Seasonality of Fertility in Spanish Provinces from 1941 to 2021

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Abstract

Seasonality of fertility is a ubiquitous phenomenon found across the globe. Several factors at the individual level and related to the economic, institutional and environmental context affect such trends. Existing studies documented a general decline in the amplitude of the seasonality of fertility in several countries. Nevertheless, there is lack of evidence on how this trend varied by geographical. In this study, we focus on the Spanish context to inquire how seasonal trends in fertility in Spanish provinces changed over time. For this purpose, we leverage monthly birth counts from 1941 to 2021. We report three main findings. First, we observe a change in the season recording a peak in births from spring to fall across time. Secondly, we observe a general decline in the amplitude of seasonality over time. Thirdly, the decline in the amplitude of seasonality is not ubiquitous across provinces, as in some we observe an increase in later decades. These findings provide further evidence on the long-term change in the seasonality of fertility and their geographical variations in Spain opening important questions on the determinants of such changes.

Introduction

Seasonal trends in births are observed in several countries and populations. For example, studies for the northern parts of the United States and Sweden showed 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). 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). Not only geographical contexts, but also sociodemographic groups show to vary in their seasonal trend. For example, high SES mothers in Sweden are less likely to give birth late in the year (Dahlberg & Andersson, 2018) and employed low SES mothers in Spain are more likely to give birth in fall (Recio Alcaide et al., 2022).

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). Nevertheless, these factors might change over time and determine a shift in the intra-annual distribution of births.

Seasonal trends in fertility have changed over time. The seasonal amplitude has decreased in the United States (Martinez-Bakker et al., 2014), Sweden (Dahlberg & Andersson, 2018) and Spain (Cancho-Candela et al., 2007) over time. Some of the factors explaining the decline in seasonality over time relate to industrialization, lower dependence on agricultural cycles and the ability to protect from meteorological stressors.

In this article we explore the seasonality of fertility in 50 Spanish provinces from 1941 to 2021. Existing studies on Spain documented a decrease in the seasonal amplitude in births between 1941 and 2000 (Cancho-Candela et al., 2007). More precisely, a peak in births was observed in spring from 1941 to 1960, but this peak showed to disappear in the later decades. A recent study, focused on the period 2016-2019 showed the existence of a seasonal pattern in Spain and a higher prevalence of births in the fall months in particular for employed low SES mothers (Recio Alcaide et al., 2022). Here, we contribute to the existing studies exploring seasonality for the entire period 1941 to 2021 and exploring geographical differences over time. In following analysis, we will further inquire the mechanisms explaining changes in seasonality over time and factors explaining different trends between provinces.

Data and methods

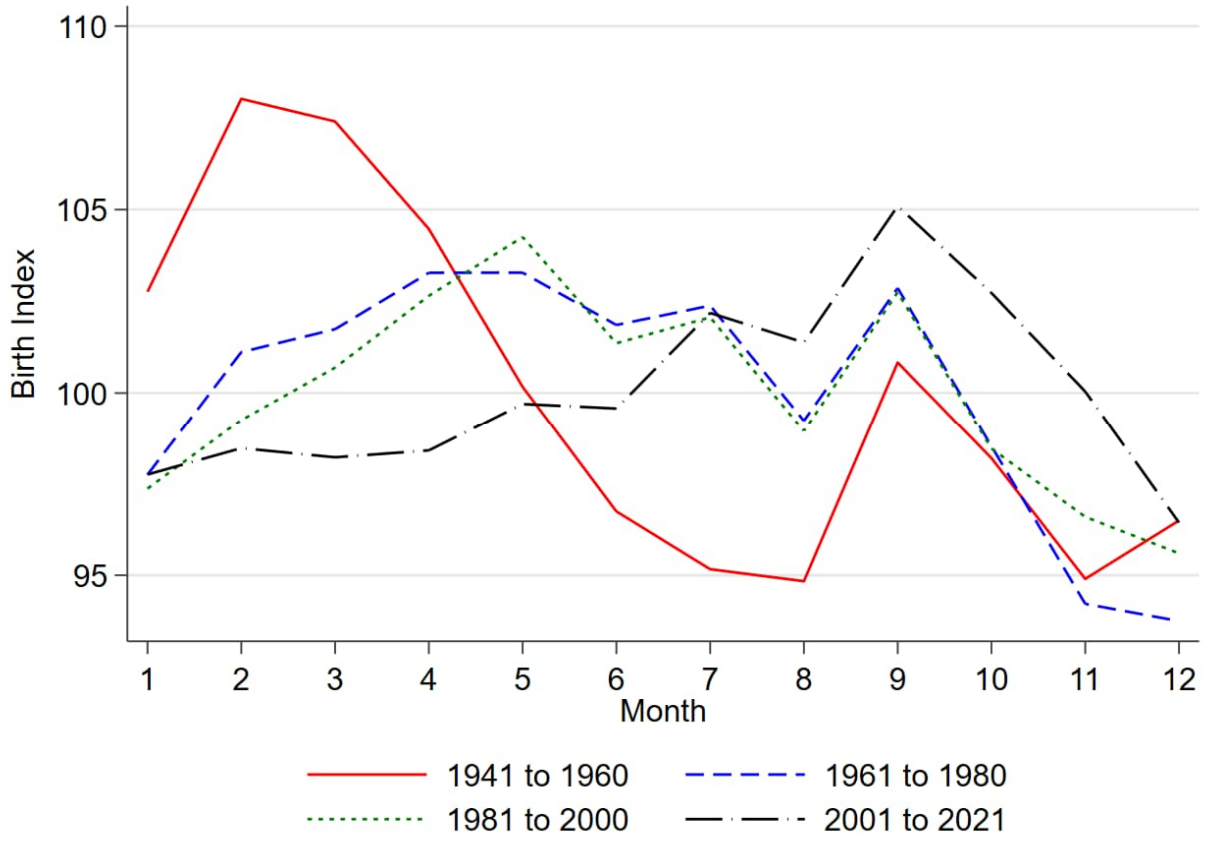
In this study we leverage data on monthly birth counts for Spain from January 1941 to December 2021 for 50 provinces[1]. The data is collected by the Spanish Statistical Institute (Instituto Nacional de Estadistica) and provides high quality information on births. From these data, we first adjust our time series of monthly birth counts by the number of days in each month. Secondly, we construct a birth index that is computed as: $I_m^p = \frac{B_m^p}{B_y^p} * 100$. In which the Index *I* for province *p* and month *m* is determined by the monthly birth counts in province *p* and month *m* divided by the average number of births in province *p* and year *y* and multiplied by 100. Using such 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). As a measure of the amplitude of the seasonality of births we compute the coefficient of variation for each year and province.

[1] We excluded the provinces of Ceuta and Melilla that lack data for the entire period of the study.

Preliminary analysis

In Figure 1, we show the change in seasonality of births over time in Spain plotting the average values of the birth index across Spain in four time periods and for 12 months. Respectively, these periods are 1941 to 1960, 1961 to 1980, 1981 to 2000 and 2001 to 2021[2]. Here, we observe a peak in births in spring in the period 1941-1960, but that is flattening between 1961 and 2000, as shown in a previous study(Cancho-Candela et al., 2007). Also, we can observe another peak in the ninth month in all periods that is expected due to the higher conception during the winter festivities (Wood et al., 2017). Nevertheless, the peak on the ninth month and in fall months is higher in the later period compared to the previous decades (this result is found also excluding the COVID years). Consequently, we observe a change in the intra-annual distribution of births with a shift in the peak of births from the spring months to the fall months over time.

Figure 1. Seasonal variation in births across four periods



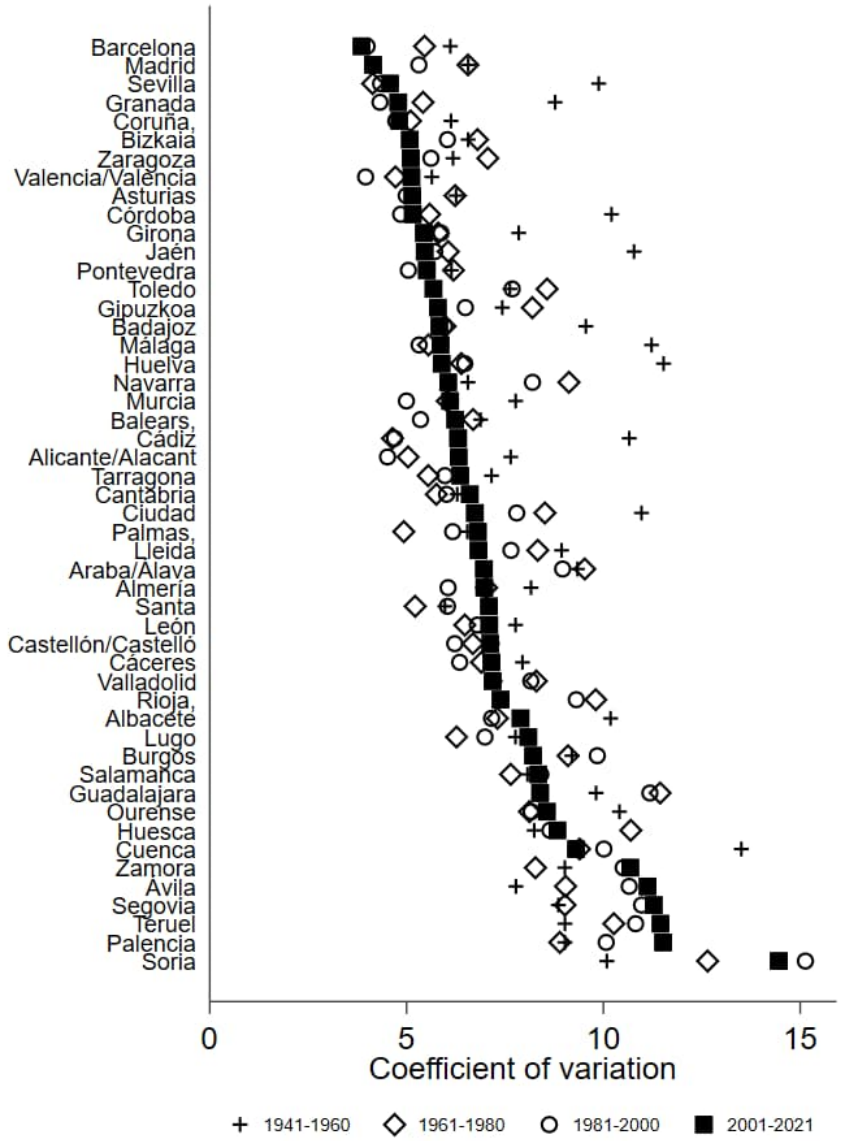
Note: in the figure, we plot the average birth index in each month across Spain in four time periods: 1941-1960, 1961-1980, 1981-2000 and 2001-2021.

In figure 2, we plot the coefficient of variation in each of the 50 provinces in Spain in the same four time periods used in figure 1 and ordered the provinces based on the values of 2001-2021.

[2] We replicated the analysis dropping years after 2019 that might bias results due to the COVID pandemic. However, we did not observe any major difference in the results.

Across Spain we observe a reduction in the coefficient of variation from 8.31% in 1941-1961 to 7.05% in 2001-2021 suggesting a reduction in the amplitude of seasonality over time. Nevertheless, differences across provinces exist. For example, in Sevilla the value in 1941-1960 is 12%, but it is reduced by half to 6% in 2001-2021[3]. Conversely, in provinces such as Palencia, Segovia, Zamora the coefficient of variation is larger in recent decades with values above 10%.

Figure 2. Coefficient of variation of births in 50 provinces across four periods



Note: in the figure, we show the average yearly coefficient of variation computed in 50 Spanish provinces across four time periods 1941-1960, 1961-1980, 1981-2000 and 2001-2021. The provinces are ordered accordingly to the values of the coefficient of variation computed in the period 2001-2021.

[3] Also in this case, we replicated the analysis dropping years after 2019. However, we did not observe any major difference in the results.

Discussion and further analysis

In this article, we have analyzed the seasonal trend in fertility in Spain over 81 years and the variation in the seasonal amplitude over this period across provinces. The results show a shift in the season that records a peak in births from spring to autumn. Despite a general decline in the seasonal amplitude over time, we observe variation between provinces. For example, some provinces show a decline in seasonal amplitude over time, but others show an increase in seasonality over the same period.

The descriptive findings presented on the change in the seasonal trends over time and between geography, leave open the question on the mechanisms that could explain these patterns. In future analysis, we will combine additional data at the provincial level to explore how socio-economic factors and environmental factors could explain these trends. For example, an increase in female employment could explain the change in the peak months of births over time or the different seasonal amplitude between provinces as hinted in a previous study (Recio Alcaide et al., 2022). Also, the intensification of hot temperatures could explain the decline in conception during the spring months in the recent decades, in accordance with recent studies showing a decline in births with exposure to hot days (Barreca et al., 2018; Conte Keivabu et al., 2023; Hajdu & Hajdu, 2022).

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