

# Change in the Seasonality of fertility in 20 European Countries From 1950 To 2019

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## **Abstract**

The seasonality of human fertility, a phenomenon observed worldwide, reflects complex interplays of individual and societal factors. However, significant societal shifts over recent decades might have reshaped these seasonal birth trends. Existing research has noted a diminishing amplitude in fertility seasonality over time, but the predominant birth timings over time remain under-explored. This study bridges this gap by analysing monthly birth data from 20 European countries spanning 1950 to 2020 and analyses changes in seasonality of fertility. Our findings reveal a marked shift in peak birth seasons from spring to late summer, occurring gradually yet consistently across various European regions. This pronounced shift not only shows a significant transformation in the seasonality of births, but also differences between European regions prompting critical questions about the underlying drivers of these trends. Such insights are critical to understand the evolving dynamics of human fertility in response to changing societal contexts.

## **Introduction**

Seasonal trends in births are observed in several countries and populations. For example, the northern parts of the United States and Sweden show a consistent pattern of birth seasonality, with peaks occurring during the spring and summer months, and troughs during the winter months (Clarke et al., 2019; Dahlberg & Andersson, 2018, 2019). Conversely, at lower latitudes and in Southern countries the seasonal amplitude is more pronounced and the peak in births is more likely in fall and winter compared to Northern countries (Martinez-Bakker et al., 2014). Consequently, seasonal trends show to vary based on geography (Wilson et al., 2020).

Seasonal trends in births and their geographical variation are explained by several factors. The main factors relate to reproductive health and sexual activity (Symul et al., 2022), individual preferences (Clarke et al., 2019), agricultural trends (Ruiu & Breschi, 2019), cultural factors (Wood et al., 2017; Yang, 2021) and meteorological phenomena (Hajdu & Hajdu, 2022). However, the impact of major societal changes, such as industrialization and reduced reliance on agriculture, could have significantly altered seasonal birth patterns.

Existing evidence shows a change in the seasonal trend in fertility over time., with the seasonal amplitude decreasing in the United States (Martinez-Bakker et al., 2014), Spain (Cancho-Candela et al., 2007) and in Sweden (Dahlberg & Andersson, 2018). Some of the factors explaining the decline in seasonality over time relate to industrialization, lower dependence on agricultural cycles, technological innovations (e.g.: the contraceptive pill), institutional changes (Conte Keivabu, 2025) and the ability to protect from meteorological stressors.

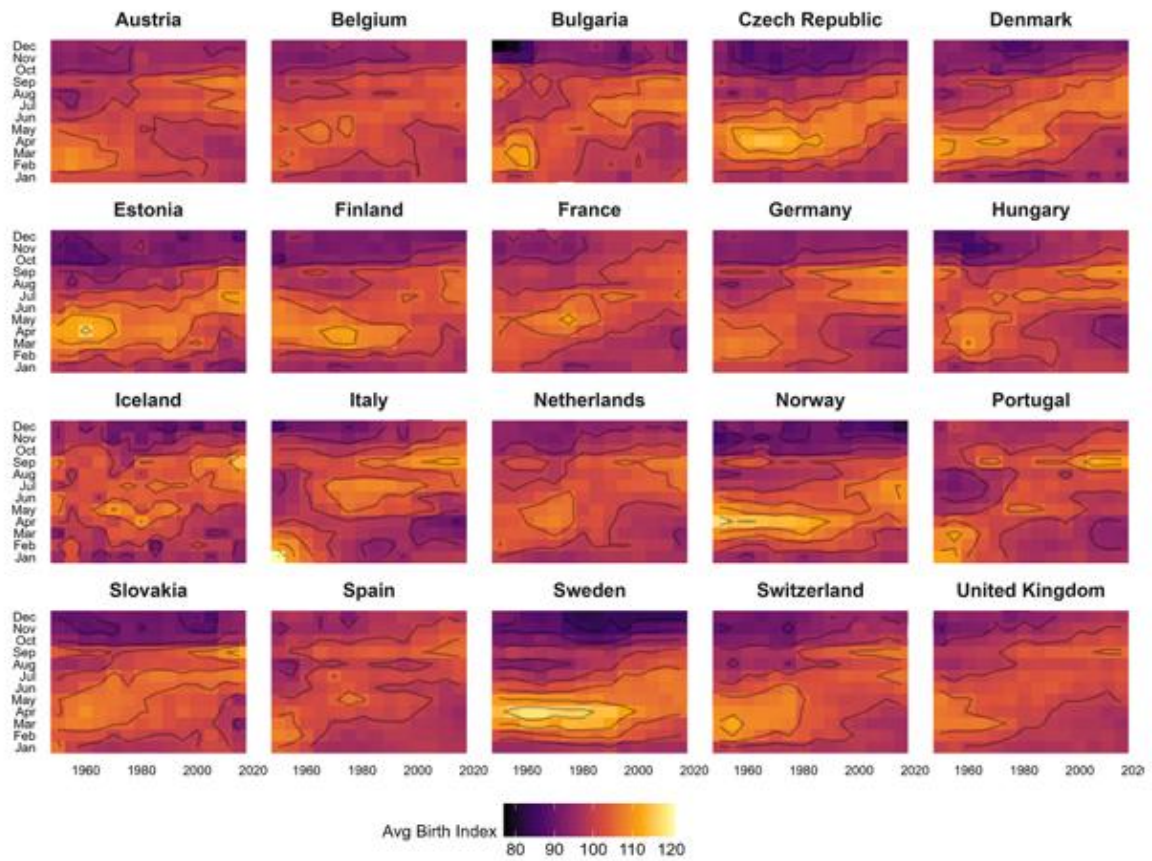
In this article we contribute to the existing literature interested in understanding the seasonality of fertility leveraging monthly births in 20 European countries from 1950 to 2020. Here, we contribute to the existing studies exploring seasonality for the entire period 1950 to 2020 and exploring the existence of geographical differences between European macro regions over time.

## Materials and Methods

In this study we leverage data on monthly birth counts for 20 European countries from January 1950 to January 2020. The data is provided by the Human Fertility Database (HFD) and provides high quality information on births for several countries. From these data, we first adjust our time series of monthly birth counts by the number of days in each month. Secondly, we construct a birth index that is computed as:  $I_m^c = \frac{B_m^c}{B_y^c} * 100$ . In which the Index  $I$  for country  $c$  and month  $m$  is determined by the monthly birth counts in country  $c$  and month  $m$  divided by the average number of births in country  $c$  and year  $y$  and multiplied by 100. Using such an index, we follow previous studies that used it to observe monthly variations in births from expected values (Recio Alcaide et al., 2022; Wilson et al., 2020).

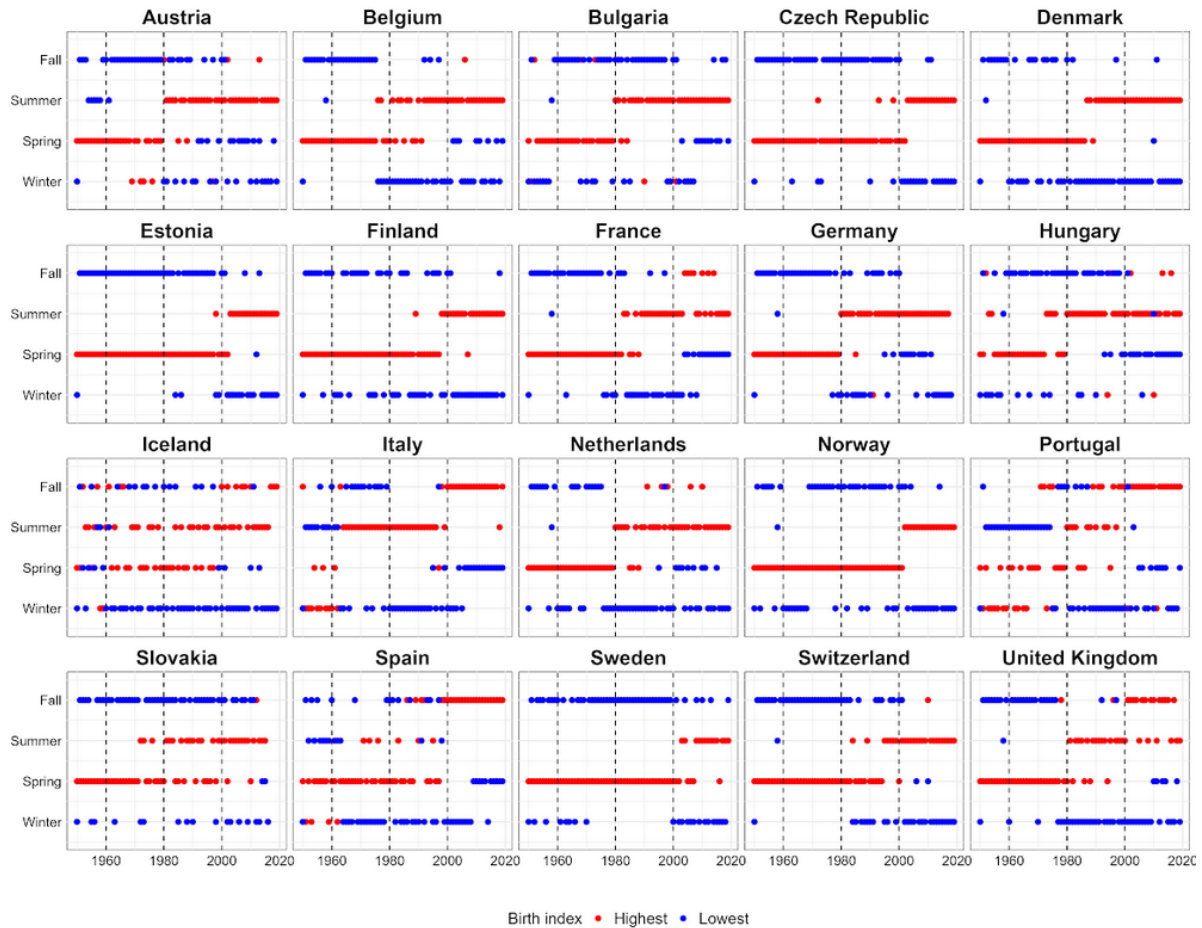
## Results

In Figure 1, we present the seasonal pattern of births from 1950 to 2019 across 20 European countries. The timing of the birth peak shifted in all countries, moving from spring toward summer or fall. The timing of this transition, however, varied across contexts, with two main groups distinguishable, those experiencing the shift during the 1980s (e.g., Austria, Belgium, Bulgaria, France, the Netherlands, Slovakia, and the United Kingdom) and those during the 2000s (e.g., Norway, Estonia, Sweden, and Finland). In the Mediterranean countries (e.g., Italy, Portugal, and Spain) as well as in the United Kingdom, the change appears to have occurred in two stages, with an initial move toward a summer peak followed by a later transition to a fall peak in the 2000s.



**Figure 1. Seasonal trends in birth in 20 European countries, 1950-2019.** Notes: We report the averaged birth index across five years and seven decades in 20 European countries.

In Figure 2, we display trends in birth seasonality by indicating the seasons with the highest and lowest number of births. The transition in seasonal patterns becomes even more evident here, particularly in the disappearance of spring birth peaks observed from the 2000s onward.



**Figure 2. Seasons with highest and lowest numbers of births from 1950 to 2019.** Notes: We report the season with the highest and lowest birth index for seven decades across 20 European Countries. We added dashed lines in the year 1960, 1980 and 2000 in which we observe the largest shifts in births.

## Discussion and Future steps

Changes in the seasonality of births were widespread across all European countries examined. Yet, the observed diversity in the timing of these shifts raises new questions about their underlying drivers. Why did the seasonality of births change between 1950 and 2019? And why did these changes occur at different points in time across countries?

In further analysis, we plan to explore in more detail the timing of the shift in the seasonality of births across the countries included in our study. By doing so, we aim to provide insights into the mechanisms driving these changes and the reasons behind the cross-country differences in their timing. To this end, we will combine national birth register data with country-level macro indicators to examine how social factors (e.g., the proportion of births outside marriage) and economic structures (e.g., the share of employment in agriculture) relate to the observed shifts in birth seasonality.

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