Cross-Sectional Average Length of Life Childless

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Short abstract

The increase in childless rate and in the average age at first birth has extended the number of years that women spend childless. These years can be quantified using a measure such as the expected years without children (*EYWC*). EYWC captures the first birth quantum and timing and allows comparisons over time and countries, however, it has the typical period-cohort index problem. To overcome this problem, we employ the cross-sectional average length of life childless, or *CALC(t)*, which includes all the first birth information available for all the cohorts present at a given time. Using Swedish and American data from Human Fertility Database, we describe the cross-sectional average length of life childless for the two populations in 2015 and decompose their difference. The result illustrates the impact of the high young age first birth rates in the US and the catching-up process of Sweden in later ages.

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Introduction

The postponement (Kohler et al. 2002; Sobotka 2004) and increasingly foregoing (Kreyenfeld and Konietzka 2017) of parenthood have been important family demographic trends of the past half a century in the developed world. Since the 1970s, the age at entering motherhood has increased on average by one year each decade in the OECD countries, with substantial variation in the average age and its rate of increase across countries (Mills et al. 2011).[4] In 2016, the average age of first birth among women in the OECD countries was 28.8 years old (OECD 2018). Among these countries, women continue to enter parenthood at a particularly low age in the US and Eastern Europe, whereas women in Southern Europe and East-Asia enter parenthood generally later than elsewhere, with average ages in these countries above age 30. Further, the postponement of parenthood places women at a higher risk of remaining childless (Kneale and Joshi 2008; Schmidt et al. 2012; Toulemon 1996) and across countries, a higher mean age at first birth is associated with higher shares of women remaining childless (Miettinen et al. 2015). In several countries remaining childless has been rising in the cohorts born from the 1940s to early 1970s, with the eventual childlessness in the more recent female cohorts still remaining undefined (Jalovaara et al. 2017; Sobotka 2017).[5] Remaining childless is particularly common in German-speaking countries and Southern Europe, where slightly over 20% of women never having children at the end of their reproductive age (Sobotka 2017). In Finland, Japan and the UK childlessness is also high in the recent birth cohorts (Jalovaara et al. 2017; Mogi 2018; OECD 2018).

There are several ways to describe the trends in the first birth behaviors considering both the timing and quantum at the same time. The most common one is the age-specific first birth rate (AS1BR). Figure 1 illustrates the AS1BR of women born in 1975 in the selected developed countries. While AS1BR intuitively shows the timing of first birth, it is hard to see the quantum of remaining childless (this can be obtained by calculating $1 - \sum \text{AS1BR}$.).

[4] For instance, in the US, the mean age rose from 23.7 years in 1985 to 26.6 in 2016, whereas in Italy the increase was more substantial from a readily higher mean age of 25.9 to 31.5 (OECD 2018).
[5] The shares of women remaining childless were also relatively high among those born in the beginning of the twenty century (Rowland 2007; Sobotka 2017).

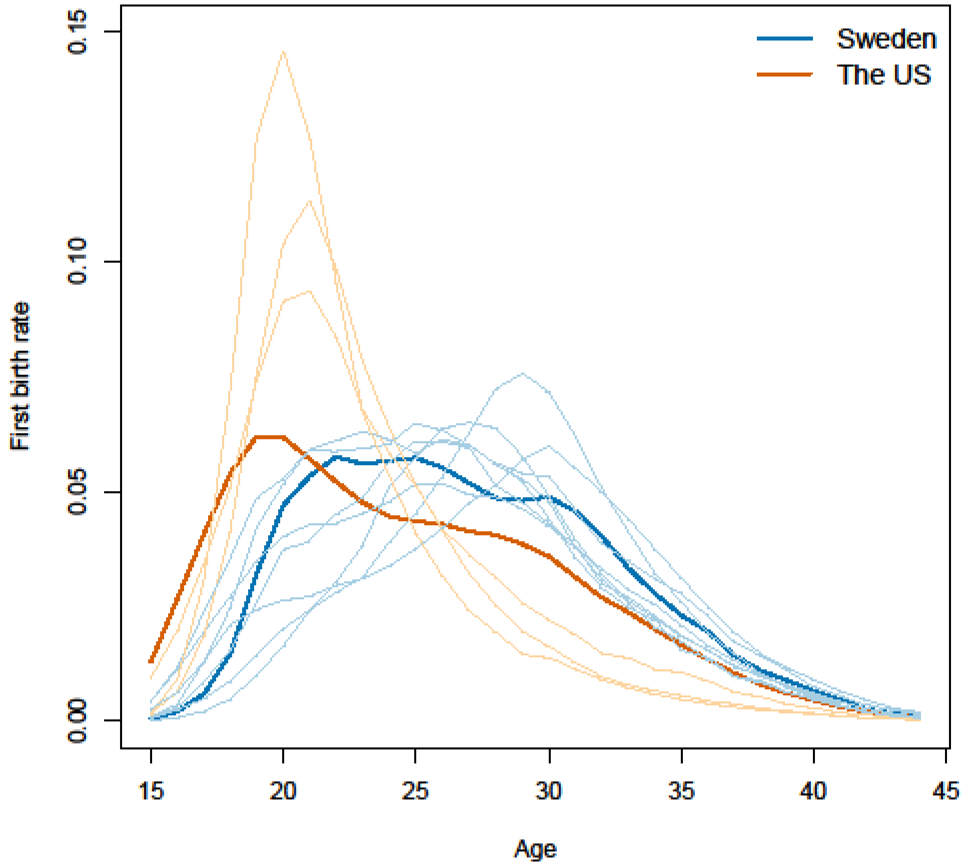

Figure 1. Age-specific first birth rate of women born in 1970 in selected developed countries.

Note: The orange lines represent early first birth schedule countries and the blue one show relatively late birth countries. We highlighted Sweden and the US as we mainly analyze those two countries in this study. However, the light-toned orange lines are Hungary, Poland, and Russia and the light blue lines illustrate the first birth rate of Canada, Finland, Japan, the Netherlands, Norway, Portugal, Spain, and Switzerland.

Source: Authors' calculations based on HFD.

Alternatively, we study the length of life before having the first child. Mogi and del Mundo (2018) employed expected years without children (*EYWC*) to measure first birth behavior and defined as $\mathrm{EYWC}(t) = \int_{15}^{50} l_{x,t} dx$, where $l_x$is the probability of remaining childless. They reported that eight selected countries from Human Fertility Database (HFD) generally increased their EYWC and the decomposition showed its increases are caused by the combination of both postponement (*timing*) and foregoing (*quantum*) of parenthood. However, variation in age-specific fertility patterns across countries as described earlier is likely to contribute to variation across countries also in EYWC. Even though fertility heavily concentrated at older ages will decrease EYWC, countries with early first birth schedules, such as the US (Rendall et al. 2010), will generally have small EYWC. The postponement of first birth is stronger in countries, such as the Northern European countries, that strongly support the combination of mother and worker roles at advanced ages and the opportunity costs of children are relatively low and mothers' employment therefore relatively high (Brewster and Rindfuss 2000; Kravdal and Rindfuss 2008).

We argue that the study of EYWC *per se* can offer an additional insight into the demographic patterns of first births and beyond. This outcome offers a new outlook on the phenomenon of childlessness in contemporary societies by placing emphasis on the amount of life lived without children at reproductive ages. In our view, EYWC may affect the individual perception of life chances during reproductive ages. Childbearing is one, although not the only, area of life that may be affected by the expectation: earlier notions on the low-fertility trap have suggested that individuals witnessing very low fertility might begin to prefer very low fertility themselves (Goldstein et al. 2003; Lutz et al. 2006). As individuals witness a longer EYWC around them, they may orientate themselves in ways that put more emphasis on other areas of life than the family, eventually increasing the risk of staying childless (Kemkes-Grottenthaler 2003; Letherby 2002). From the societal point of view, EYWC can have value for policymakers in the areas of public health, employment and pensions. For instance, variation in the expectation of childless life is likely to contribute to variation in the cumulative employment rate of women at working age, at least between countries where mothers typically have lower employment than childless women, and may thus further contribute to cross-country inequality in economic well-being at older ages.

Generally, the study of childbearing in the period perspective faces a challenge that measures exclusively based on period data do not necessarily reflect the experience of any real birth cohorts (Bongaarts and Sobotka 2012; Luy 2011). Thus, main challenge in fertility research has been to deal with the tempo distortion effect (Bongaarts and Feeney 1998, 2008; Schoen 2004). However, cohort-based index has also a commonly known problem; the cohort fertility history has to be complete to be analyzed. In this study, to overcome this challenge of a period and cohort measure, we employ an alternative measure developed in mortality research: the Cross-sectional Average length of Life (*CAL*) (Brouard 1986; Guillot 2003). Our aim in this study is to present how the concept of CAL can be applied to a family demographic outcome, the first birth. The value of using CAL is 1) comparability across countries and periods; 2) the possibility to decompose the total measure to contributions from specific cohorts and ages groups. Using Sweden and the United States data from Human Fertility Database, we describe the cross-sectional average length of life childless (*CALC*) of Sweden and the US in 2015 and decompose its differences into age and cohort. The comparison of Sweden with selected 11 countries can be found in the Appendix.

Data and methods

Data

We use Human Fertility Database (HFD) and select Sweden and the United States as an example. HFD has information about only female population. There are two reasons to select those countries. First, the childlessness rates of both countries are nearly close, 12.2% in Sweden and 11.9% in the US in 1970 birth cohort from the HFD estimate. Secondly, we can obtain long-span birth cohort data from Sweden and the US, which is 1966-2003 birth cohorts, from ages under 12-50.

Cross-sectional average length of life childless (CALC)

While the concept of life expectancy has not been commonly used in family demography, it actually has a potential to shed light on the current changes in fertility. Over the decades, both childless rate and the average age at first birth have been increasing. This translates as an extension of the duration women spends childless. This period is exactly the same as the concept of life expectancy calculated for a fertility-lifetable, where the event of interested is first birth. We call the duration of remaining childless the expected years without children (*EYWC*), suggested by Mogi and del Mundo (2018). This is a useful index to consider the quantum and timing of first birth altogether and to compare it over time and countries. However, it faces the classical period and cohort index problem of mismatch time trends. In mortality research, an alternative index, called the cross-sectional average length of life (*CAL*) was developed and elaborated to complement period life expectancy and cohort life expectancy (Brouard 1986, Guillot 2003). CAL(t) is a period measure which includes all the cohort mortality information of the population present at a given time t. In our fertility research interest, CAL is the cross-sectional average length of life childless (*CALC*). As the event of interest is first births, the analytical age range corresponds to the reproductive ages. Thus, we analyze ages 12 to 50. CALC(t) is defined as,

$$\text{CALC}(t) = \int_{12}^{50} l_c(x, t-x)dx,$$

where $l_c(x, t-x)$ is probability of remaining childless from age 12 to x according to the first birth conditions observed in the cohort born at time $t-x$.

Decomposition of CALC

To decompose the difference between CALC in Sweden and that in the US, we employ the decomposition method developed by Canudas-Romo and Guillot (2015). The age-cohort contribution to the difference in CALCs between Sweden and the US is estimated as

$$\Delta\text{age} - \text{cohort}\ (a, t-x) = \left[\frac{l_c(x, t, \text{US}) + l_c(x, t, \text{SWE})}{2}\right] \ln\left[\frac{{}_1p_a(t-x, \text{US})}{{}_1p_a(t-x, \text{SWE})}\right],$$

where $l_c(x, t, i)$ is the probability of remaining childless from age 12 to age x at time t in population i and ${}_1p_a(t-x, i)$ is the probability of remaining childless from age a to $a + 1$ for the cohort which becomes age 12 in year t - x in population i. Then, the difference in CALCs is calculated as

$$\text{CALC}_{\text{US}}(t) - \text{CALC}_{\text{SWE}}(t) = \sum_{x=12}^{50} \sum_{a=12}^{x} \Delta\text{age} - \text{cohort}(a).$$

Preliminary results

The CALC of Sweden is 20.95 years and for the US is 18.61. That is, on average, Swedish women spend 20.95 years remaining childless from age 12, which means they spend more than half of their reproductive period being childlessness. The American women, on the other hand, spend 2.33 years less compared to Swedish. To identify which ages and cohorts contribute to the 2.33 years gap in CALCs, we use the decomposition method. Figure 2 presents the age- and cohort-contributions to the difference of CALCs between Swedish and American women in 2015.

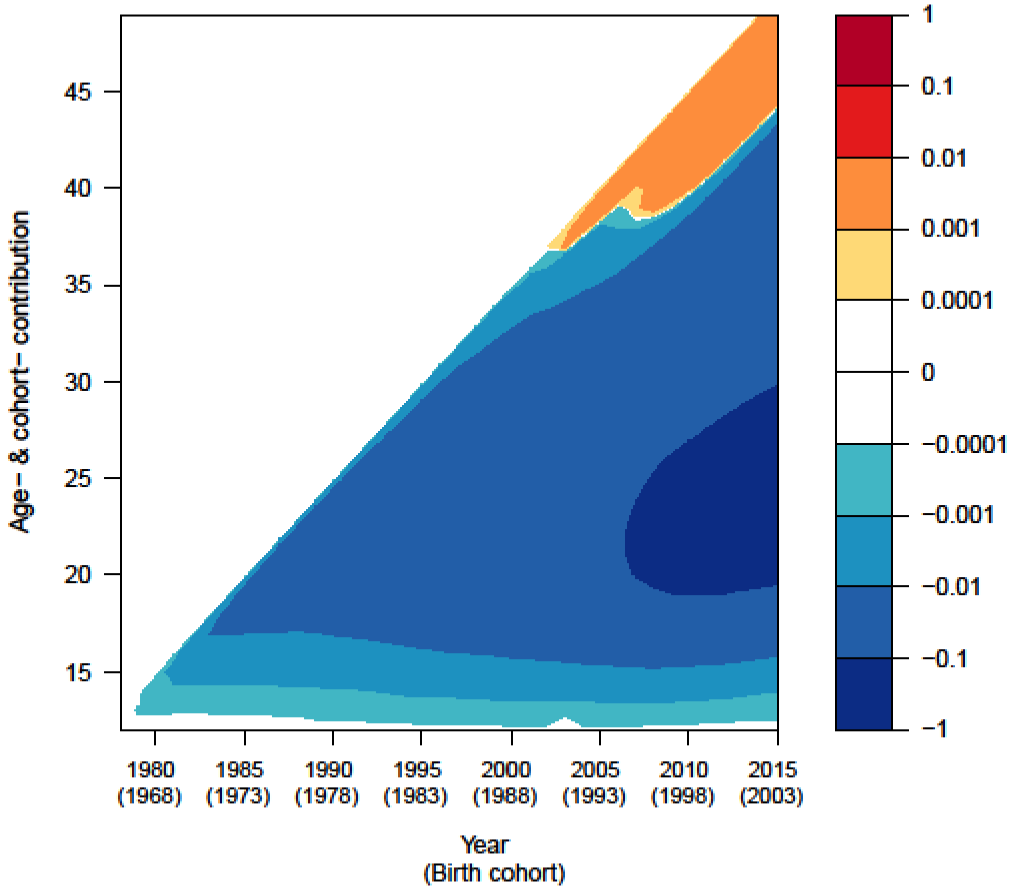

Figure 2: Lexis surface for the cumulative age- and cohort-specific contributions to the differences in CALCs between Sweden and the US, 1978-2015 (1966-2003 birth cohorts)

Note: Positive values correspond to the advantage of "surviving" of Sweden, which means Swedish women are more likely to remain childless state than Americans. Contrary, negative values correspond to the lower first birth rate of Sweden than one of the US. The x axis has two labels: a period year and a birth cohort in parentheses.

Source: Authors' calculations based on HFD.

The negative contribution means that Swedish women are more likely to remain childless than the Americans, in other words, Sweden has a lower first birth rate. Contrary, the positive contribution corresponds to a higher first birth rate of Sweden than the US. Swedish cohorts from 1966 to mid-1970s have negative contributions until the age late 30s. Then, they have positive values. It is interpreted as the long-lasting effect of first birth postponement and catching up at later age for Swedish female. This is consistent with the high first birth rate at teenage and young age in the US. After those birth cohorts, all ages and cohorts negatively contribute to the differences of CALCs. It illustrates that Swedish female of the current cohorts are more likely to remain childless than the older cohorts, particularly, we can see this at age 20s of 1985 to 1995 birth cohorts. The recuperation process of Swedish female is not observed among the current cohorts anymore at least ages we observed. The lower first birth rate at young and adult ages and lack of catching-up at older age in Sweden are the reasons why the CALC of Sweden has larger than the one of the US.

Preliminary conclusion

This study presents an alternative way of summarizing first birth behavior compared with two countries by a clear visualization. We suggested to use alternative measures to capture first birth quantum and timing, which are expected years without children (EYWC) and the cross-sectional average length of life childless (CALC), instead of traditional indices; childless rate and age-specific first birth rate. Our result illustrates that Swedish women, on average, spend more than half of their reproductive period being childlessness in 2015 (20.95 years) and American women spend 2.33 years less. The decomposition of its difference presented the impact of the high young age first birth rates in the US and the catching-up process of Sweden in later ages.

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Appendix

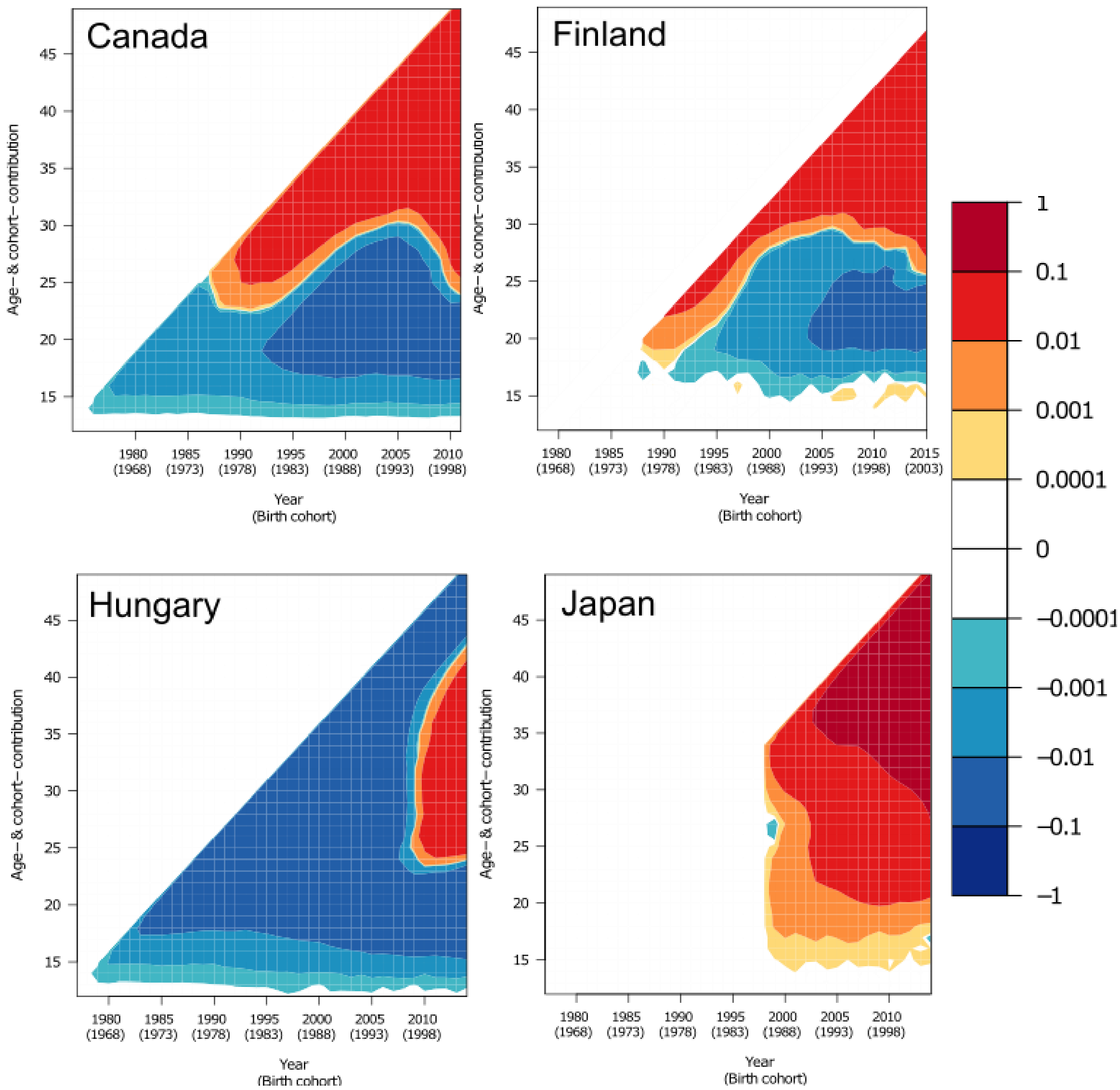

Figure 1A: Lexis surface for the cumulative age- and cohort-specific contributions to the differences in CALCs between Sweden and Canada, Finland, Hungary, and Japan.

Note: Please check the note of Figure 2.

Source: Authors' calculations based on HFD.

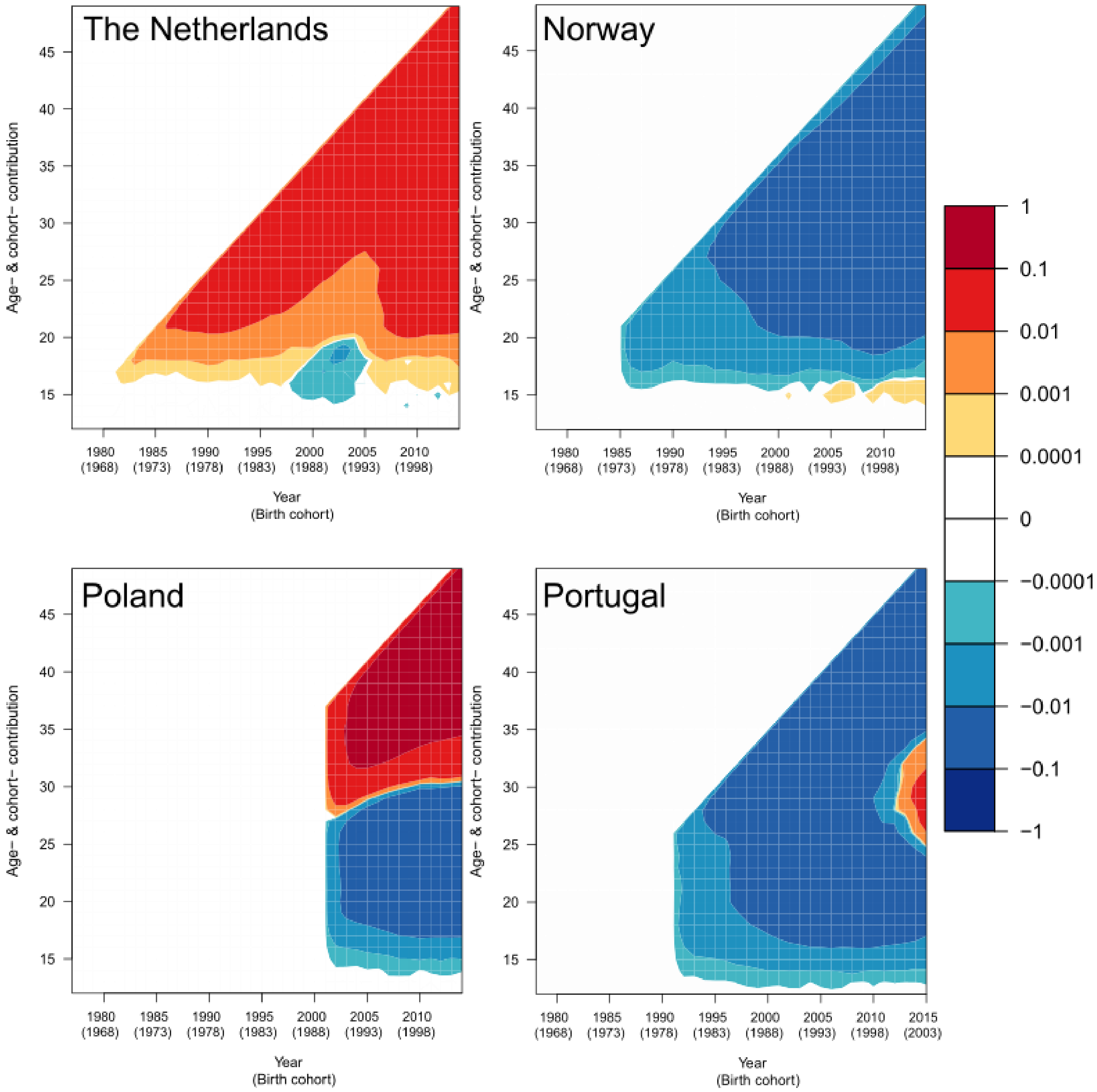

Figure 2A: Lexis surface for the cumulative age- and cohort-specific contributions to the differences in CALCs between Sweden and the Netherlands, Norway, Poland, and Portugal.

Note: Please check the note of Figure 2.

Source: Authors' calculations based on HFD.

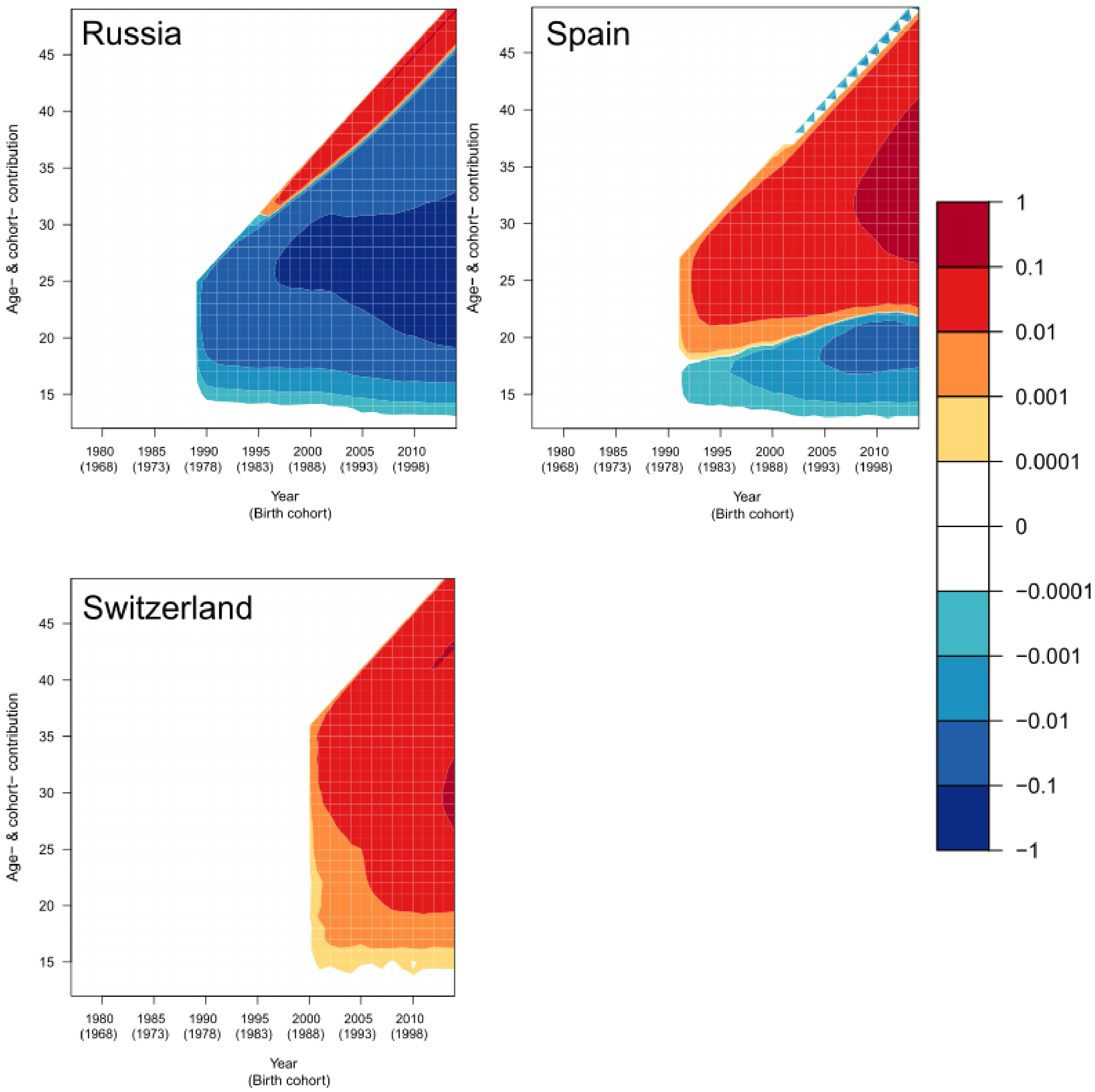

Figure 3A: Lexis surface for the cumulative age- and cohort-specific contributions to the differences in CALCs between Sweden and Russia, Spain and Switzerland.

Note: Please check the note of Figure 2.

Source: Authors' calculations based on HFD.