

Investigating Short- and Medium-Term Fluctuations in Birth Series and Sex Ratio at Birth in Trentino (1815-1923): A Historical Demographic Analysis Using Baptismal Records and Climatic Data

Francesco Scalone, Nadia Barbieri, Francesca Tosi, Rosella Rettaroli

University of Bologna, Italy

(Extended abstract)

Abstract

The analysis of the evolution of interrelations between birth and related sex ratio trends, and climatic, socio-economic, demographic, and cultural variables is a key focus of demographic research, even in historical periods prior to the onset of the demographic transition in fertility. The existence of such relationships serves to illustrate the sensitivity of the reproductive process to climatic and social variations. The debate on the influence of climatic conditions or shocks on the annual number of births and sex ratio remains open, as do discussions on the effects of various geographical and socio-demographic conditions on changes in birth seasonality. Demographic factors such as birth order and isonymy are considered, alongside geographical components such as parish or area, municipality, or altitude, and climatic conditions measured by precipitation intensity and temperature, both in terms of slow climate change evolution and shocks. The monthly historical time series of births by sex in the Trentino region of Italy from 1815 to 1923 allows us to assess the presence and measure the strength of these factors' impact. The analysis will employ time-series models. Fixed effects models will account for municipality and surname-specific characteristics, ensuring that variations attributable to these factors are properly controlled.

Relevance

This study leverages unique and rich historical microdata from the entire Trentino region (north-eastern part of Italy), including 1,254,623 live births recorded nominatively in digitized baptismal registers from 1815 to 1923. These records contain detailed information such as birth date, birth order, sex, parish and municipality of birth, together with names of the newborns and their parents. Additionally, monthly aggregated data on precipitation and temperature from the HISTALP project, a database, consisting of monthly homogenised temperature, pressure, precipitation, sunshine and cloudiness records for the 'Greater Alpine Region', offer a comprehensive perspective on climatic influences during this period.

General Objective

The primary aim of this research is to explore short- and medium-term fluctuations in birth series and the linked sex ratios at birth in relation to various determinants to shed light on the influence of climate variation on demography also in historical time. This analysis will allow us to gather a first answer on the demographic constraints due to climate shocks in the past. Our interests are mainly to test the influences of demographic factors (birth order, isonymy), geographical components (parish or area, municipality, altitude), climatic conditions (precipitation and temperature), and seasonality. By analyzing these factors, the study seeks to identify patterns and correlations that influenced the evolution of these demographic variables in more than one century.

Background

Historical demographic studies have shown that factors such as birth order and isonymy can influence sex ratios and birth frequencies (Biggar et al. 1999). Climatic conditions, including temperature and precipitation, have also been linked to variations in birth rates, potentially through their effects on agricultural productivity, nutritional status of the mothers and the families, and overall health conditions (Ruiu, Breschi 2017; Barbieri et al. 2024). Previous research on historical Italian populations has indicated critical demographic responses to periods of epidemics, wars, and famines (Rettaroli and Scalone 2021), suggesting that such external shocks could alter birth patterns and sex ratios. Recent studies shed further light to the link between sex ratio and evolutionary aspects (Scalone and Dribe 2024).

Data Description

The rich dataset comprises detailed, nominative baptismal records from Trentino region in Italy, capturing information over more than 100 years. The historical period is characterized by the last epidemic waves, a stability of the fertility measure on high levels and the onset of the fertility transition at the end of the time interval, while mortality seems to slowly decrease for the last decades of the XIX century. These relatively long time series can be supplemented with climatic data from the HISTALP project, providing monthly homogenised series of temperature, pressure, precipitation, sunshine and cloudiness (Rubel et al. 2017). This combination of demographic and climatic data allows for a robust analysis of the factors affecting birth series and sex ratio fluctuations.

Birth Patterns and Sex Ratios

The attached figures provide a comprehensive look at the demographic dynamics in Trentino from 1815 to 1923. The monthly births distribution chart highlights the pronounced seasonality in births, which may be influenced by environmental factors, such as climatic conditions and agricultural cycles, or cultural and social practices that dictated fertility patterns during this period (Scalone and Dribe 2024). The annual births trend over time

illustrates significant fluctuations in birth rates, which could correspond with historical events such as epidemics (like the Spanish flu in the first decade of the XXth century), famines, economic changes, or shifts in societal behaviors (Barbieri et al. 2024). Notably, the periods of increase and decline in the birth rate reflect the broader demographic changes and challenges faced by the population of Trentino. The sex ratio at birth, plotted annually, shows variations that generally hover around the expected biological norm but also reflect potential influences of demographic factors like birth order and isonymy, as well as external stresses, which might skew the ratio. These visual insights underscore the complex interplay of environmental, social, and biological factors that shaped the population's structure and dynamics during the 19th century.

Methodology

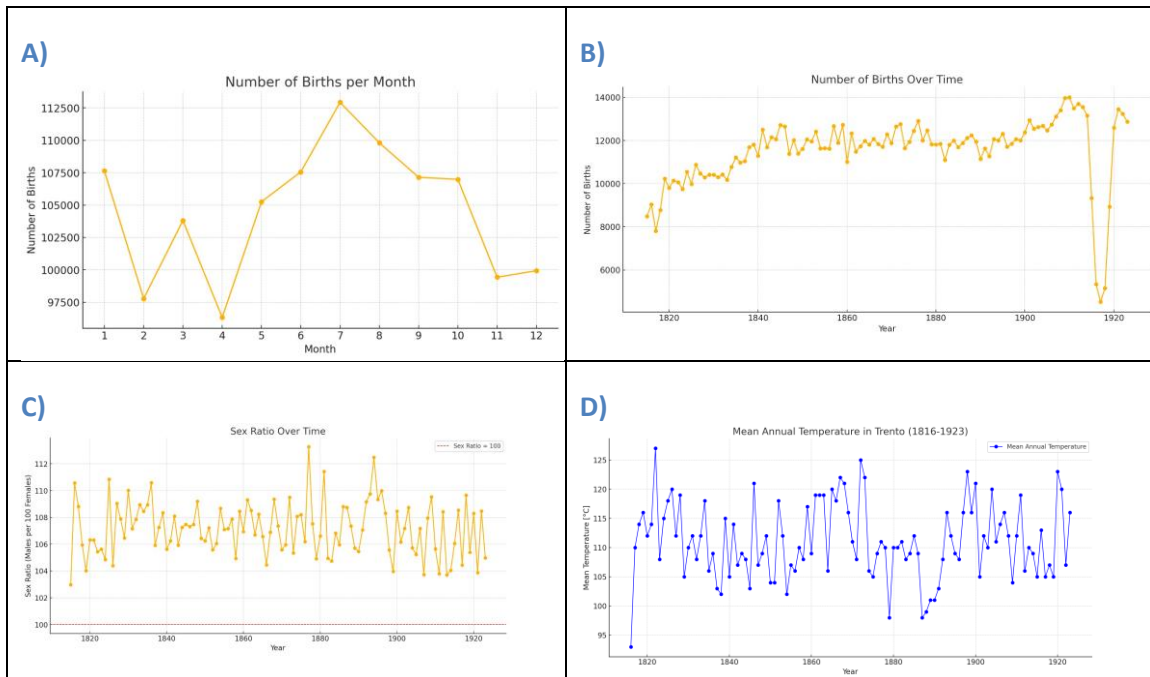
The analysis will utilize time-series models to investigate the relationships between birth fluctuations and the identified determinants. Fixed effects models will account for municipality and surname-specific characteristics, ensuring that variations attributable to these factors are properly controlled. This approach will enable a nuanced understanding of the interplay between demographic, geographical, and climatic factors in shaping historical population dynamics.

Expected Contributions

The study is expected to provide insights into the demographic and environmental determinants of birth fluctuations and sex ratio variations in historical populations when subjected to climatic stress. It will contribute to the broader field of historical demography by highlighting the importance of integrating climatic data with demographic records to understand population dynamics over time.

This proposal aims to offer a comprehensive analysis of the complex factors influencing birth series and sex ratios, advancing our understanding of historical population responses to environmental and societal stresses and evolutions.

Figures – Trentino region (Italy) 1815-1923: A. Total absolute number of births per month; B. Annual number of births; C. Evolution of the sex ratio (M/F) at birth; D. Mean annual temperatures.



References

- Barbieri, N., Ghulami, H.R, Rettaroli, R., Scalone, F. 2024. *Tracing Demographic Events Through the Seasons in 18th and 19th Century Bologna*, paper presented at LX Riunione della Società di Economia, Demografia e Statistica (SIEDS), Milano 23-24 Maggio.
- Biggar, R.J., Wohlfahrt, J., Westergaard, T. and Melbye Biggar, M. 1999. Sex Ratios, Family Size, and Birth Order, *American Journal of Epidemiology* Vol. 150, No. 9
- Rettaroli, R. and Scalone, F. 2021. The Human Sex Ratio at Birth and Late Fetal Mortality: The Italian Case. *Biodemography and Social Biology* 66 (2):172–190. doi:10.1080/19485565.2021.1879627.
- Rubel, F., Brugger, K., Haslinger, K., and Auer, I. (2017). The climate of the European Alps: Shift of very high resolution Köppen-Geiger climate zones 1800-2100. *Meteorologische Zeitschrift*, 26(2), 115-125. DOI: 10.1127/metz/2016/0816. Publisher: Schweizerbart Science Publishers, Stuttgart, Germany.
- Ruiu, G. and Breschi, M., Seasonality of livebirths and climatic factors in Italian regions (1863-1933). *Historical Life Course Studies*, v. 4 (2017), 145-164.
- Scalone, F. and Dribe, M. 2024. *Ambient temperature and sex ratios at birth: A county-level analysis of Sweden, 1756–1859*. Paper presented at the Annual PAA Conference, Columbus.