Remaining childless or postponing first birth?

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December 5, 2018 @ 3rd HFD Symposium

Introduction

- The common indices of first birth trend
  1. Quantum: % of childless population
  2. Timing: average age at first birth
- Both phenomena have a different consequence and effects

  e.g., aggregate fertility, female life course, and social policy

Introduction

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Research question

- Remaining childless or postponing first birth? Which phenomena mainly happens?
- How does it differ by birth cohorts and countries?

Common indices

- Quantum: % of childless population → all women
- Timing: average age at first birth → women who have children

⇒ We have to have an index to combine quantum and timing for all population.

New index: EYWC

"Life expectancy"

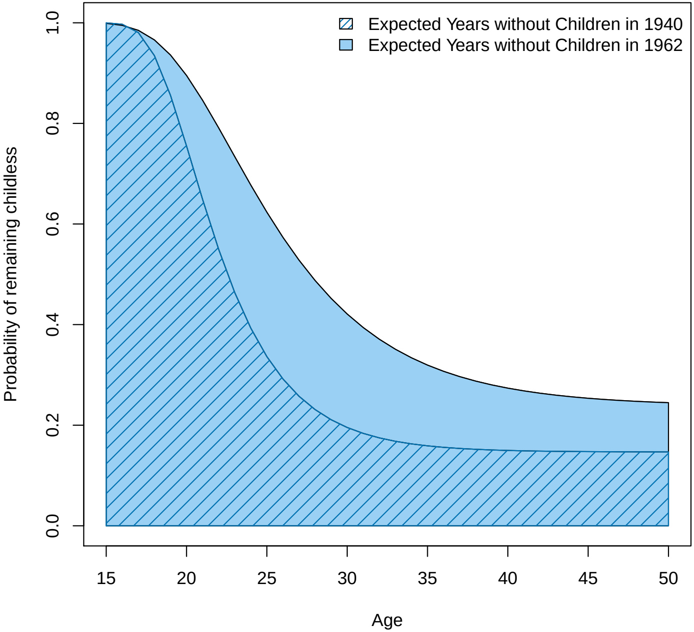
$\downarrow$

Expected **Y**ears **W**ithout **C**hildren "EYWC"

Life exp: die: $e_0(t) = \int_0^\infty l_{x,\,t}\, dx$

$\downarrow$

EYWC: 1st birth: ${}_{35}e_{15}(t) = \int_{15}^{50} l_{x,\,t}\, dx$


Expected Years without Children in 1940
Expected Years without Children in 1962
Probability of remaining childless
0.0
0.2
0.4
0.6
0.8
1.0
15
20
25
30
35
40
45
50
Age

Advantages of EYWC

- to combine with quantum and timing.
- the index of all population (not only people who have children).
- $15+$ EYWC $\rightarrow$ expected age at the first birth
- one value to be able to compare through time and country.

Decomposition

$l_{x,\,t} \rightarrow$ Coale-McNeil model

$$f_{x,\,t} = C_t \cdot \frac{1}{\sigma_t} \cdot a_1 \exp\left[a_2(\frac{x-\mu_t}{\sigma_t} + a_3) - \exp\{-a_4(\frac{x-\mu_t}{\sigma_t} + a_3)\}\right]$$

Decompose the changes of EYWC over time $({}_{35}\dot{e}_{15}(t))$ into three parameters.

- C: proportion of ever-had child (scale)
- μ: age at first birth (location)
- σ: s.d. of the average age at first birth (variance)

$${}_{35}\dot{\mathsf{e}}_{15}(t) = \frac{\partial\, {}_{35}e_{15}(t)}{\partial C_t}\dot{C}_t + \frac{\partial\, {}_{35}e_{15}(t)}{\partial \mu_t}\dot{\mu}_t + \frac{\partial\, {}_{35}e_{15}(t)}{\partial \sigma_t}\dot{\sigma}_t$$

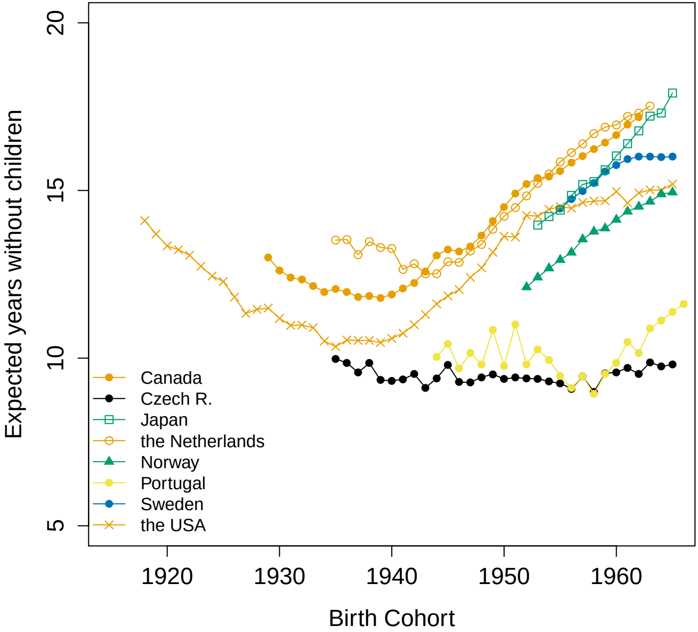
Data

Human Fertility Database (completed cohorts)

- Female population exposure (exposVV)
- Birth counts by birth order (birthsVVbo)

Table 1 : Data information

Country	Birth cohort
Canada	1929 - 1962
Czech.R	1935 - 1965
Japan	1953 - 1965
the Netherlands	1935 - 1963
Norway	1952 - 1965
Portugal	1944 - 1966
Sweden	1955 - 1965
the USA	1918 - 1965



Expected years without children
20
15
10
5
1920
1930
1940
1950
1960
Birth Cohort
Canada
Czech R.
Japan
the Netherlands
Norway
Portugal
Sweden
the USA

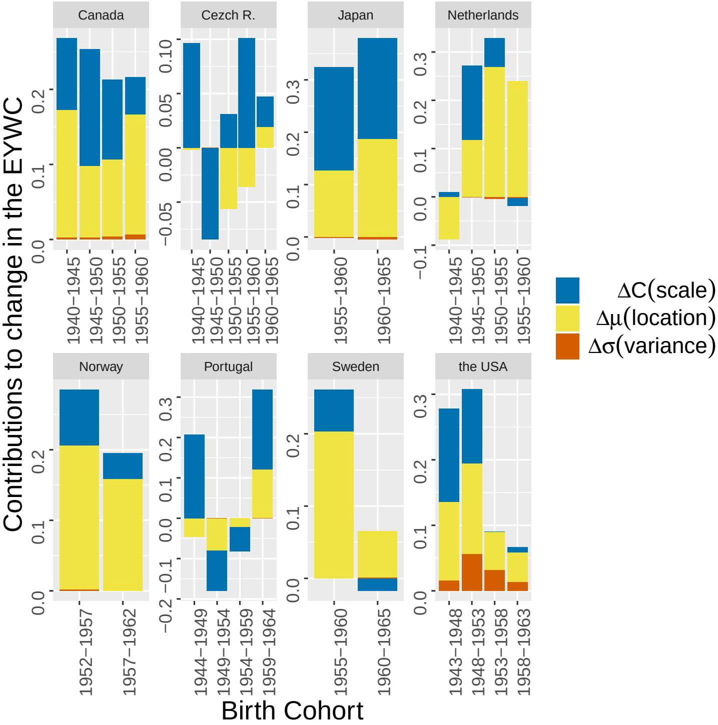
Results

In the latest birth cohorts, the EYWC is

- Canada, Japan, and the Netherlands: 17.5 years
- Norway, Sweden, and the USA: 15 years
- Portugal: 11.5 years
- Czech. R: less than 10 years

$\Rightarrow$ the reproductive period $= 35(50 - 15)$

Canada, Japan, and the Netherlands spent the half of the reproduction period without any children.


Canada
Cezch R.
Japan
Netherlands
Norway
Portugal
Sweden
the USA
Contributions to change in the EYWC
Birth Cohort
1940−1945
1945−1950
1950−1955
1955−1960
1960−1965
1952−1957
1957−1962
1944−1949
1949−1954
1954−1959
1959−1964
1943−1948
1948−1953
1953−1958
1958−1963
ΔC(scale)
Δμ(location)
Δσ(variance)

Discussion

- The Netherlands and Sweden show a negative value for the scale factor in the most recent cohort.
  $\Rightarrow$ Also shown by Persson (2010) and Miettinen et al. (2015).
- The high contribution of the scale factor in Japan.
  $\Rightarrow$ The strong linkage between nuptiality and fertility may be a key.
  - the birth rate outside of marriage: 2.25% in 2015.
  - the proportion of never-married women at age 50: 14.1% in 2015.
- The relatively high variance in the U.S may be related to high heterogeneity by SES.

Summary and Future research

- Alternative index to understand the first birth trend
- Quantify the effect of remaining childless, postponing, and variance
- Future:
  - Check EYWC by sub-population (educational level, union status, race/ethnicity)
  - Check variances of EYWC
  - Application to other events??

Thank you!!!

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Acknowledgement

This oral presentation is part of the project Estrategias familiares y respuestas demográficas a la crisis económica (CRISFAM) that has received funding from Ministerio de Economía y Competitividad. Ref. CSO2015-64713-R and CERCA Programme/Generalitat de Catalunya.

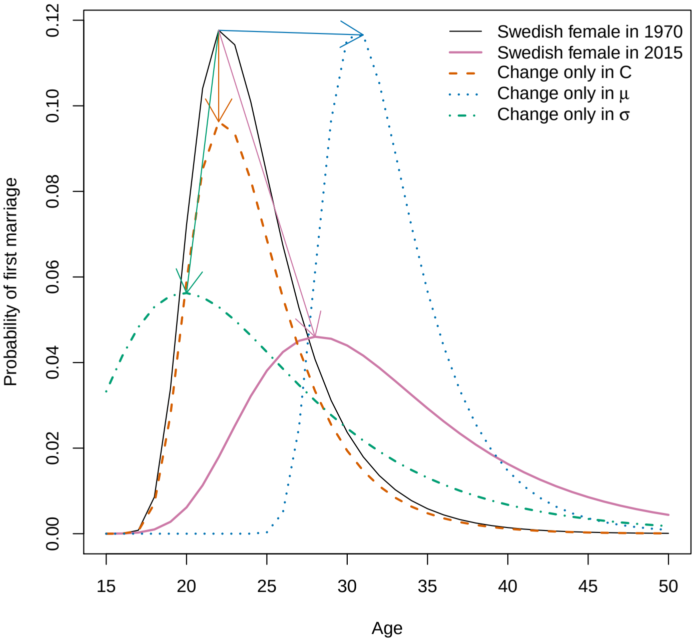

Swedish female in 1970
Swedish female in 2015
Change only in C
Change only in μ
Change only in σ
Probability of first marriage
0.00
0.02
0.04
0.06
0.08
0.10
0.12
15
20
25
30
35
40
45
50
Age

Table 2 : Goodness-of-fit of the CM model using Kolmogorov-Smirnov test

Country	Birth cohort	D	P-value	Country	Birth cohort	D	P-value
Canada	1940	0.1429	0.8745	Norway	1952	0.1429	0.8674
	1945	0.1714	0.6902		1957	0.2000	0.4858
	1950	0.1714	0.6902		1962	0.1714	0.6902
	1955	0.1714	0.6902	Portugal	1944	0.2000	0.4916
	1960	0.1714	0.6902		1949	0.1429	0.8674
Czech Republic	1940	0.1143	0.9794		1954	0.1143	0.9763
	1945	0.1429	0.8674		1959	0.1143	0.9794
	1950	0.1143	0.9763		1964	0.1714	0.6902
	1955	0.0857	0.9995	Sweden	1955	0.1714	0.6902
	1960	0.1143	0.9763		1960	0.1714	0.6902
	1965	0.1143	0.9763		1965	0.1429	0.8745
Japan	1955	0.1143	0.9794	the USA	1943	0.1143	0.9794
	1960	0.1143	0.9794		1948	0.1429	0.8745
	1965	0.1714	0.6902		1953	0.1714	0.6902
the Netherlands	1940	0.1714	0.6826		1958	0.1714	0.6902
	1945	0.1143	0.9763		1963	0.1714	0.6902
	1950	0.1429	0.8745				
	1955	0.2000	0.4916				
	1960	0.1714	0.6826				

Source: Authors' calculations.

$$\mathrm{lnLH} = \sum_{15}^{49} (\mathrm{With}_x \log[F_{(x+0.5)}] + \mathrm{Without}_x \log[1 - F_{(x+0.5)}]),$$

where With_x is female population with children at age x and $\mathrm{Without}_x$ is female population without children at age x, and F_x is the cumulative probability function at age x.

For the functions except EYWC, an exponential change assumption is used.

$$\upsilon_{x,\,t+\frac{h}{2}} = \upsilon_{x,\,t}(\frac{\upsilon_{x,\,t+h}}{\upsilon_{x,\,t}})^{0.5}$$

The derivative of the function $\upsilon_{x,\,t+\frac{h}{2}}$ was estimated by

$$\dot{\upsilon}_{x,\,t+\frac{h}{2}} = \upsilon_{x,\,t+\frac{h}{2}}(\frac{\log[\frac{\upsilon_{x,\,t+h}}{\upsilon_{x,\,t}}]}{h}).$$

The midpoint of EYWC is assumed a linear change in the interval, which is

$$\upsilon_{x,\,t+\frac{h}{2}} = \frac{\upsilon_{x,\,t+h} + \upsilon_{x,\,t}}{2},$$

and

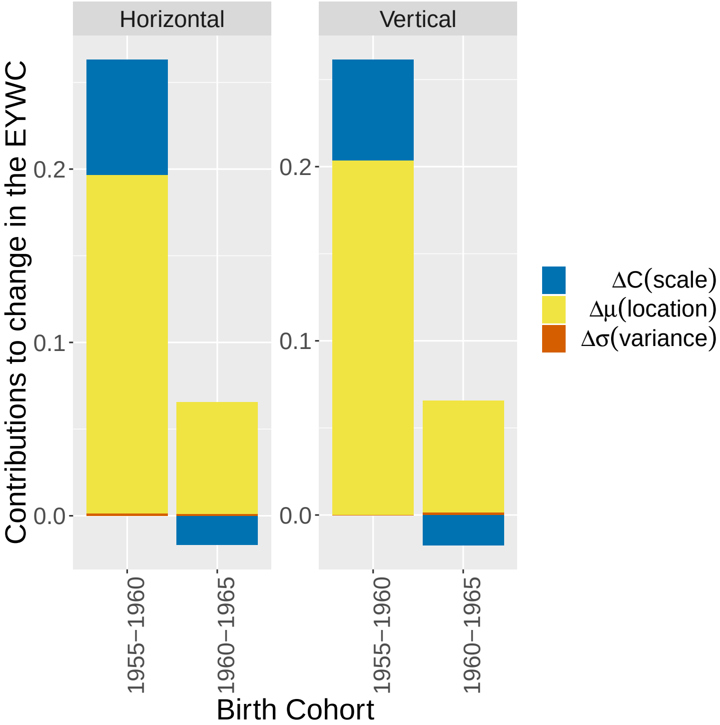
$$\dot{\upsilon}_{x,\,t+\frac{h}{2}} = \frac{\upsilon_{x,\,t+h} - \upsilon_{x,\,t}}{h}.$$

Results

- Canada, the Netherlands, and the USA: U shape, increase from around 1940
- Czech.R: stagnated
- Japan and Norway: increase in all observed birth cohort
- Portugal: stagnated then increase after the mid-1950s
- Sweden: in plateau after increasing

Results (Cont)

- The location parameter is the biggest in Canada, the Netherlands, Norway, Sweden, and the USA
  $\Rightarrow$ postponement of first birth mostly occurred.
- The scale factor contributed most in Japan and Portugal
  $\Rightarrow$ childlessness was mainly observed.
- The variance did not have much impact (except the U.S).


Horizontal
Vertical
Contributions to change in the EYWC
0.2
0.1
0.0
1955–1960
1960–1965
Birth Cohort
ΔC(scale)
Δμ(location)
Δσ(variance)