

Corvinus Institute for Advanced Studies (CIAS)
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Intergenerational Transfer of Care Work: How Technology would Meet with Future Care Demand in Japan and the UK?

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“The Future of Unpaid Work: AI’s potential to transform unpaid domestic work in the UK and Japan”, UKRI-JST Call on Artificial Intelligence and Society (2020.1-2023.12), P.I. Prof. Nobuko Nagase (Ochanomizu University) & Dr. Ekaterina Hertog (Oxford University)

Three broad social changes across the globe

1. Population aging
 - ➔ Increasing demand for care and housework for elderly, but opposite for children.
 2. Gender revolution
 - ➔ Women will have less time at home (but, men may have more time at home)
 3. AI/Technology development
 - ➔ Automation of work tasks and **unpaid work activities** may be possible
- How would the future of unpaid work look like?

What we do

- Estimate future care needs (incl. childcare and housework) in households in Japan and the UK, by using time-use surveys
- Simulate how large the gap between the demand and supply of future domestic unpaid work, assuming that only population structure alone changes
- Estimate the future automation percentages of unpaid work activities
- Simulate **how automation of unpaid work would fill in the gap**

Methods

① NTTA (National Time Transfer Accounts)

➔ Estimating **per capita** production (supply) and consumption (demand) of **unpaid work time** by sex and single-year age for Japan and the UK around 2015

URL: <https://www.countingwomenswork.org/about/methodology>

② The UN World Population Prospects 2021

➔ Population by sex and 5-year-old age of Japan and the UK in 2015-2060

URL: <https://population.un.org/wpp/>

③ Simulation of future care mismatch + Prediction of unpaid work automation in the future

➔ See if future demand-supply gaps would be solved by technology

Time Use Data

- UK time use data 2014-15
 - Nationally representative samples of households and individuals in the United Kingdom
 - Sample size: over 16,000 (men and women age over 10)
- Japanese time use data 2016
 - Nationally representative cross-sectional samples in Japan
 - Sample size: less 20,000 (men and women age over 10)
- Both follow the standard method to collect time-use data, that is instructed by the UN.

Access to the UKTUS 2015 is obtained through the UK Data Archive <http://doi.org/10.5255/UKDA-SN-8128-1>.

Permission to use the data on STULA 2016 was obtained through the Statistics Bureau of Japan based on the Statistics Act (Act No. 53 of 2007), Article 33

A substantial time use on unpaid work in Japan and The UK

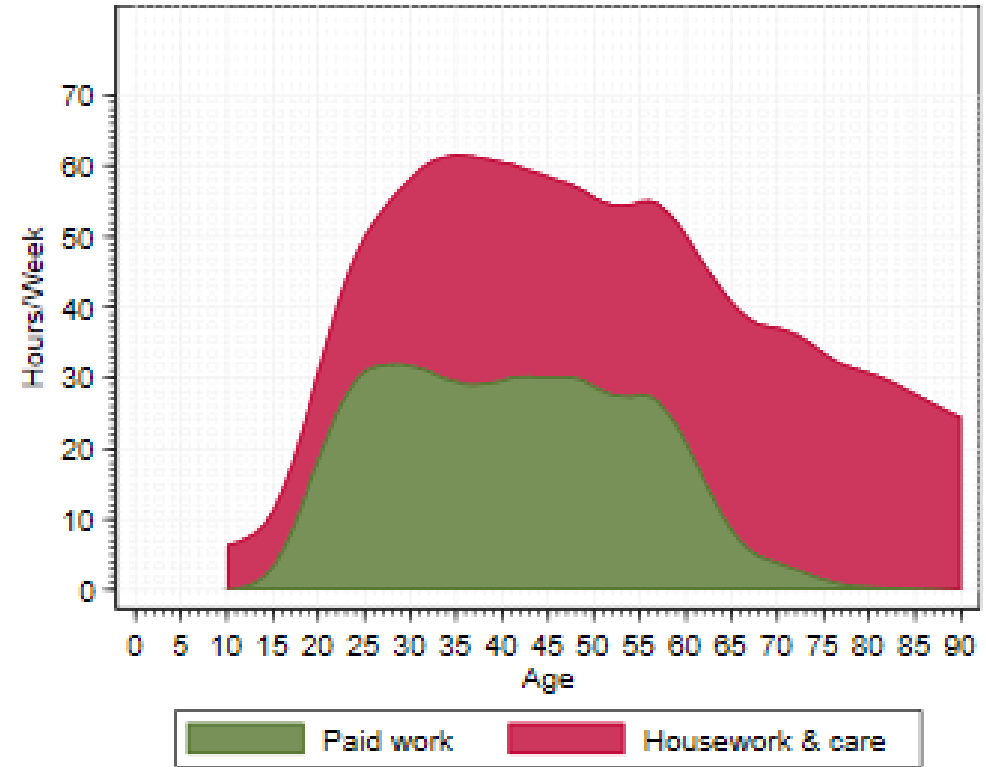
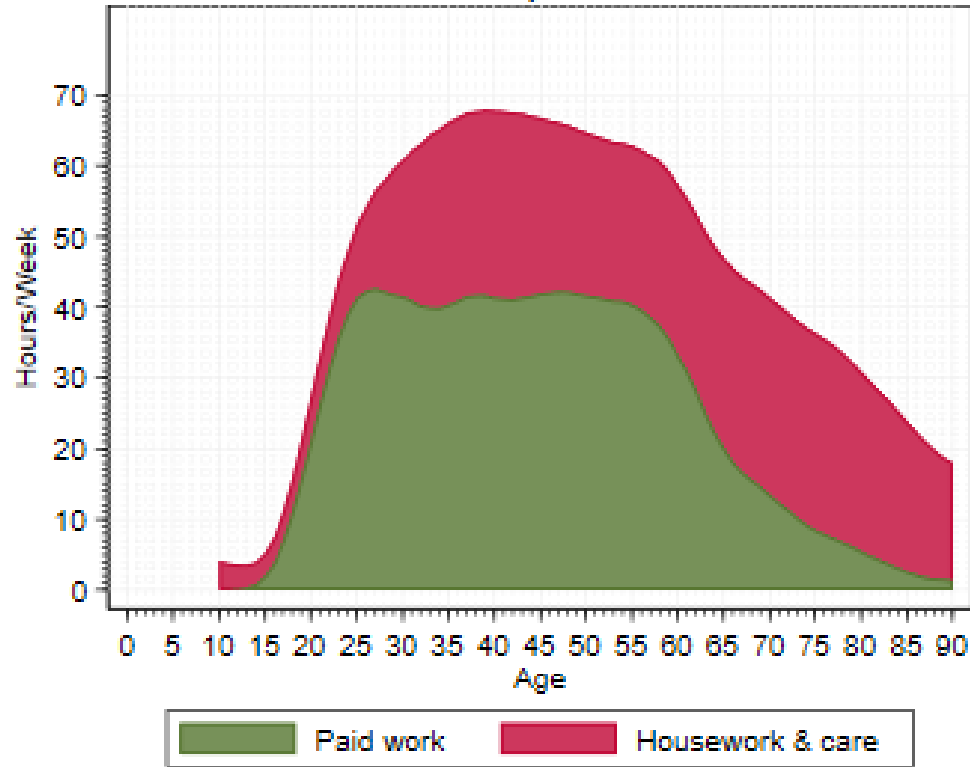
Per capita values

2016

2014-15

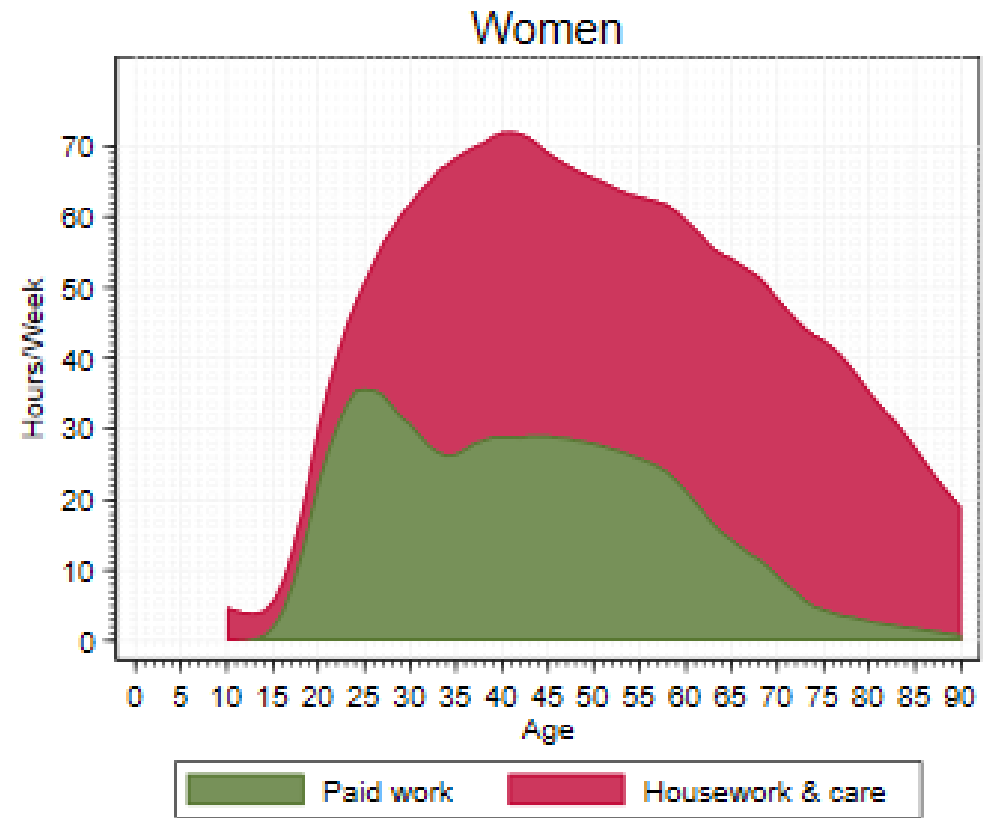
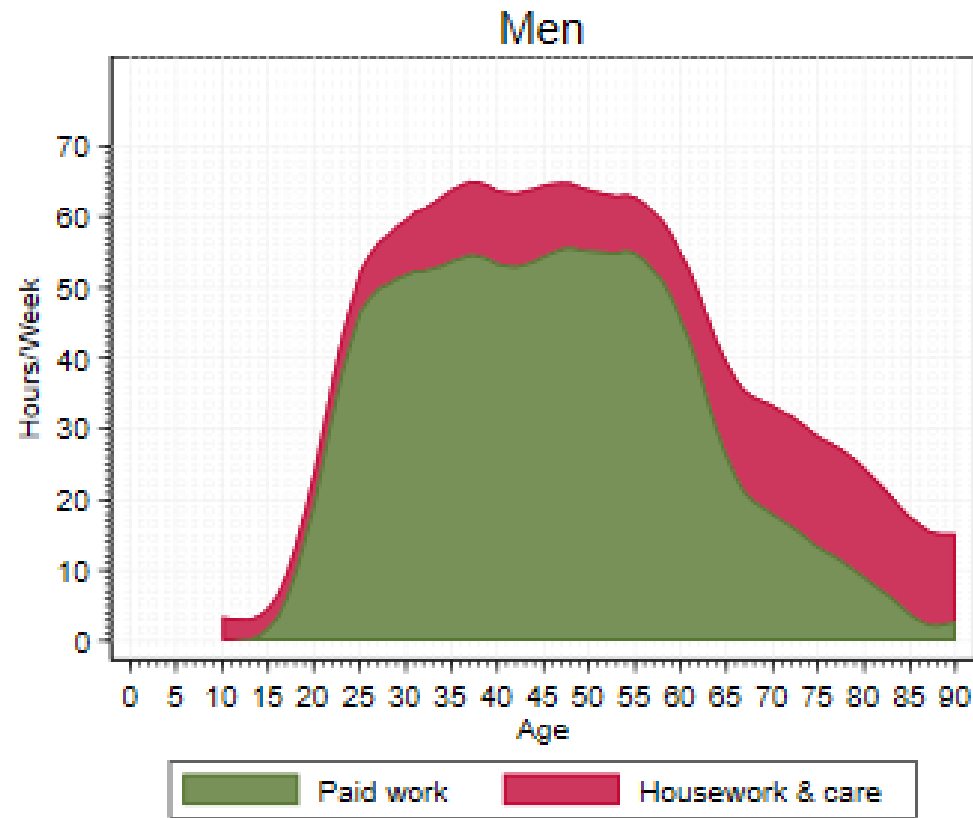
Japan

The UK



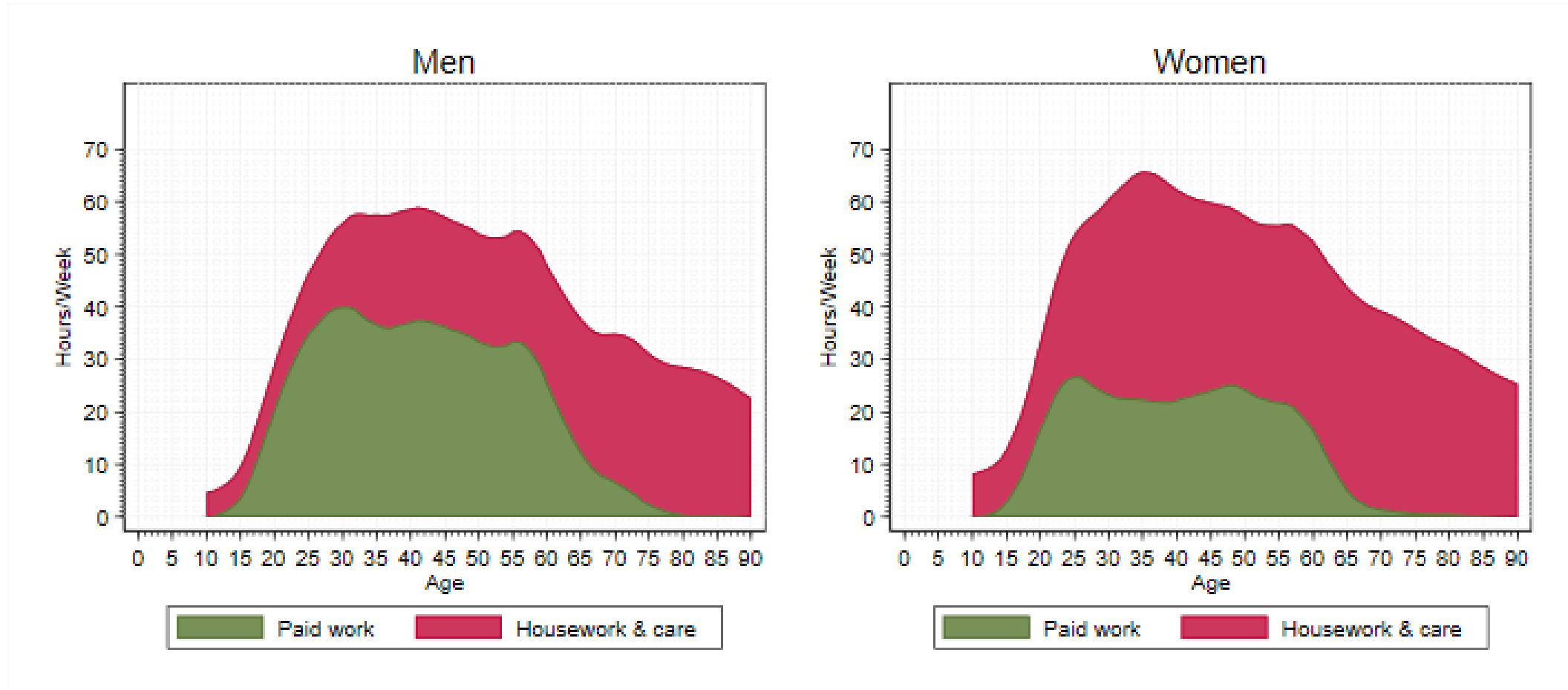
Strong gender division in Japan

Per capita values



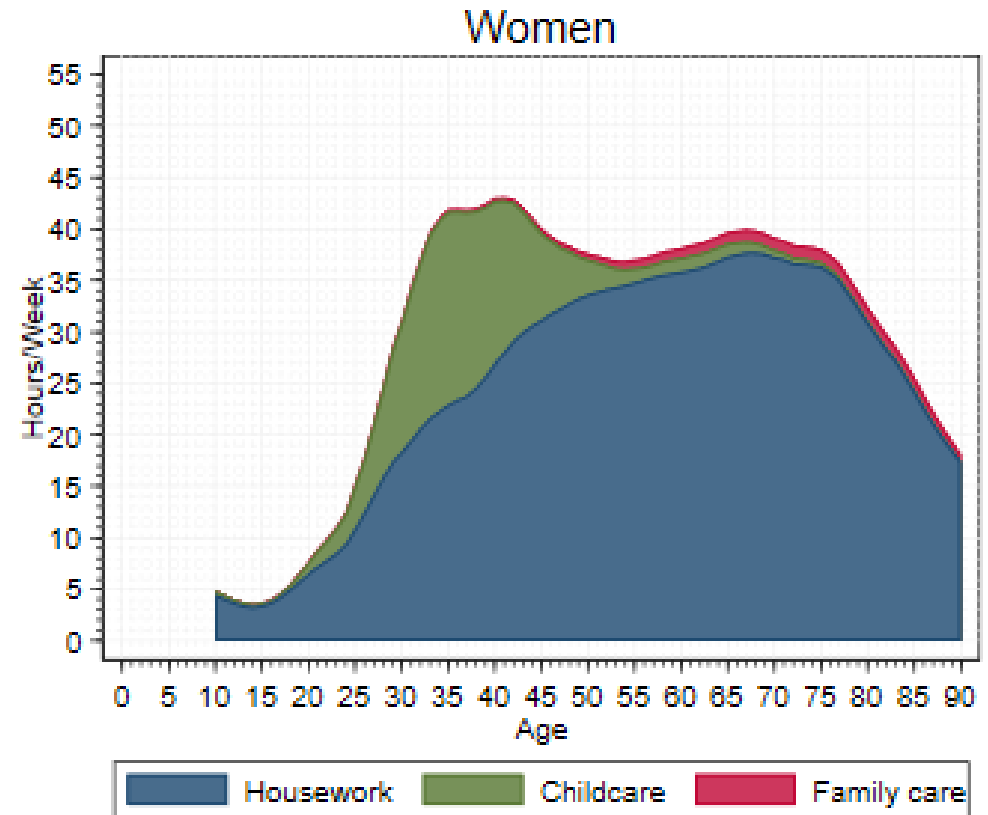
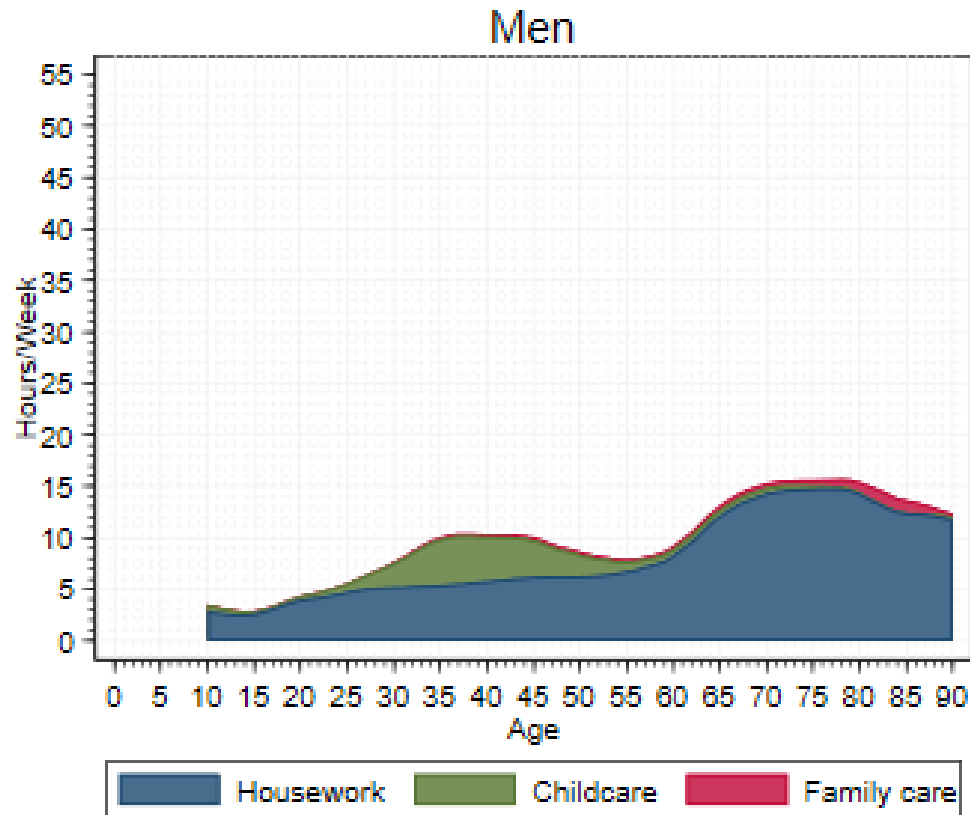
Clear but less gender division in the UK

Per capita values



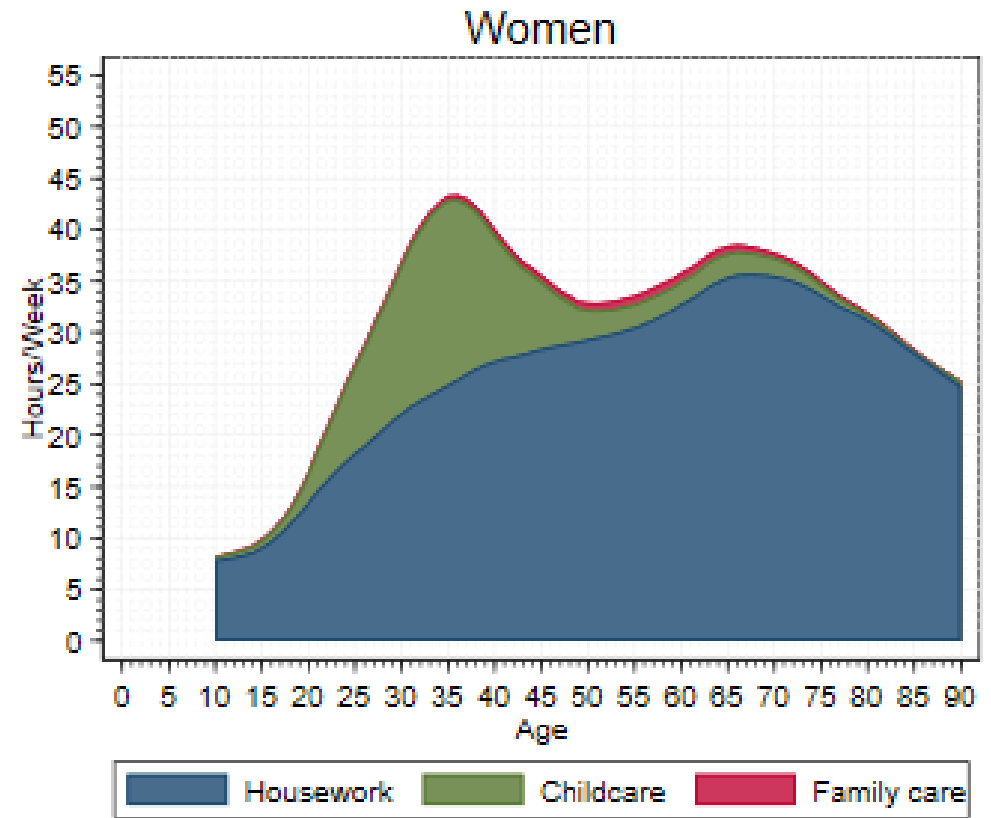
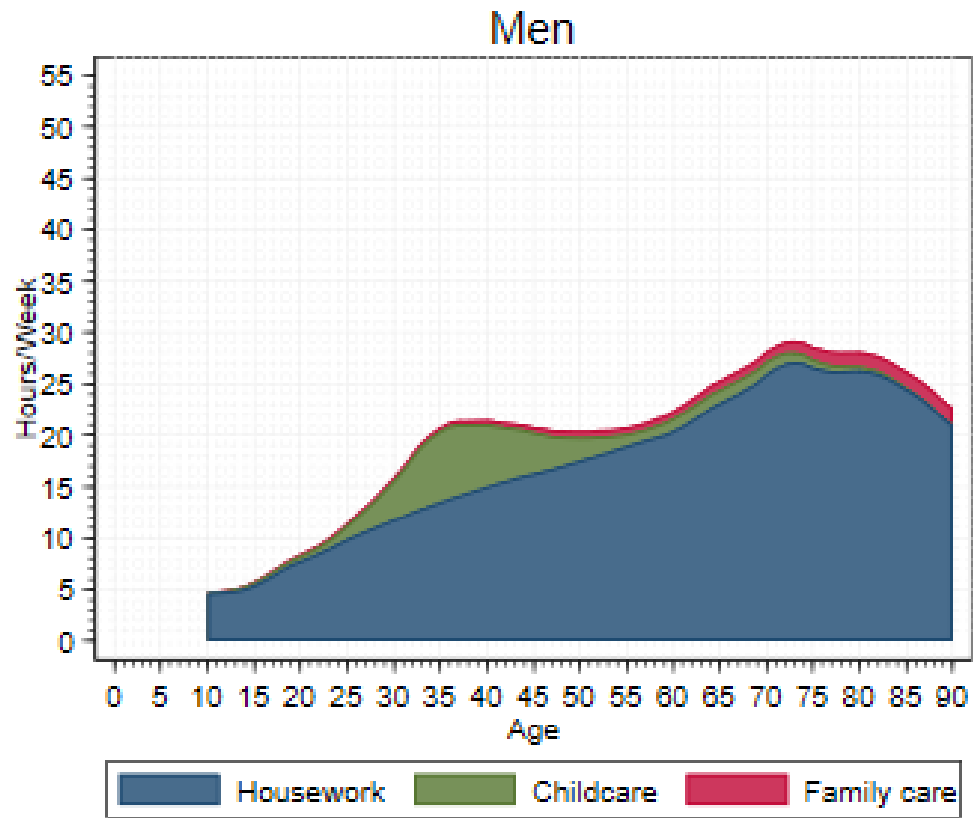
NTTA: Strong gender diff. in unpaid work in Japan

Per capita production of unpaid work



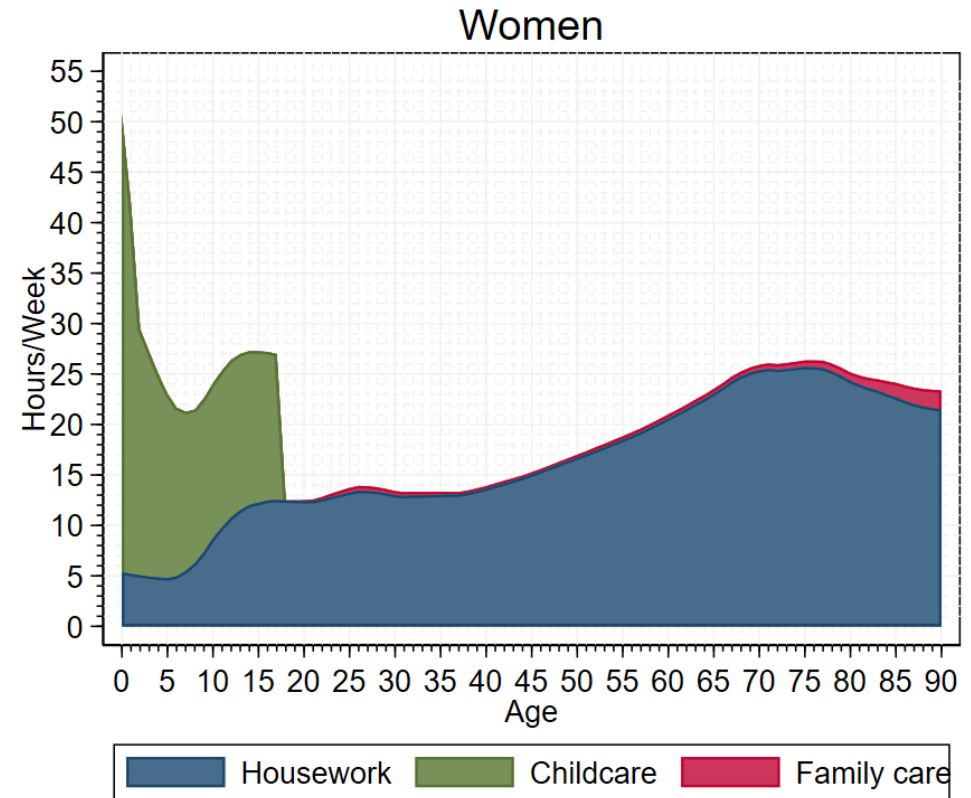
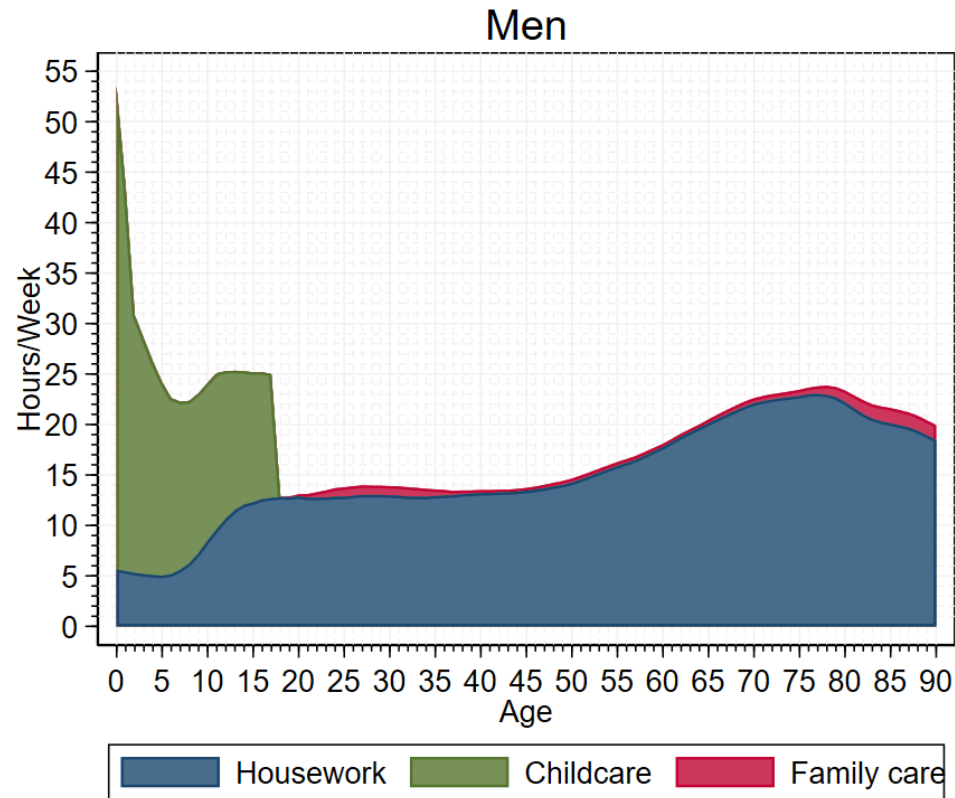
NTTA: Less gender diff. in unpaid work in the UK

Per capita production of unpaid work



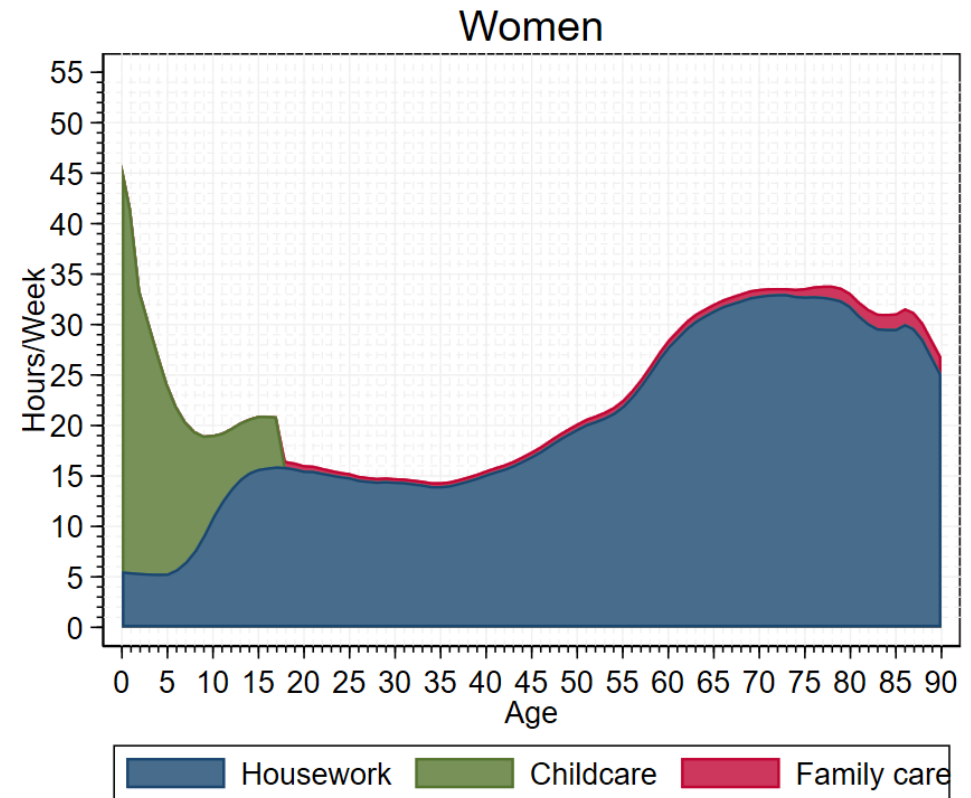
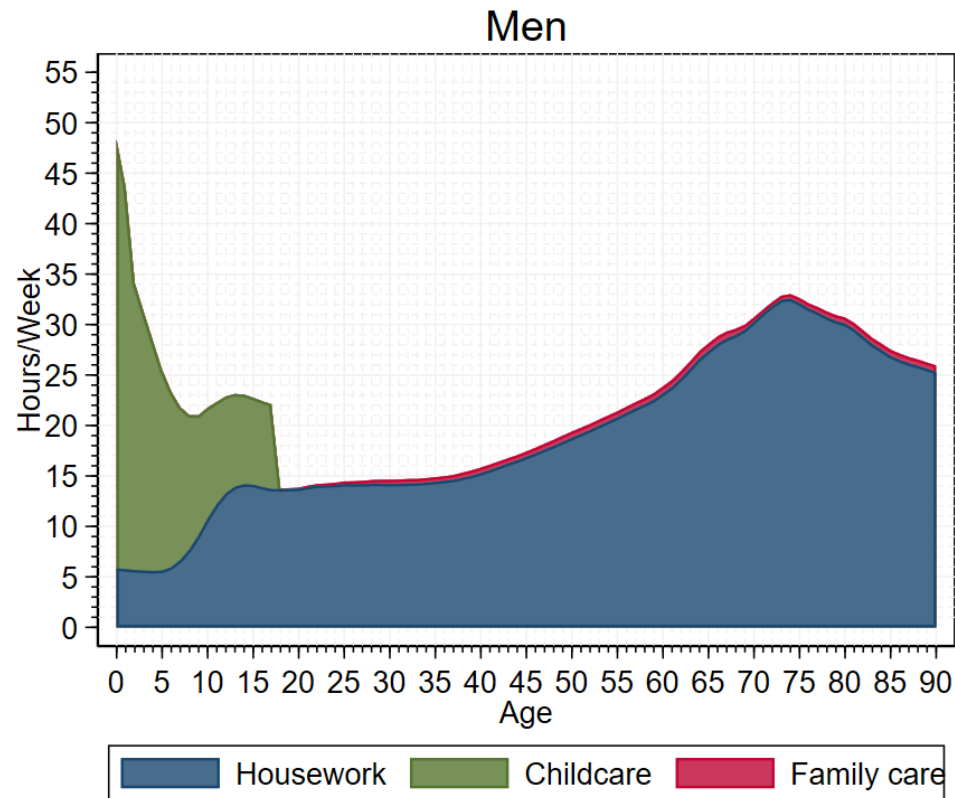
NTTA: Children consume a lot in Japan

Per capita consumption of unpaid work



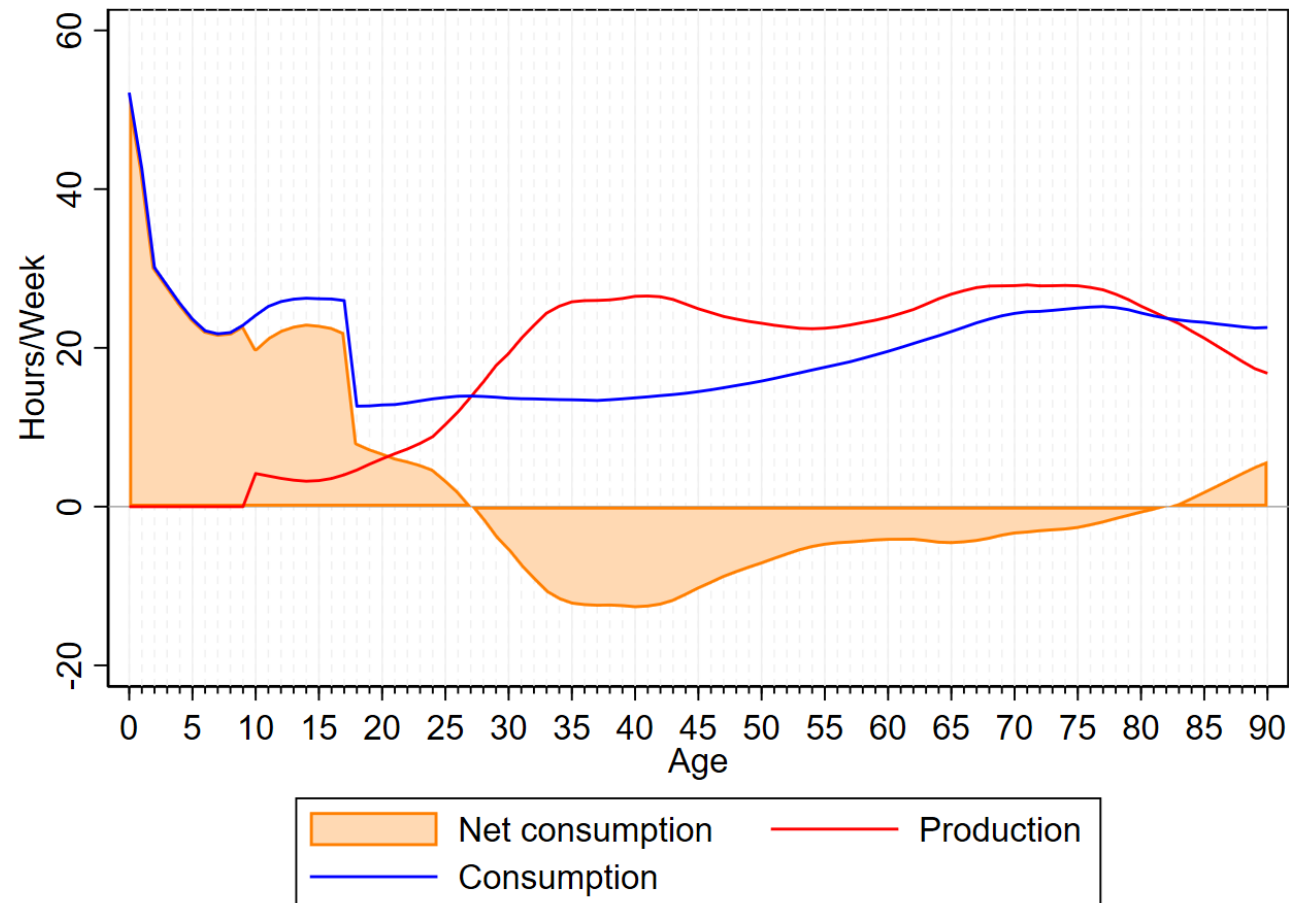
NTTA: Adults and elderlies consume a lot in the UK

Per capita consumption of unpaid work



Net Consumption of Unpaid Work

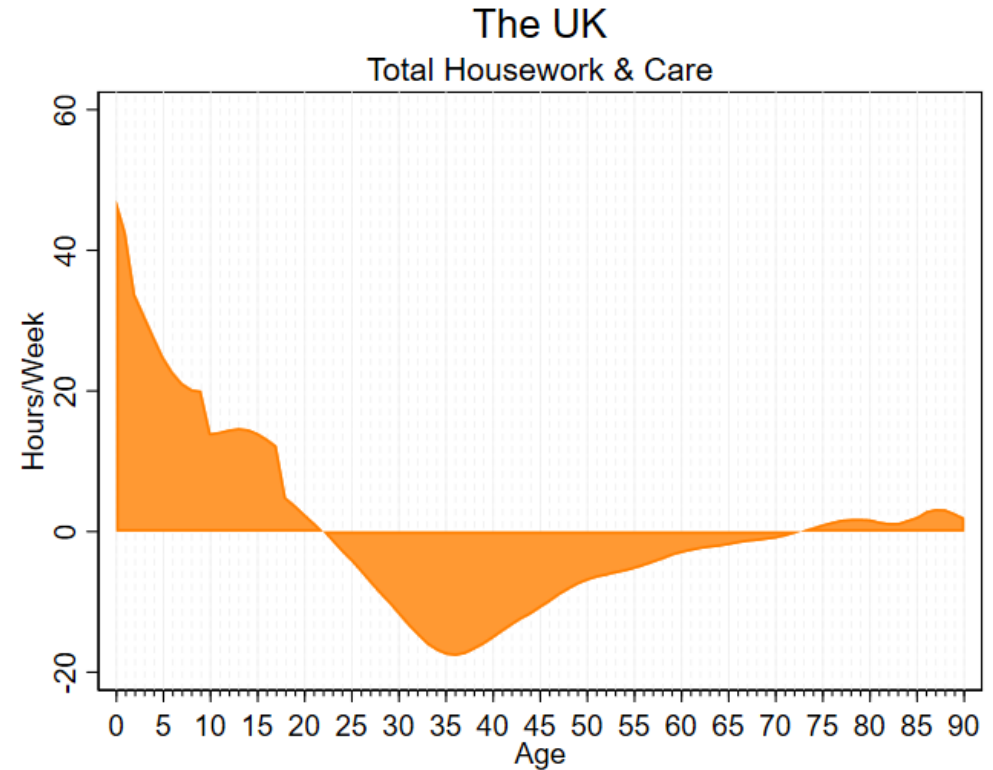
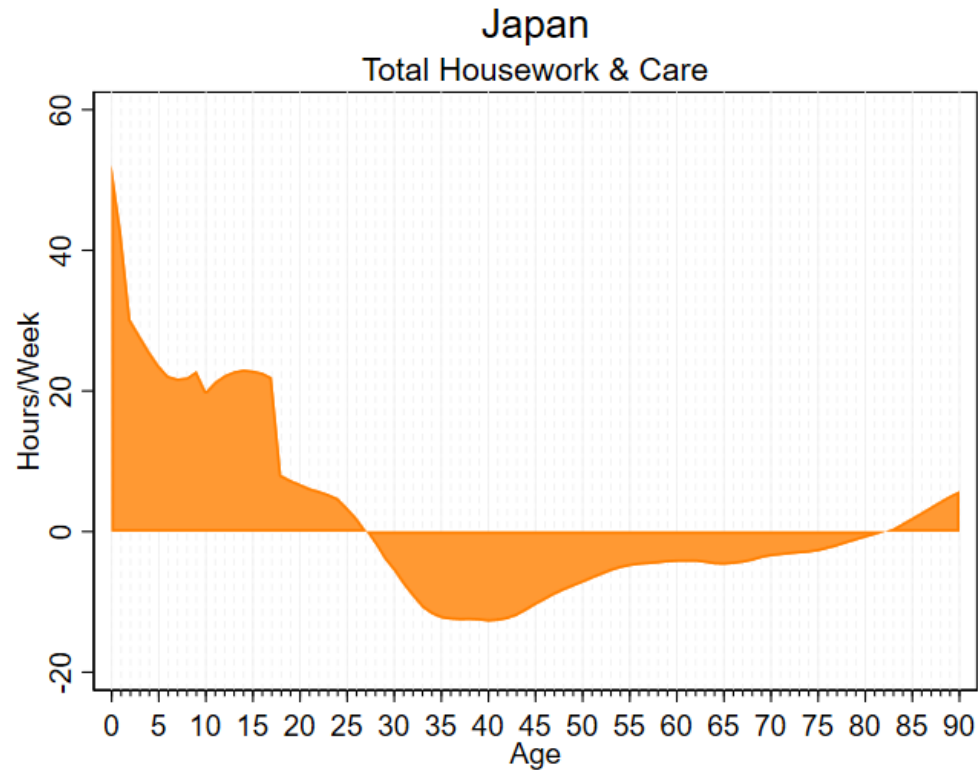
Net cons. = Consumption – Production (per capita)



Compared with the UK, child net consumption is larger, and net production is lower but longer in Japan.

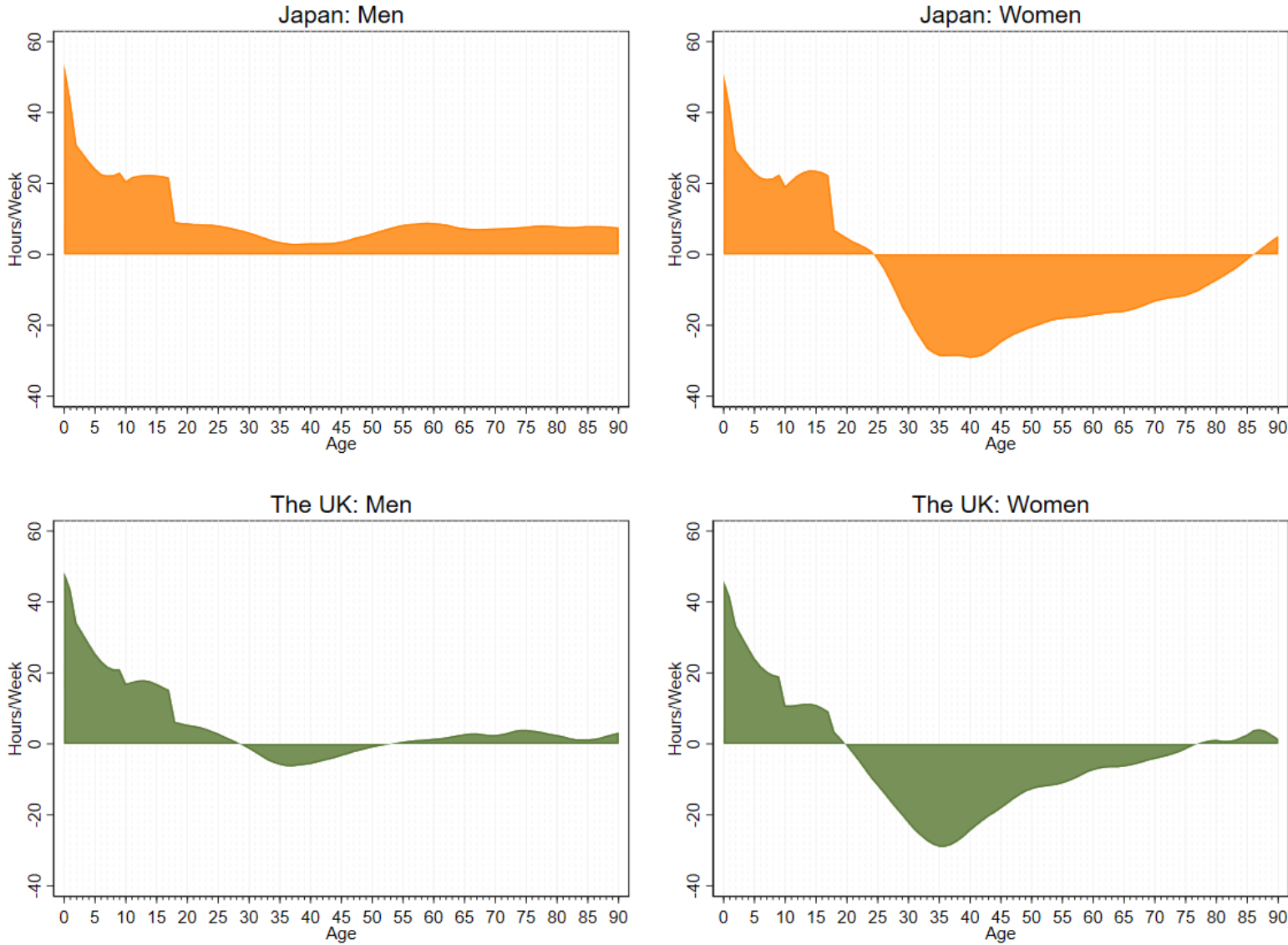
Per capita values

Net Consumption by Age



Men continue to be net consumers throughout their life in Japan

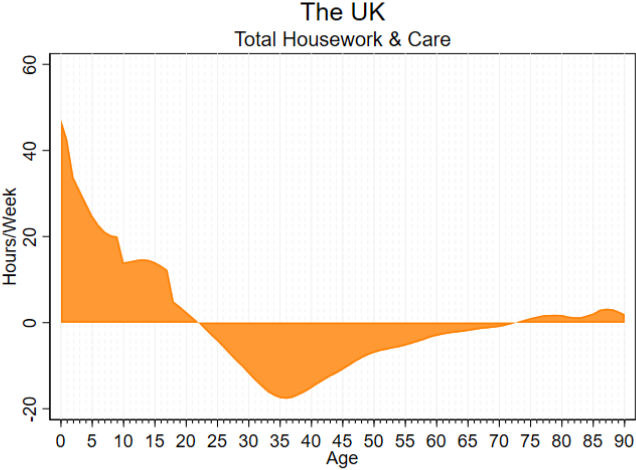
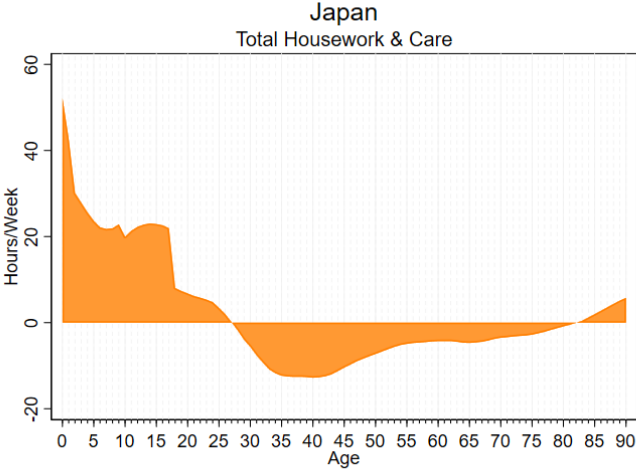
Net Consumption by Sex, per capita



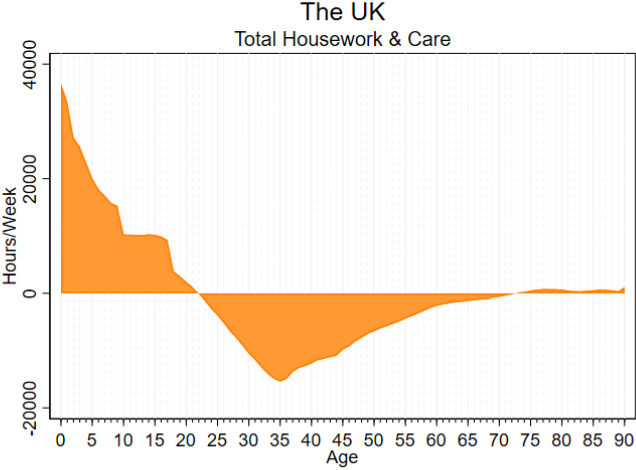
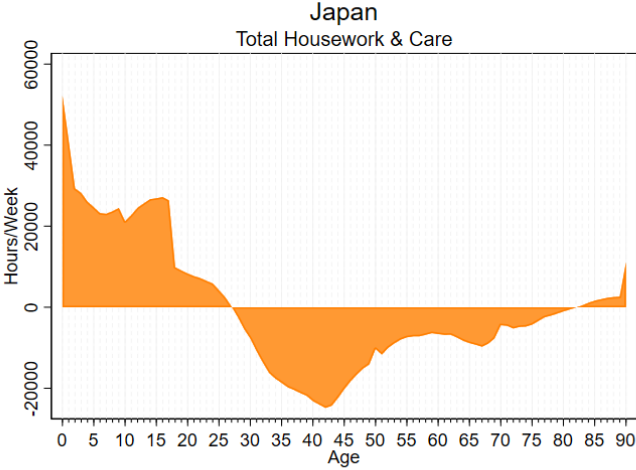
Population
Aggregate

per capita
time use
×
pop. by age
(and sex)

Net Consumption by Age
per capita



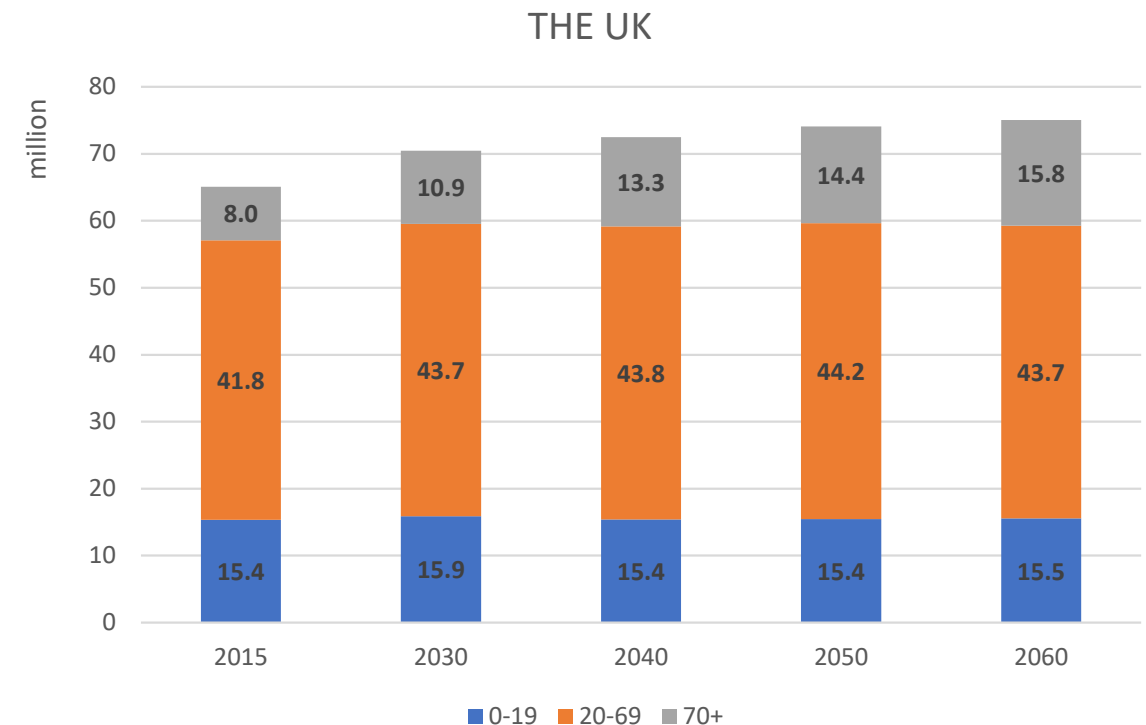
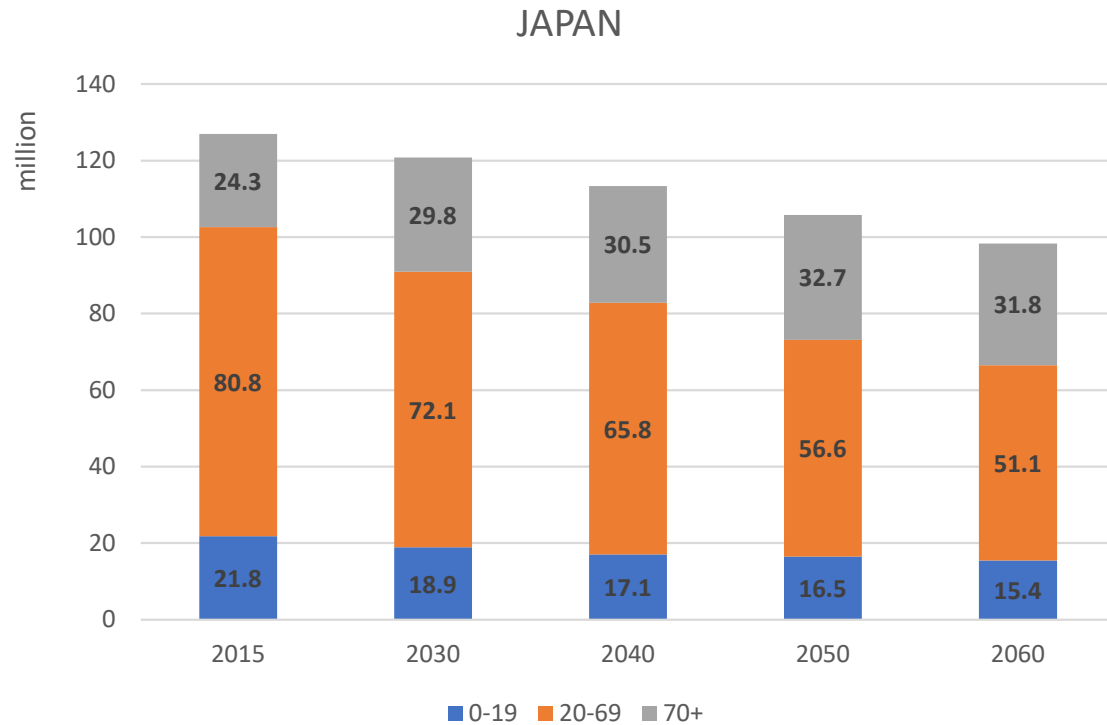
Net Consumption by Age
population aggregate



Simulation of Future Care Mismatch

- **Assumption:** The per capita production and consumption of unpaid work stay the same in the future (Only the population sizes and age structures change in both countries)
- Population data: The UN World Population Prospects 2021
- Period: 2015-2060

The UN Population Projection (2021) shows that JPN population continues to decline and age, while the UK population will age but continues to increase.



Changes from 2015 to 2060

Japan

Age 0-19: -29.3%
 Age 20-69: -36.8%
 Age 70+: +30.8%
 Total: -22.5%

The UK

Age 0-19: +1.2%
 Age 20-69: +4.7%
 Age 70+: +97.5%
 Total: +15.3%

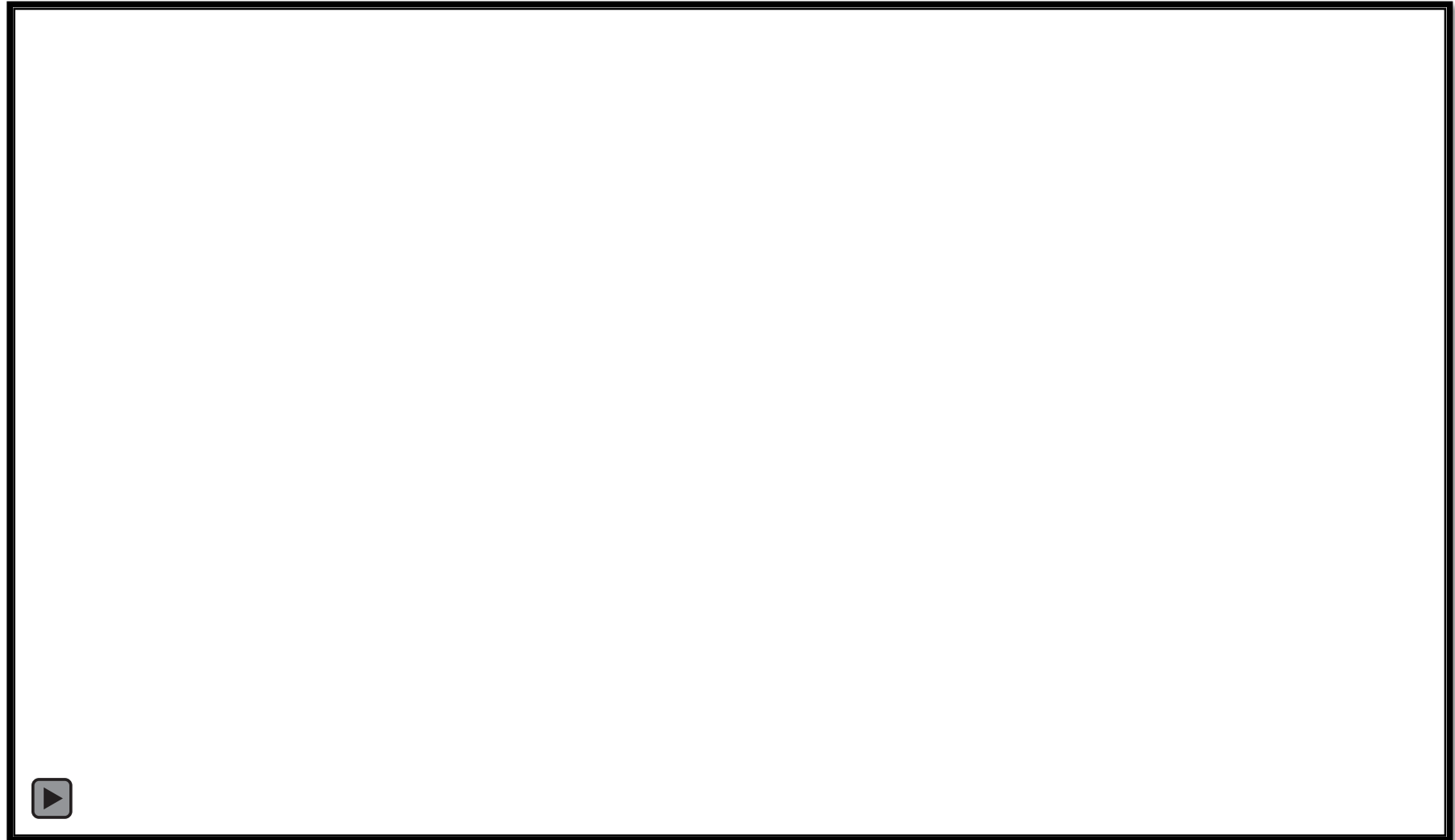
Net consumption of unpaid work increases, while net production decreases in Japan

Net
consumption
of unpaid
work in Japan
2015-2060

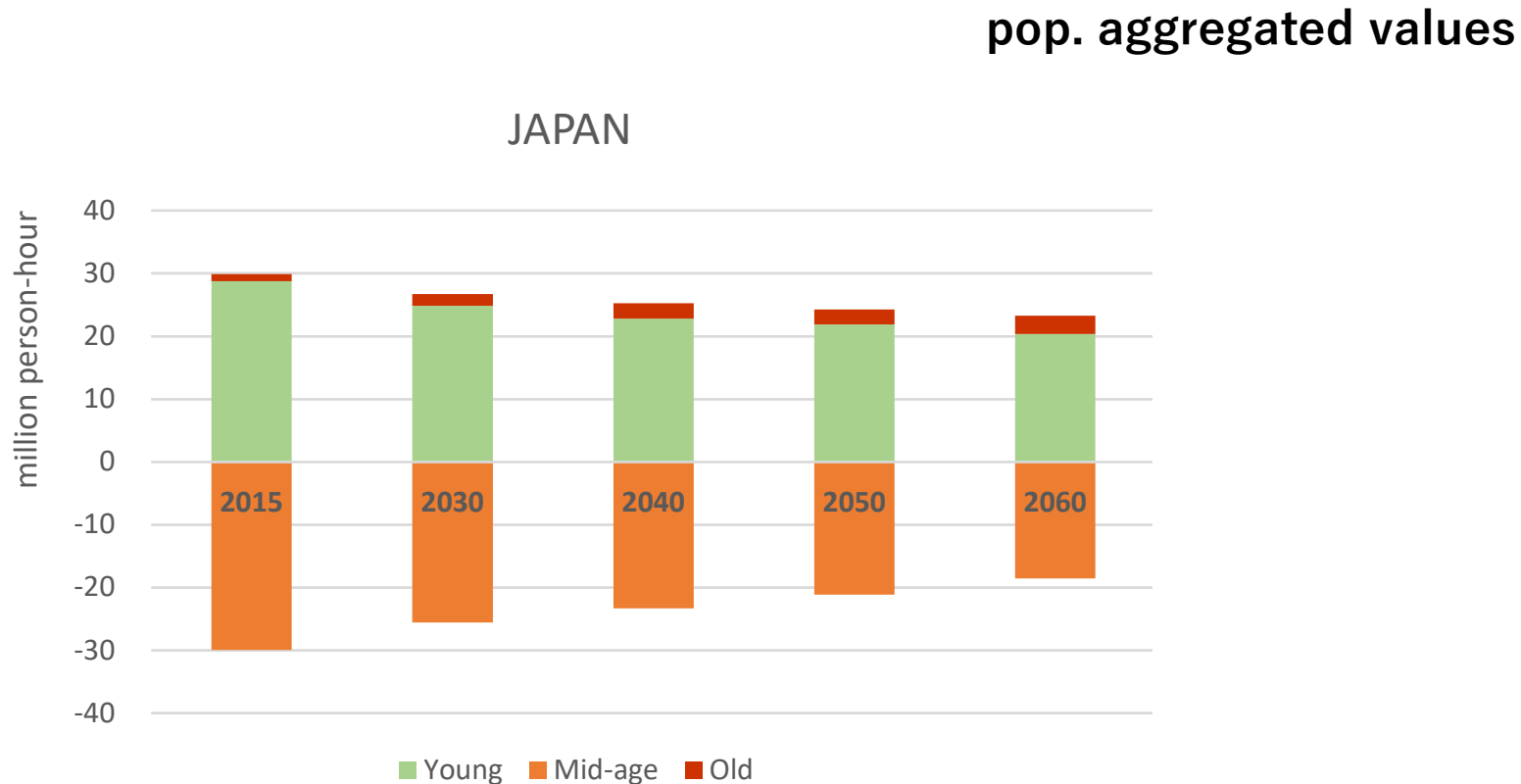


The child net consumption slightly decrease, while the elderly net consumption increase. The net production stays the same in the UK.

Net
consumption
of unpaid
work in the
UK
2015-2050



Net production of unpaid work decreases faster than net consumption in Japan.



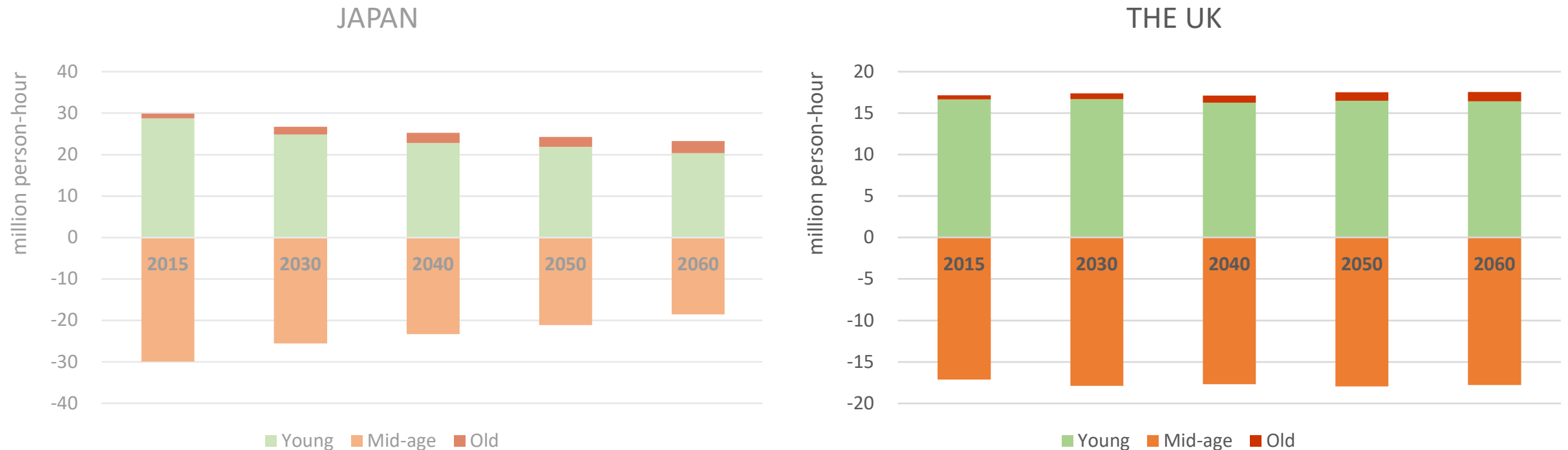
Young: People at young age whose average net consumption is positive.

Mid-age: People in middle age whose average net consumption is negative.

Old: People in old age whose average net consumption is positive.

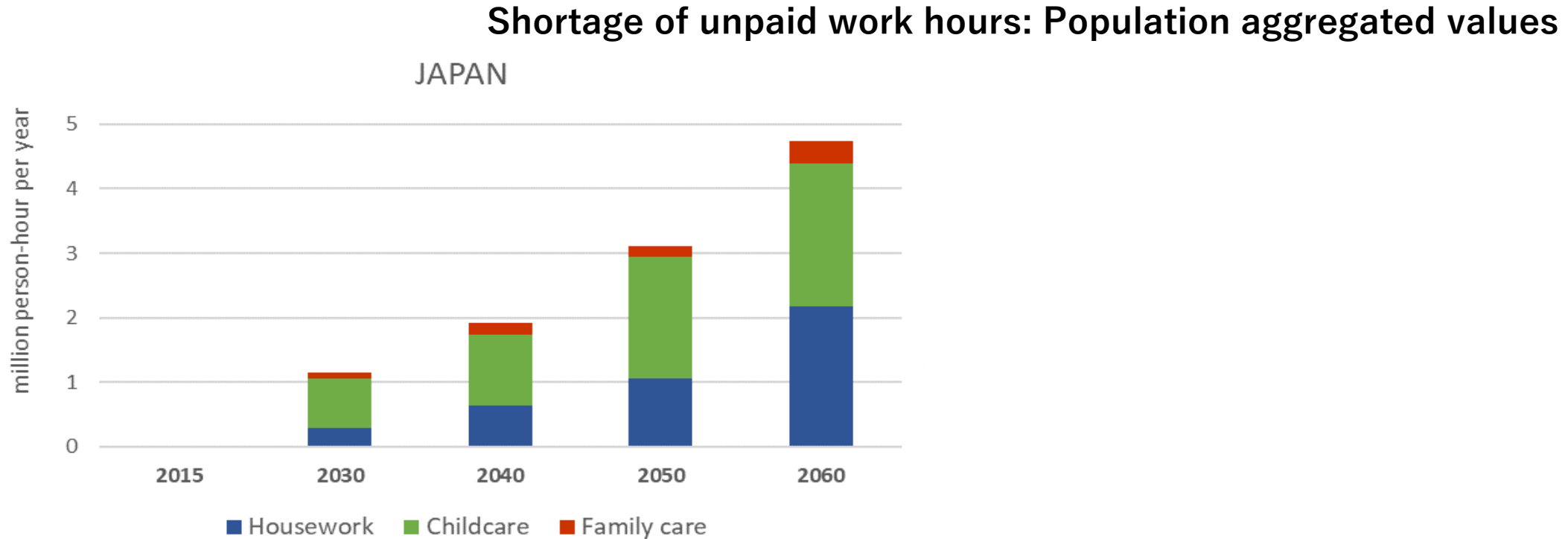
While in the UK, the amounts of net consumption and net production of unpaid work stay similar across the period.

pop. aggregated values



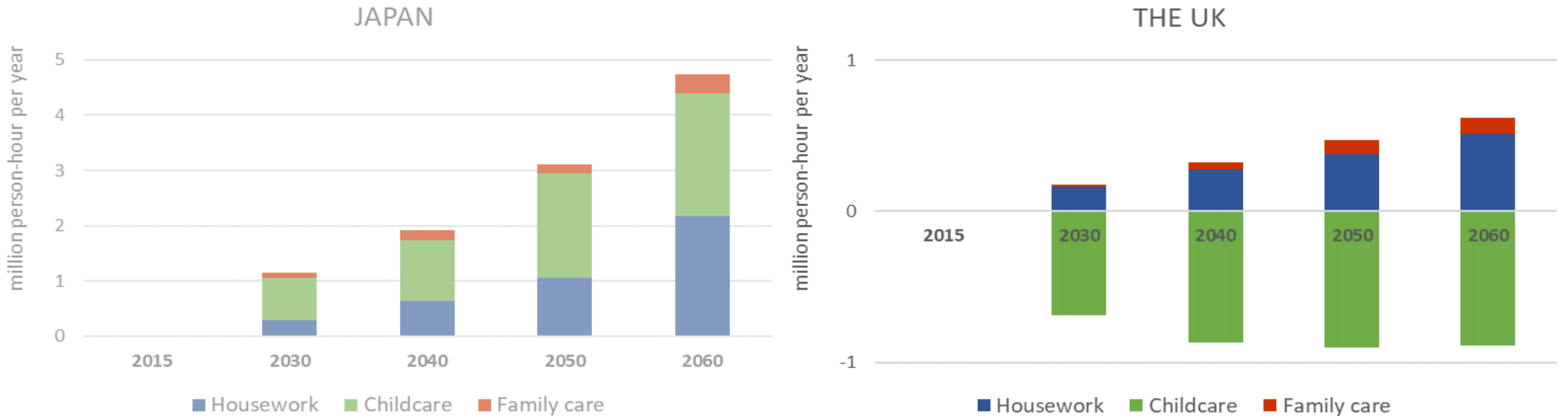
Young: People at young age whose average net consumption is positive.
Mid-age: People in middle age whose average net consumption is negative.
Old: People in old age whose average net consumption is positive.

The amount of unpaid work consumption, not filled by production, will rapidly increase in Japan, particularly in childcare and housework.



In the UK, housework and family care will be only slightly short, but the childcare supply will largely be in surplus.

Shortage of unpaid work hours: Population aggregated values



Japan needs additional production of unpaid work in all three areas to meet the demand.

% of additional production necessary to fill in the gap in each year

Japan	2015	2030	2040	2050	2060
Housework	0	0.3%	0.6%	1.1%	2.5%
Childcare	0	4.6%	7.1%	12.6%	16.2%
Family care	0	3.0%	6.0%	5.7%	11.3%

In the UK, the housework shortage will be smaller, and the childcare surplus can fulfill family care needs.

% of additional production necessary to fill in the gap in each year

Japan	2015	2030	2040	2050	2060
Housework	0	0.3%	0.6%	1.1%	2.5%
Childcare	0	4.6%	7.1%	12.6%	16.2%
Family care	0	3.0%	6.0%	5.7%	11.3%

THE UK	2015	2030	2040	2050	2060
Housework	0	0.2%	0.4%	0.5%	0.7%
Childcare	0	-5.9%	-7.6%	-7.8%	-7.7%
Family care	0	1.1%	2.8%	4.8%	5.7%

Mainly due to having more grandparents (younger elderlies) available

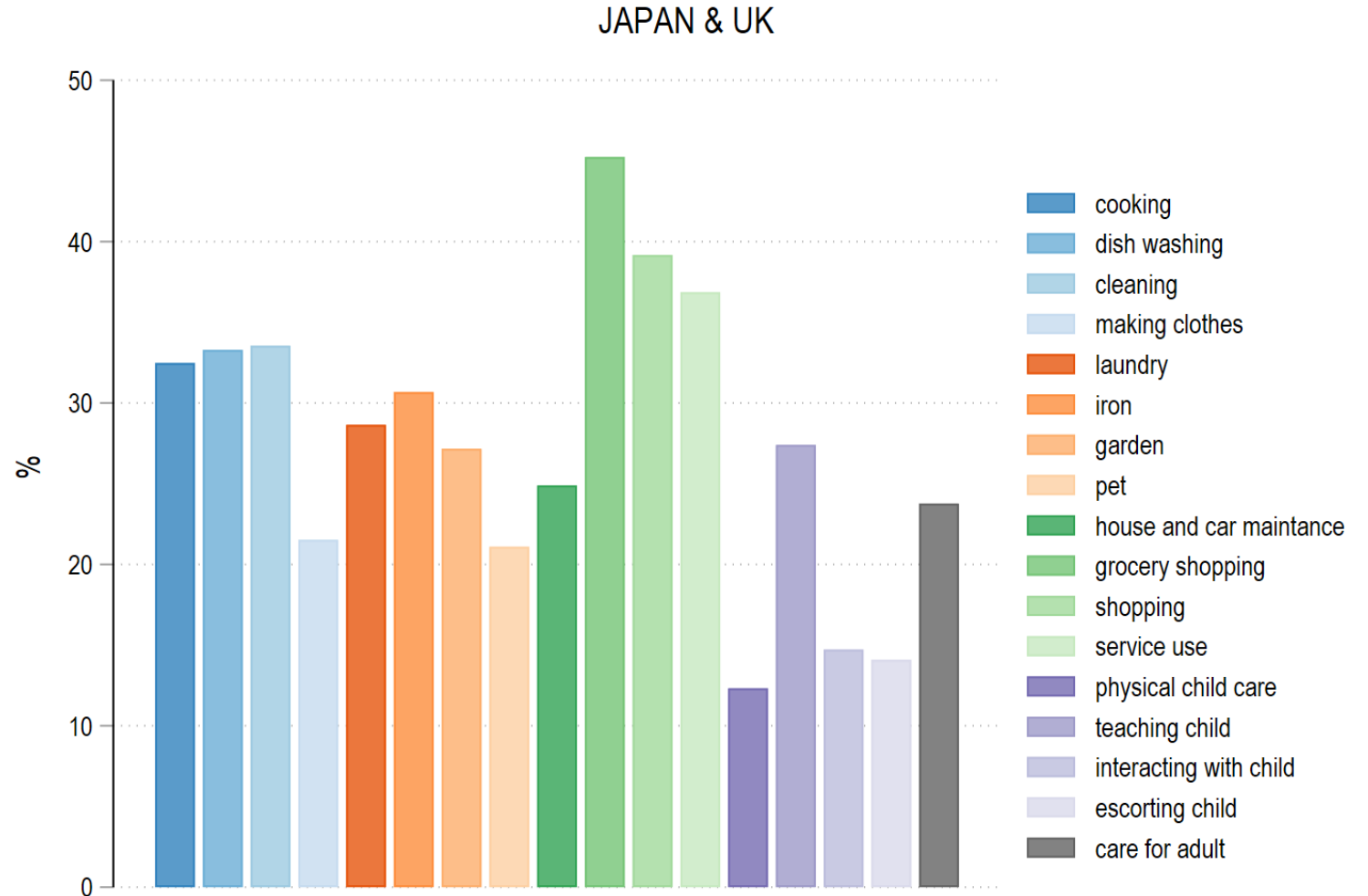


Would technology solve the future care mismatch?

What proportion of the task could be automated in 5 years? (or in 10 years?)

- Results from the AI experts Delphi surveys conducted in Japan and the UK
- 36 experts from Japan and 29 experts from the UK

Lehdonvirta V, Shi LP, Hertog E, Nagase N, Ohta Y (2023) The future(s) of unpaid work: How susceptible do experts from different backgrounds think the domestic sphere is to automation? *PLoS ONE* 18(2): e0281282.



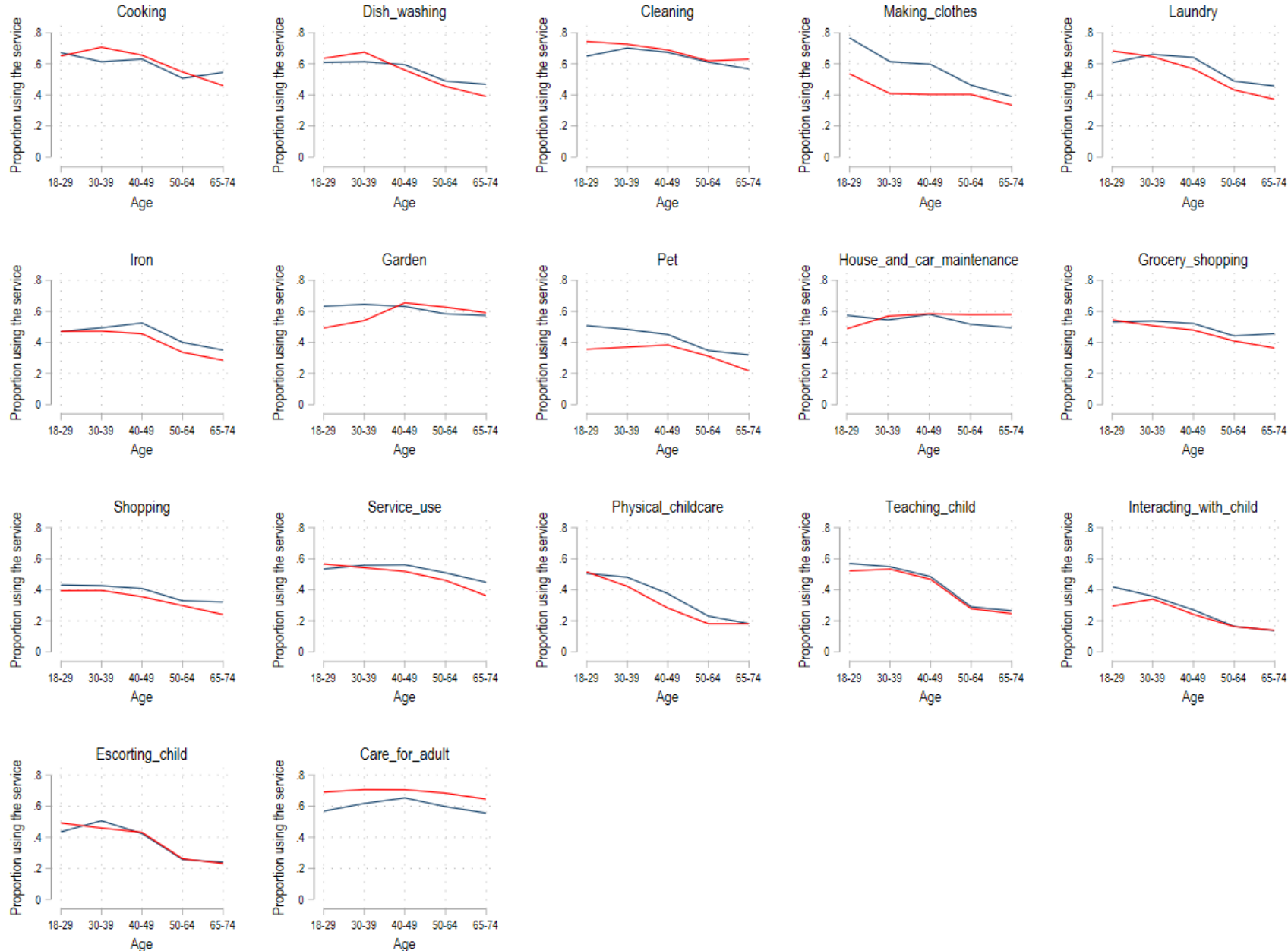
Given automation efficiency, would you like to use the service?

- Results from the household vignette surveys conducted in Japan and the UK
- 15,108 sample from Japan and 11,604 sample from the UK
- Asked the question for 17 unpaid work activities
- %s of people who would use the services are tabulated by sex and age

Proportion of people who would use the automation service

JAPAN

Proportion using the service

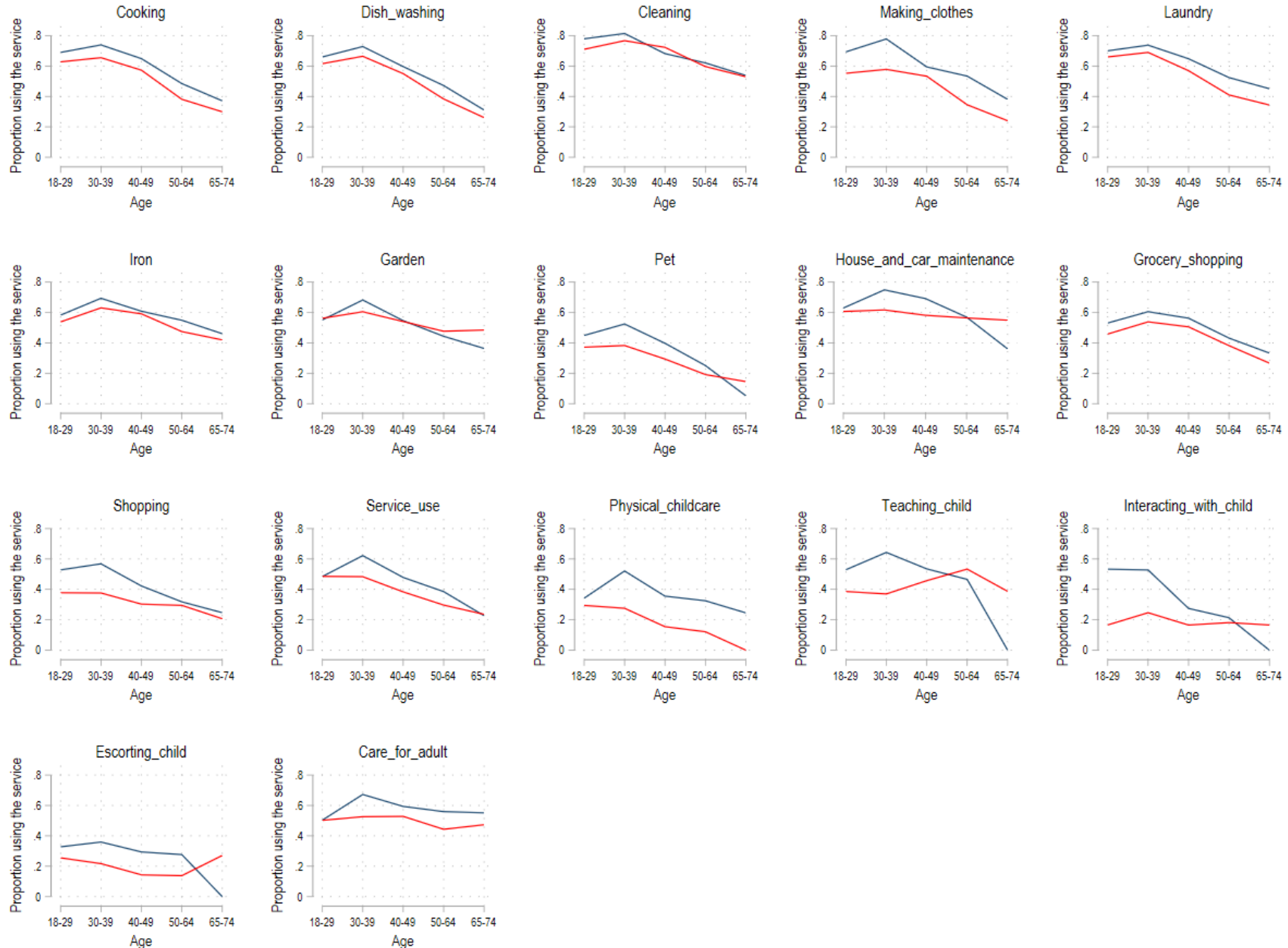


— Men
— Women

Proportion of people who would use the automation service

The UK

Proportion using the service



— Men
— Women

Simulation of possible increase in unpaid work due to technology

➤ Possible increase in unpaid work due to technology

Reduced unpaid work Time by Automation ($RTA_{s,x,i}$) s: sex, x: age, i: activity
= $(Time_use_{s,x,i} * P_{s,x,i} * AP_i)$

$P_{s,x,i}$: % of people who would use the automation services for each unpaid work activity (i) by sex (s) and age (x) - data from the HH surveys

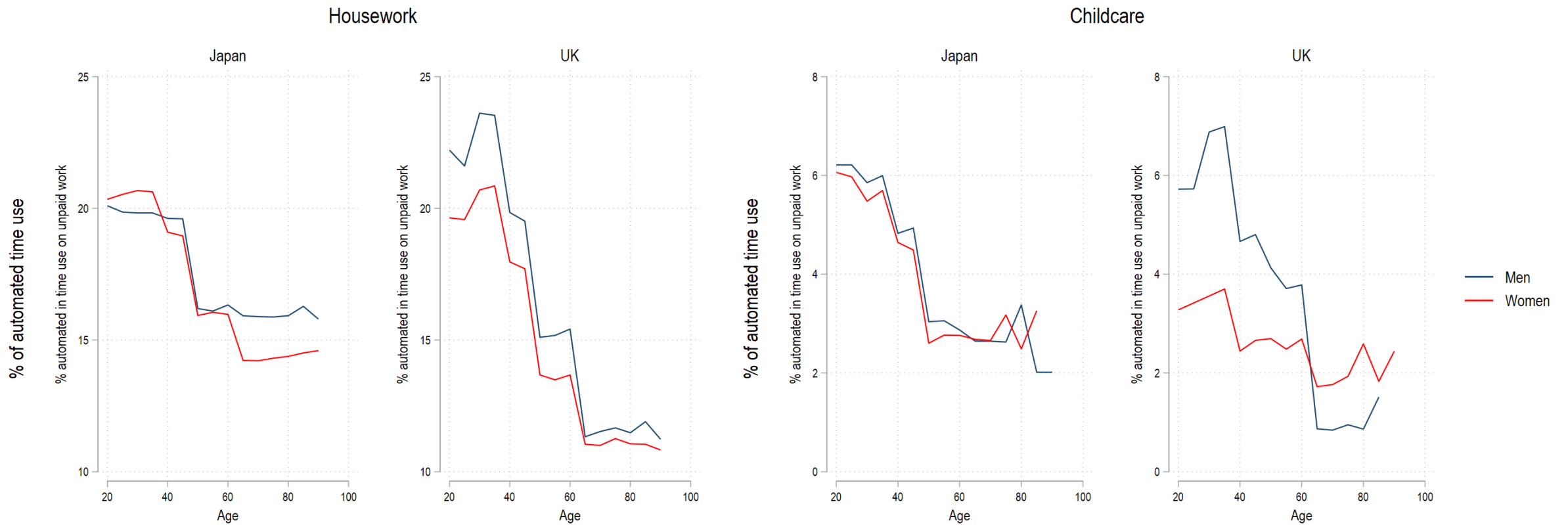
AP_i : % of time that would be reduced by the automation service in each unpaid work activity (i) - data from the Delphi surveys

Possible increase in unpaid work due to technology at population level

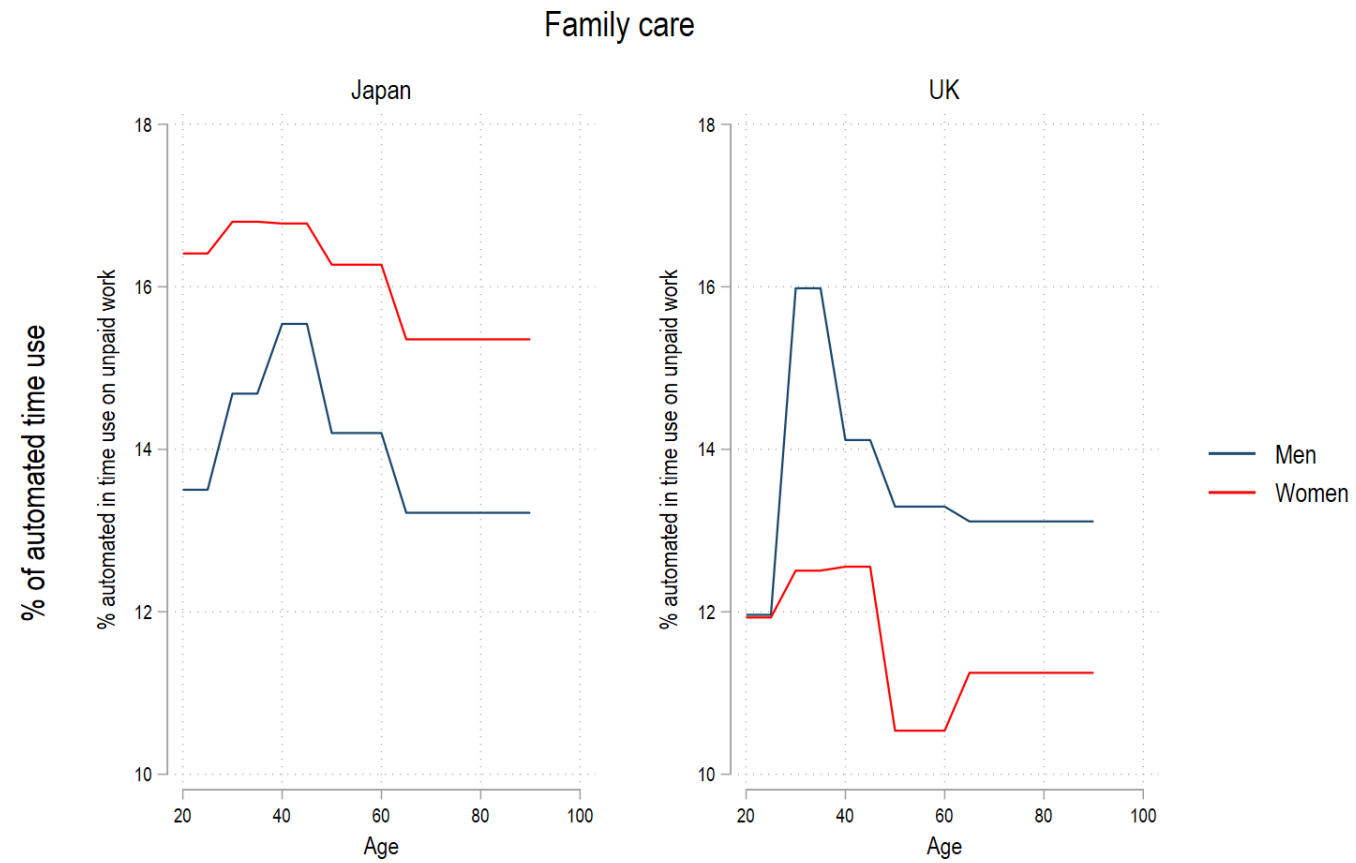
$$\sum_s \sum_x \sum_i (RTA_{s,x,i}) * Population_{s,x}$$

% reduced in unpaid work by Automation ($P_{s,x,i} * AP_i$)

% of **R**educed unpaid work **T**ime by **A**utomation ($RTA_{s,x,i}$)



% of Reduced unpaid work Time by Automation ($RTA_{s,x,i}$)



Would technology solve the future care mismatch?

	% necessary to substitute	% predicted to be automated	Surplus (Difference)
Japan	2060	2060	
Housework	2.5%	15.5%	+13.0% point
Childcare	16.2%	4.9%	-11.3% point
Family care	11.3%	14.3%	+3.0% point
Total	4.8%	14.2%	+9.4% point
THE UK	2060	2060	
Housework	0.7%	14.2%	+13.5% point
Childcare	-7.7%	3.7%	+11.4% point
Family care	5.7%	11.8%	+6.1% point
Total	-0.3%	12.7%	+13% point

Discussion 1:

The study shows the first time ever the potential of the future automation in unpaid work

- The simulation can be extendable to other countries with the time use data
- The automation score of unpaid work can be updated by using other methods or data
- The results can be used to estimate the economic impacts of unpaid work automation
 - potential increase in employment rate or leisure time
 - potential impacts on GDP (or national income)
 - potential automation of paid work can also be incorporated if the automation score of paid work is used.

Discussion 2:

More space for exploring/improving;

- Why Japan will be so much in short of future childcare?
 - ➔ The simulation should be done with the net consumption by unpaid work activities?
- How much people use the automation services depends on the price and quality of the services/products
 - ➔ The simulation method needs to be more refined.
- Reproducibility of the Delphi (expert opinion) results?
 - ➔ More accurate prediction data is necessary.
- People may change per capita time use of unpaid work in the future, adjusting to HH structure
- Possible underestimation of family care due to the nature of the time-use survey

Thank you

Any comments or questions are
welcome!



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