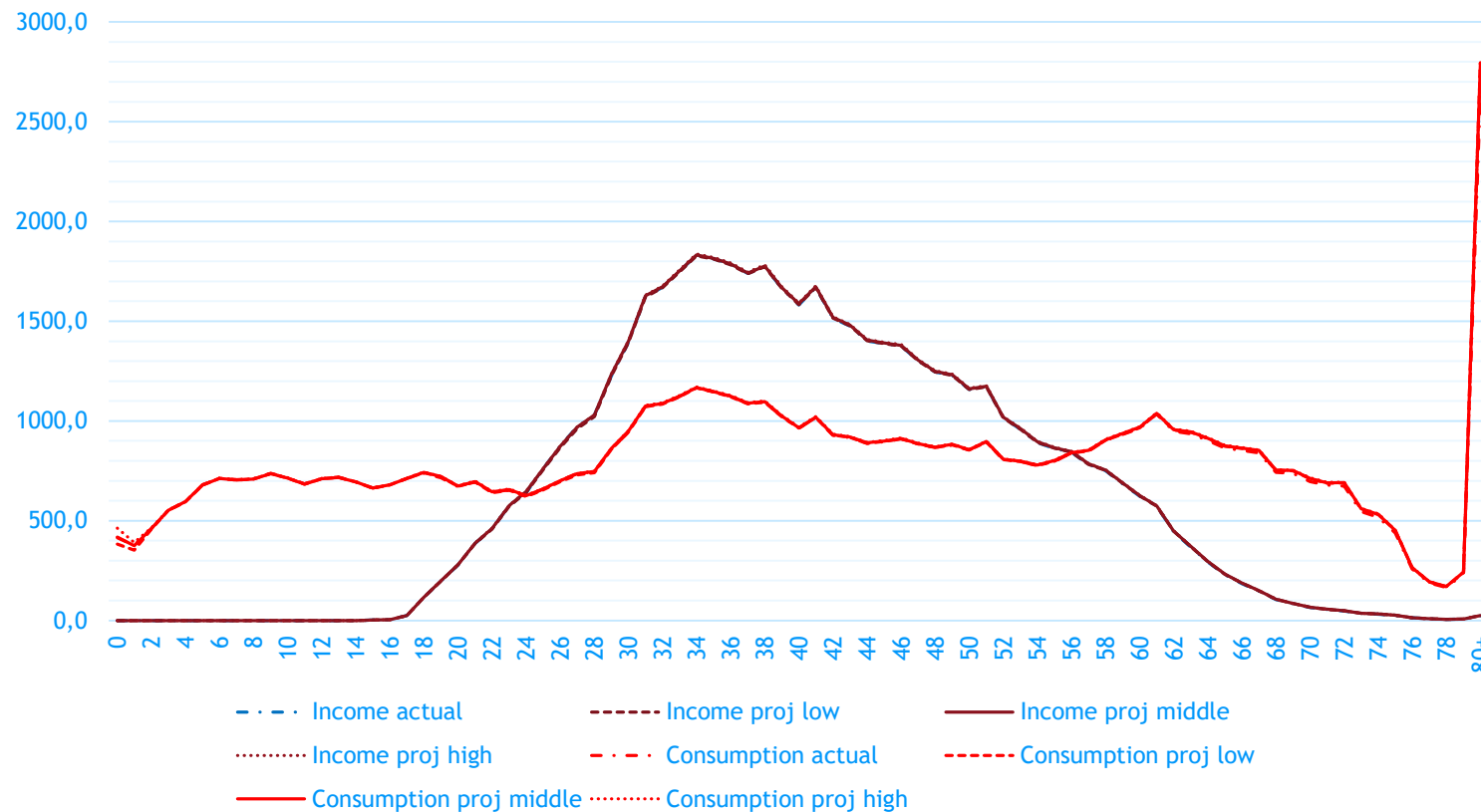
## The results based on the other countries NTA

### The data available:

- ❏ Russia NTA 2019 (per capital and aggregate) by sex
- ❏ Moldova NTA 2019 (per capital and aggregate) by sex
- ❏ Serbia NTA 2019 (per capita and aggregate)
- ❏ Kyrgyzstan NTA profiles based on data from National Statistical Committee for 2017, the SNA statistics for 2019 is used for aggregate figures calculation by sex

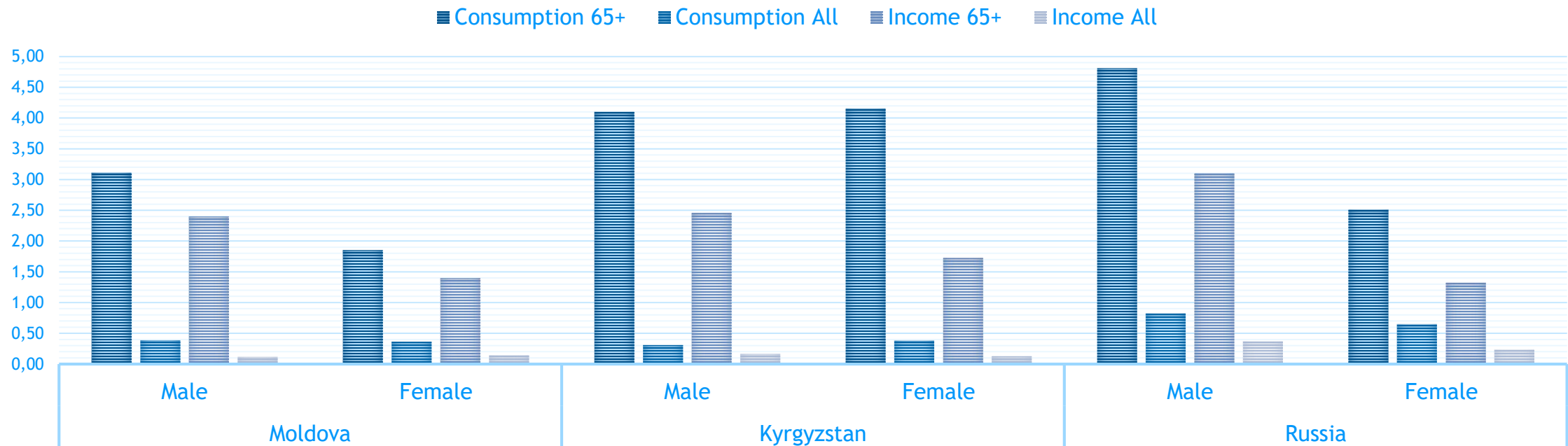
## The results (economic losses) based on NTA indicators (Russia)

On the common picture (Life Circle Deficit in absolute figures, mln.) we see almost nothing

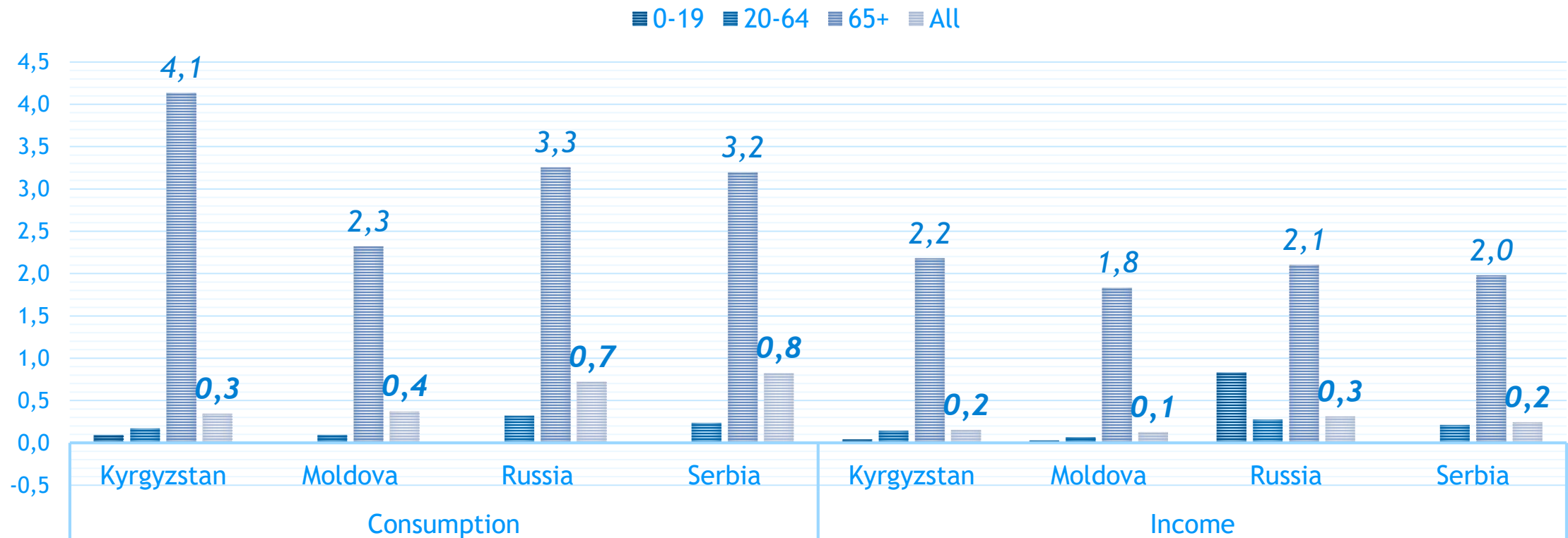


However aggregated age groups are more interesting, and we use only middle variant of demographic forecast

## 3 countries losses based at the same methodology by gender (Income, Consumption), % from 2019



## 4 countries losses based at the same methodology, total (Income, Consumption), % from 2019





## Cross-country comparisons, losses as % GDP

		2019	2020+2021
<b>Income</b>	<i>Russia</i>	<b>0.140</b>	<b>0.071</b>
	<i>Moldova</i>	<b>0.069</b>	<b>0.034</b>
	<i>Kyrgyzstan</i>	<b>0.072</b>	<b>0.034</b>
	<i>Serbia</i>	<b>0.121</b>	<b>0.058</b>
<b>Consumption</b>	<i>Russia</i>	<b>0.417</b>	<b>0.211</b>
	<i>Moldova</i>	<b>0.327</b>	<b>0.163</b>
	<i>Kyrgyzstan</i>	<b>0.291</b>	<b>0.147</b>
	<i>Serbia</i>	<b>0.555</b>	<b>0.265</b>

GDP for all the countries in 2019 prices

## Alternative estimations (The human capital approach is used): Russian YPLL

Using YPLL (Years of Potential Life Lost) (Gardner & Sanborn, 1990) regarding C-19 (excess mortality) in Russia for 2020-2021, with discounts and inflation rate, based on 5 and 10-age groups wages by gender.

### For Russia, Standardised YPLL per 1000

- 2019: 249.2
- 2020: 285.1
- 2021: 318.8

The difference is assumed to be C-19 excess mortality

## Some alternative estimations

Using YPLL (Years of Potential Life Lost) (Gardner & Sanborn, 1990) regarding C-19 (excess mortality) in Russia for 2020-2021, with discounts and inflation rate, based on 5 and 10-age groups wages. The human capital approach is used

Year	Gender	% of GDP	% of GDP (labour part)
<b>2020</b>	<i>male</i>	<b>0.69</b>	<b>0.32</b>
<b>2020</b>	<i>female</i>	<b>0.26</b>	<b>0.12</b>
<b>2020</b>	<i>both</i>	<b>0.95</b>	<b>0.44</b>
<b>2021</b>	<i>male</i>	<b>0.99</b>	<b>0.40</b>
<b>2021</b>	<i>female</i>	<b>0.62</b>	<b>0.26</b>
<b>2021</b>	<i>both</i>	<b>1.61</b>	<b>0.66</b>

## Non-market production

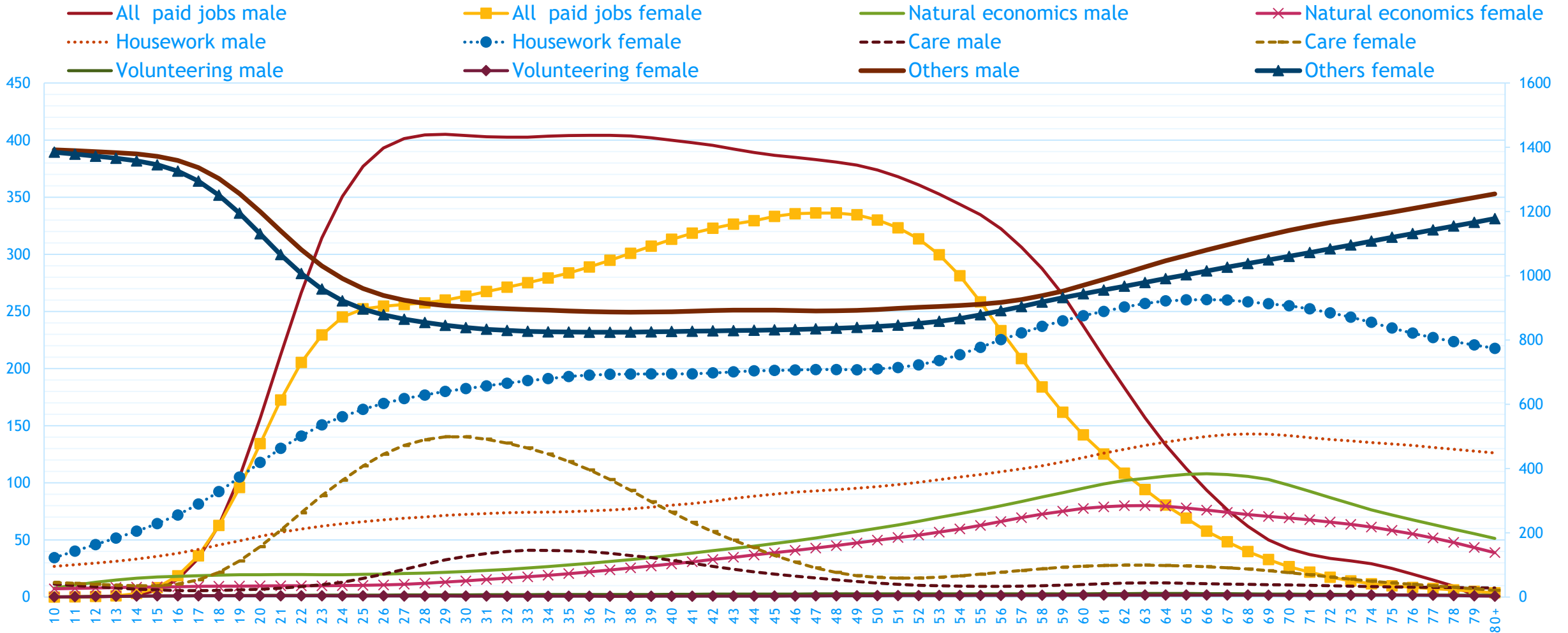
**Russian results only (for Kyrgyzstan the results are double checking, for Serbia and Moldova data is under construction)**

🔗 We look at the non-market production as it was in Hanley et. al (2022) papers and by NTTA (time transfers) approach:

The non-paid labour is estimated in minutes and distributed by each age

The 'wage' is assigned based by occupations, age and gender

# Russia: The results based on time spent, minutes per day (2019)



Others\*: Study, Social activity, Leisure, Sleeping, Self-care

## Non-market work and excess mortality

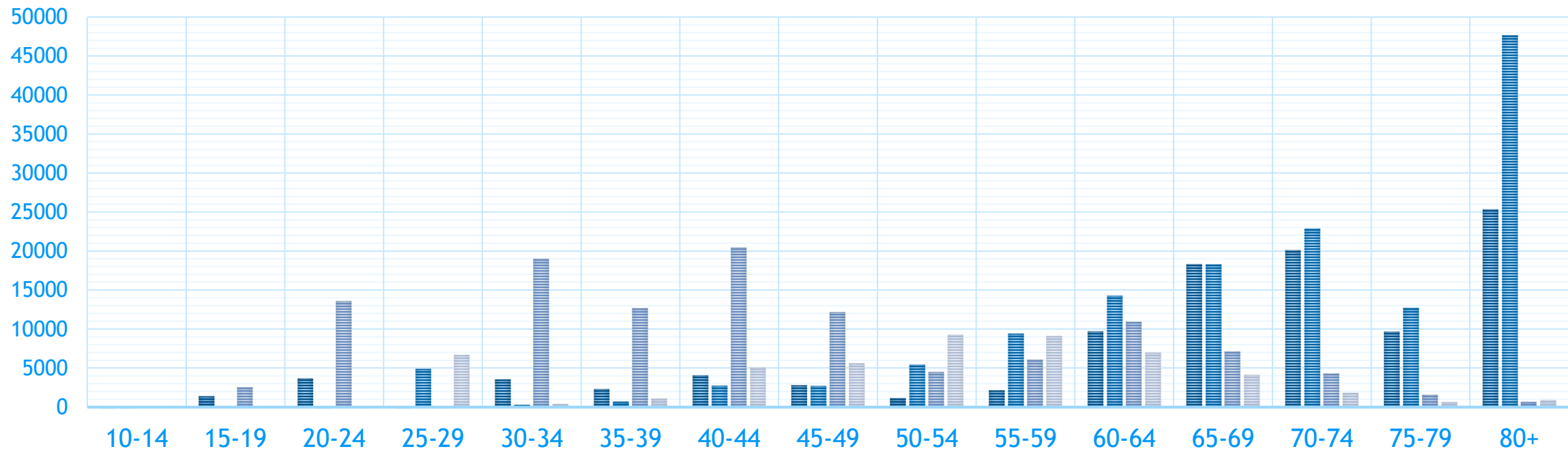
Hanley et al (2022) estimations for EU with proxy good approach (PGA) - Unpaid work of employed and non-employed individuals valued by the shadow prices:

- ❏ Male costs in the beginning of pandemics were the highest in the 55-64 age group (paid work for employed), and for female costs were the highest in the 65-74 age group especially in S. Europe (unpaid work of non-employed)
- ❏ Limitations: unpaid work in institutional social care units for older persons? - not a Post-Soviet space case

The advantages from NNTA: not only the unpaid work as it is, but a balance: production - consumption. (no over- or underestimation)

# Market (NTA indicator 'Income') and Non-market (in shadow prices - 2019 wages) production, mln. Rub

■ Non-market male ■ Non-market female ■ Market male ■ Market female



Losses (bln.):

- Market: 112 (male) + 50 (female),
- Non-market: 103 (male) + 140 (female)

## Cross-country comparisons, losses as % GDP

		2019	2020+2021
Income	<i>Russia</i>	<b>0.140</b>	<b>0.071</b>
	<i>Moldova</i>	<b>0.069</b>	<b>0.034</b>
	<i>Kyrgyzstan</i>	<b>0.072</b>	<b>0.034</b>
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	<i>Kyrgyzstan</i>	<b>0.291</b>	<b>0.147</b>
	<i>Serbia</i>	<b>0.555</b>	<b>0.265</b>
Non-market Production	<i>Russia</i>	<b>0.147</b>	<b>0.075</b>

Russia YPLL			
Year	Gender	% of GDP	% of GDP (labour part)
<b>2020</b>	<i>male</i>	<b>0.69</b>	<b>0.32</b>
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<b>2021</b>	<i>both</i>	<b>1.61</b>	<b>0.66</b>

Hanly (2022) within 9 weeks in the beginning of C-19 pandemics the losses were (% GDP):

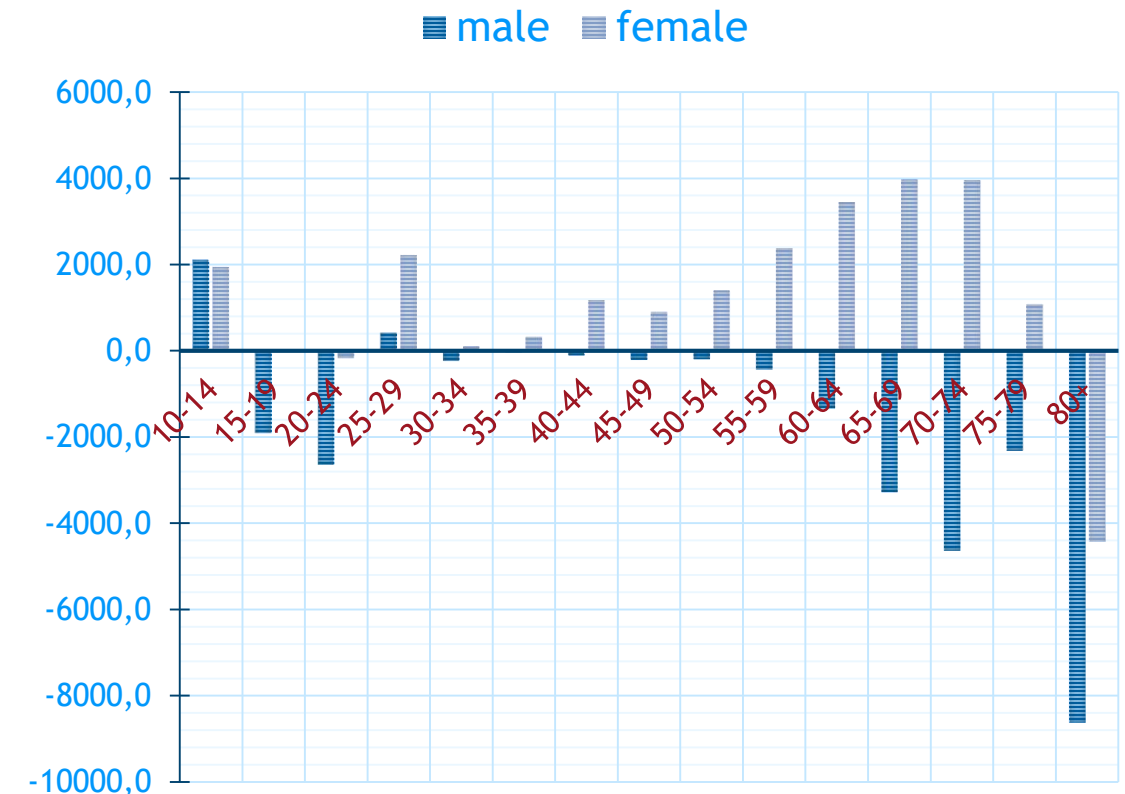
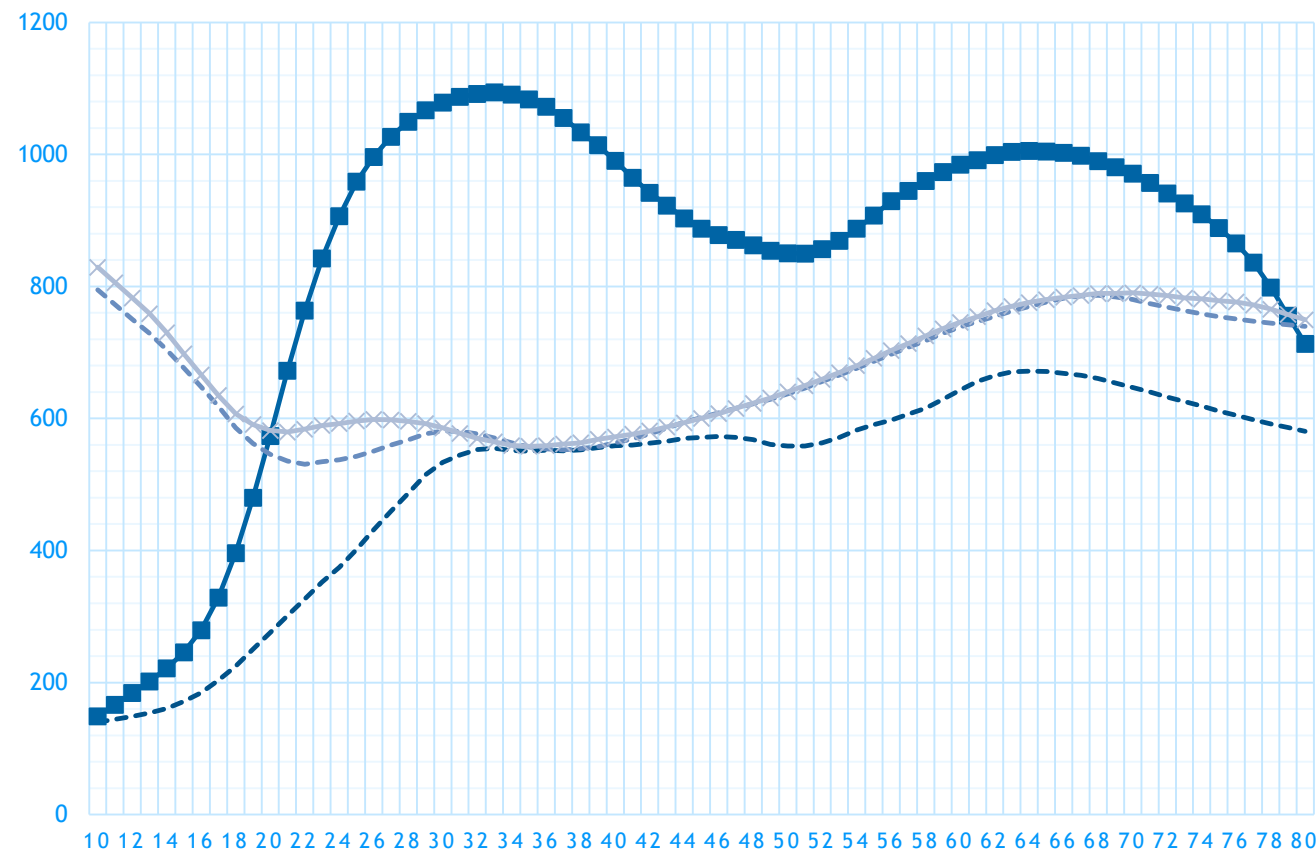
Country	Paid+Unpaid	Paid
Spain	0.112	0.036
Netherlands	0.09	0.047
Italy	0.05	0.028



If we look at the balance (Production - Consumption, rub per day)

- - - production male  
 - - - consumption male  
 ■ production female  
 × consumption female

And multiply it for the general mortality losses (mln. per year).

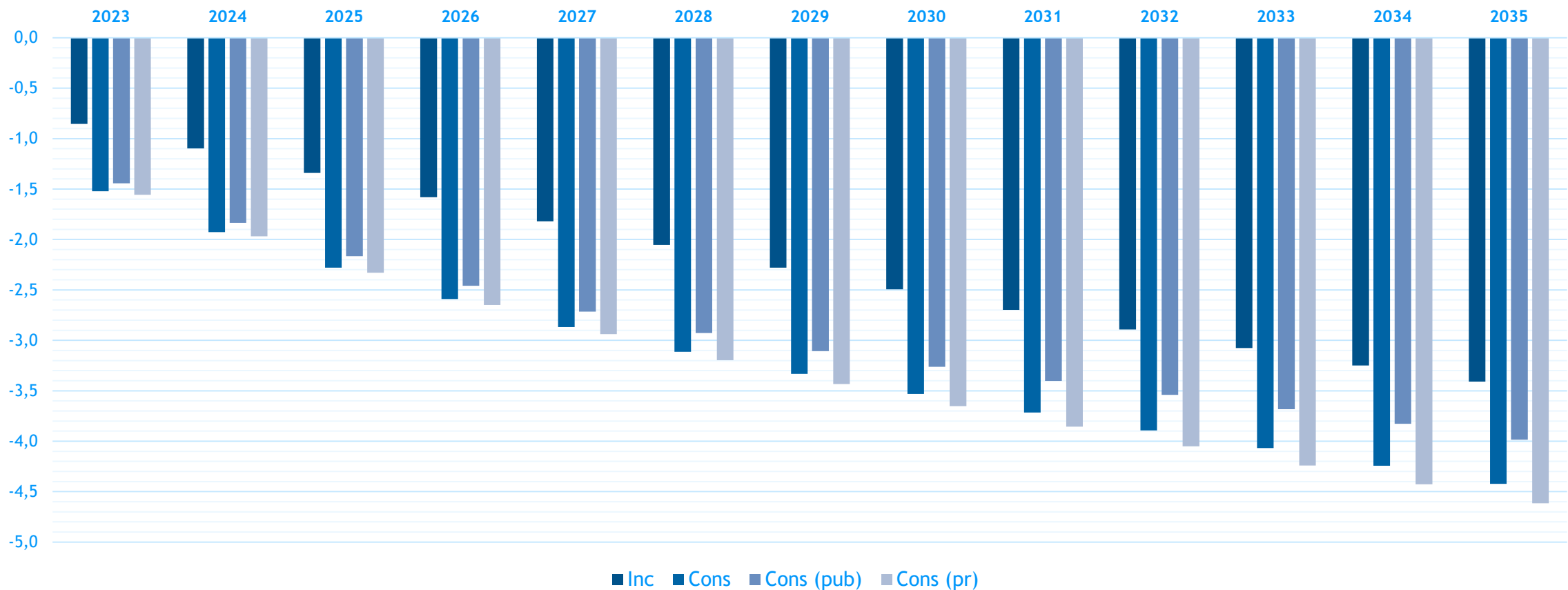


## The results based on NTA (middle term)

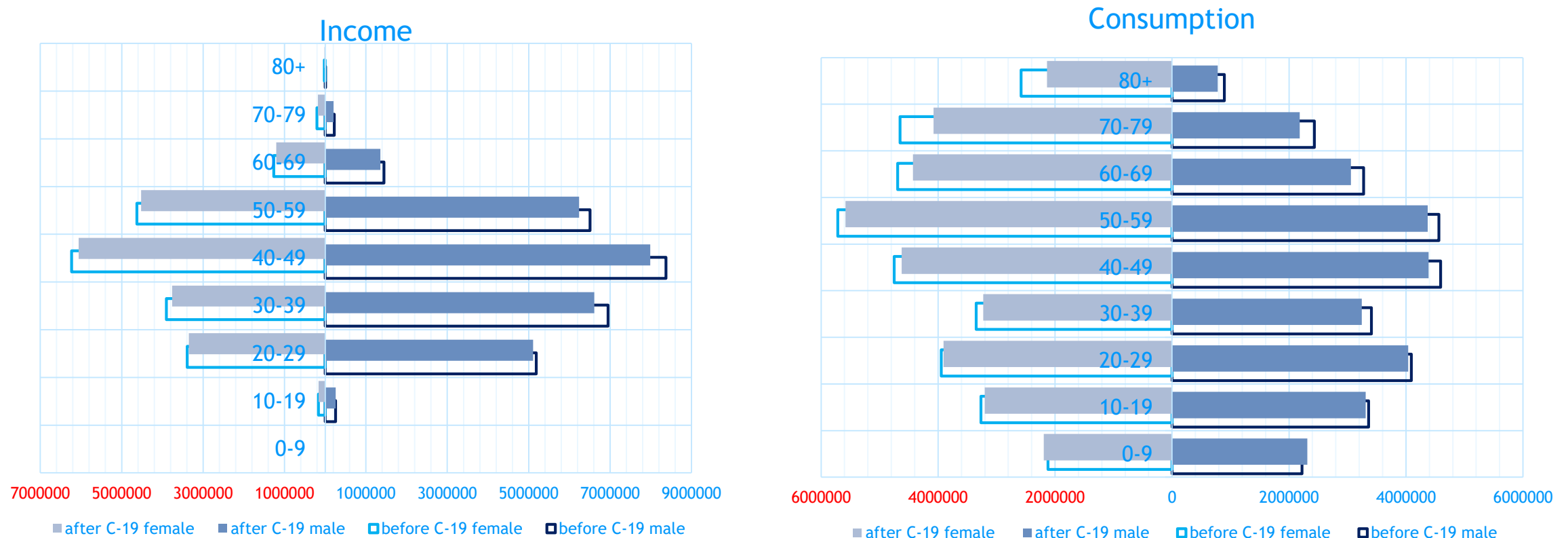
- 🔗 The results of the age structures change due to mortality
- 🔗 Forecasts until 2035:
  1. Already used demographic projection from 2020
  2. New demographic forecast from 2022 (took into consideration the C-19 changes)

## The results based on NTA (middle term)

Differences between 2 demographic projections in Income, consumption, transfers balances (% changes between projections)



# Decomposing differences to the end of the period in bln. rubbles



The difference for Income: -4.1% (male) and -2.8% (female)  
Consumption: -4.0% (male) and -4.8% (female)

## Further work

- ✂ There is still a work with the balancing NTA by sex and NTTA for all the countries
- ✂ 2020 and 2021 age profiles for the better economic losses estimation - to see the economic effect (not just demographic for the ratios)
- ✂ Non-paid work for the losses by causes of death
- ✂ Macroeconomic effect
- ✂ Profiles by other SES