

University of Groningen

## Fertility trends and its determinants in Spain and Europe

Carioli, Alessandra

DOI:  
[10.33612/diss.237466569](https://doi.org/10.33612/diss.237466569)

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*  
Publisher's PDF, also known as Version of record

*Publication date:*  
2022

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*  
Carioli, A. (2022). *Fertility trends and its determinants in Spain and Europe*. University of Groningen.  
<https://doi.org/10.33612/diss.237466569>

### Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

### Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

# **Fertility trends and its determinants in Spain and Europe**

**Alessandra Carioli**





university of  
 groningen

# Fertility trends and its determinants in Spain and Europe

PhD thesis

to obtain the degree of PhD at the  
University of Groningen on the authority of the  
Rector Magnificus Prof. C. Wijmenga and in accordance with  
the decision by the College of Deans.  
This thesis will be defended in public on  
Thursday 20 October 2022 at 14.30 hours

by

**Alessandra Carioli**  
born on 4 April 1982  
in Novara, Italy

**Supervisor**

Prof. L.J.G. van Wissen

**Co-supervisor**

Dr. J. Spijker

**Assessment Committee**

Prof. A.C. Liefbroer

Prof. D. Reher

Prof. A. Rey Del

*to my parents, Enzo e Margherita*

# Table of content

<b>CHAPTER 1 Introduction</b>	13
1.1 European fertility diversity across space and time	14
1.2 Data and methods	17
1.3. Approach	18
1.4 Outline of the thesis	19
1.5 References	20
<b>CHAPTER 2 The changing geographies of fertility in Spain (1981-2018)</b>	23
Abstract	24
2.1. Introduction	25
2.2. Data and Methods	26
2.2.1. Data	26
2.2.2 Fertility indexes	28
2.2.3. Method	29
2.3. Results	32
2.3.1. Descriptive	32
2.3.2.1 <i>Global Moran's I</i>	37
2.3.2.2 <i>Correlogram Analysis</i>	38
2.3.3. Local Indicators of Spatial Association	39
2.3.4 Exploring the determinants of change	41
2.3.4.1 <i>Results of the spatial lag model</i>	42
2.4. Discussion	44
2.5. Availability of data and materials	46
2.6. Funding	47
2.7. Acknowledgements	47
2.8. References	48
<b>CHAPTER 3 Determinants of Fertility in Spain: A Spatial Panel Analysis</b>	51
Abstract	52
3.1. Introduction	53
3.2. The spatial dimension of fertility	54
3.2.1. The Spanish context and its spatial dimension	55
3.3. Data	57
3.4. Method	58
3.4.1. Specification of the spatial Durbin panel model	58
3.5. Results	61
3.5.1. Descriptive findings	61
3.5.2. The spatial panel model	65
3.6. Discussion	69
3.7. References	71

<b>CHAPTER 4 Mind the gap: the difference between observed and desired fertility in 10 European countries. A microsimulation model</b>	77
Abstract	78
4.1. Introduction	79
4.2. The relationship between observed and desired fertility	80
4.2.1. The direct and indirect effect of fertility postponement on the gap	81
4.2.2. Change in preferences	81
4.2.3. Union dissolution	81
4.3. Data	82
4.4. Methodological framework	84
4.4.1. Desired fertility measurement	86
4.4.1.1. <i>Model assumptions</i>	87
4.5. Results	89
4.5.1. The gap between desired and observed fertility	90
4.6. Conclusions	92
4.7. References	94
<b>CHAPTER 5 Does Union Formation Change Attitudes towards Childbearing in Bulgaria? A Propensity Score Analysis.</b>	99
Abstract	100
5.1. Introduction	101
5.2. Theoretical background	103
5.3. Sample description	106
5.4. Attitude indices	108
5.5. Statistical methodology	110
5.6. Propensity Score Specification	113
5.7. Matching Estimates	116
5.8. Discussion and Conclusions	121
5.9. References	124
<b>CHAPTER 6 Conclusions</b>	129
6.1 Objectives	130
6.2 Central findings	130
6.2.1 Limitations of the studies	136
6.3 Methods for analysing fertility	136
6.3.1. Aggregated data	137
6.3.2. Survey data	137
6.4 Policy recommendations	138
6.5 Recommendations for future research	139
6.6. References	140
Dutch summary	143
English summary	146
Acknowledgements	149
About the author	150



## List of tables

<b>Table 2.1:</b> Summary of regions characteristics for selected years.	27
<b>Table 2.2:</b> Summary of the Contiguity neighbors used for the neighborhood matrix.	29
<b>Table 2.3:</b> Total fertility rate spatial lag model results for the four distinct points in time corresponding to the last four census.c	43
<b>Table 3.1:</b> Time-specific descriptive statistics for fertility rates and independent variables across all aggregate municipality units (N=910).	64
<b>Table 3.2.</b> Spatial autocorrelation (Moran's I) of total fertility rate and main explanatory variables (N=910).*	66
<b>Table 3.3:</b> Results from spatial Durbin panel model for total fertility rate, naive standard errors in brackets.	67
<b>Table 3.4:</b> Results from spatial Durbin panel model for mean age at first birth model, naive standard errors in brackets.	68
<b>Table 4.1.</b> Desired and observed fertility for women, total and by parity, in 10 European countries. Own elaboration based on FFS data.*	82
<b>Table 4.2.</b> Level of desired parity progression ratios and proportion of unwanted births by country, from FFS data.*	83
<b>Table 4.3.</b> Values of input parameters used in the microsimulation model, for union formation, dissolution, and contraception use at the start of the union (estimated from FFS data).*	83
<b>Table 4.4.</b> Desired, observed, and simulated fertility and decomposition of the gap.	91
<b>Table 5.1.</b> Sample used in the analysis by status during the first and second waves	107
<b>Table 5.2.</b> Results for factor analysis with respect to attitudes towards childbearing	108
<b>Table 5.3.</b> Odds ratios for determinants of entering a union: results of logit model.	114
<b>Table 5.4.</b> Effect of union formation on childbearing attitudes, whole sample	117
<b>Table 5.5.</b> Decomposition of causal effect of union formation (cohabitation and marriage) on childbearing attitudes, whole sample	117
<b>Table 5.6.</b> Decomposition of the causal effect of union formation (cohabitation and marriage) on childbearing attitudes, childless sample	119

## List of figures

<b>Figure 2.1:</b>	Castile and Leon 2248 municipalities (in grey) and 76 comarcas.	28
<b>Figure 2.2:</b>	Subdivision of Spain into macro-regions.	31
<b>Figure 2.3:</b>	Boxplot for total fertility rate between 1981 and 2018 for selected years by big regions.	33
<b>Figure 2.4:</b>	Boxplot for mean age at childbearing between 1981 and 2018 by big regions.	34
<b>Figure 2.5:</b>	Total fertility rate and mean age at childbearing for years 1981 and 2018.	35
<b>Figure 2.6:</b>	Total fertility rate and mean age at childbearing for the first birth order in 1981, 1997 and 2018.	36
<b>Figure 2.7:</b>	Correlogram plot for TFR. Regional view	39
<b>Figure 2.8:</b>	LISA maps for total fertility rate. Years 1981, 1997, 2008, and 2018. First Order Rook Contiguity.	40
<b>Figure 2.9:</b>	LISA maps for mean age at first birth. Years 1981, 1997, 2008, and 2018. First Order Rook Contiguity.	41
<b>Figure 3.1:</b>	Temporal distribution of total fertility rate by year for all 910 areas, period 1981-2015.	62
<b>Figure 3.2:</b>	Distribution of mean age at first birth by year for all 910 areas, period 1981-2015.	62
<b>Figure 3.3:</b>	Total fertility rate for 1981 and 2011 census (top panels) and LISA maps for the same variable (bottom panels). LISA maps report only statistically significant clusters. Non-significant clusters omitted.	63
<b>Figure 3.4:</b>	Mean age at first birth for 1981 and 2011 census (top panels) and LISA maps for the same variable (bottom panels). LISA maps report only statistically significant clusters. Non-significant clusters omitted.	63
<b>Figure 4.1:</b>	Proportion of final childlessness in simulated populations, with varying age at first union, various levels of celibacy, of divorce, and of the length of contraception at the start of union.	88

# LIST OF ACRONYMS AND SYMBOLS

- ADE:** Average Direct Effect  
**AIC:** Akaike Information Criterion  
**AIE:** Average Indirect Effect  
**ASFR:** Age Specific Fertility Rate  
**ATE:** Average Total Effect  
**ATT:** Average Treatment effect on Treated  
**ATTDD:** Average Treatment effect on Treated for matched individuals  
**BIC:** Bayesian Information Criterion  
**d0->1:** Proportion of childless women who desire at least one child  
**d1->2:** Proportion of women with one child who desire a second children  
**d2->3:** Proportion of women with two children who desire a third children  
**d3+>4+:** Proportion of women with three children who desire a fourth or more children  
**DD:** Difference in difference estimator  
**DFS:** Desired Family Size  
**FFS:** Fertility and Family Survey  
**FOQ:** First Order Queen neighborhood  
**FOR:** First Order Rook neighborhood  
**HFD:** Human Fertility Database project  
**HH-LISA:** High-High Local Indicators of Spatial Association cluster  
**HL-LISA:** High-Low Local Indicators of Spatial Association cluster  
**INE:** Instituto Nacional de Estadística, Spanish National Institute  
**KKN:** K-Nearest Neighbors  
**LH-LISA:** Low-High Local Indicators of Spatial Association cluster  
**LISA:** Local Indicators of Spatial Association  
**LL-LISA:** Low-Low Local Indicators of Spatial Association cluster  
**LM test:** Lagrange Multiplier test  
**LR test:** Likelihood Ratio test  
**MAC:** Mean Age at Childbearing  
**MAUP:** Modifiable Area Unit Problem  
**OLS:** Ordinary Least Squares  
**P:** Propensity score  
**p0->1:** Proportion of childless women who had a first birth  
**PSM:** Propensity Score Matching Estimator  
**SMAM:** Singulate Mean Age at Marriage  
**SMAU:** Singulate Mean Age at first Union

**SOQ:** Second Order Queen neighborhood

**SOR:** Second Order Rook neighborhood

**TFR:** Total Fertility Rate

**TFR\*:** Total Fertility corrected for tempo distortion

