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Pandemic Babies? The Fertility Response to the First Covid-19 Wave Across European Regions

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Abstract

As expected, birth rates have been affected across high-income countries in the aftermath of the Covid-19 pandemic. Initial studies reported heterogeneous fertility responses across countries. Yet, country level assessments may mask important regional variation and paint an imprecise average picture. Regional level analyses are thus needed to deepen our understanding of the fertility response to Covid-19. Our study fills this gap. We conducted a rigorous data collection effort in 24 European countries, and report how the first pandemic wave affected birth rates across European sub-national regions. We find large sub-national regional variation in the birth rate response between December 2020 and May 2021, with more pronounced variation in countries with lower Covid-19-mortality rates during the first wave. Future analyses will formally assess regional heterogeneity in the fertility response within and across countries, and examine whether regional fertility response variation is predicted by regional Covid-19 infection- and mortality rates or economic indicators.

Introduction, Background and Aim of Study

During the first months of the COVID-19 pandemic, scientists and the media alike speculated about how fertility would be impacted by this world crisis and predicted everything between a baby bust and a baby boom. More than a year later, birth rates appear indeed significantly affected, at least for a subgroup of countries for which data is available. First studies indicate that fertility, measured as crude numbers of births, plummeted in many countries, followed by small baby booms which occurred in some of them. Yet, in other countries, fertility remained unaffected or boomed without falling first (Sobotka et al 2021, STFF Database, Aassve et al. 2021). Figure 1 depicts this heterogeneous response as percent changes in monthly births relative to the births in the same month of the previous calendar year in selected European and North American countries. However, to date reports on birth rate changes have focused on the country level and neglected any potential subnational variation in the fertility response to the pandemic.

Yet, previous literature shows that the fertility response to disasters is often regionally diverse. Natural disasters, in particular, seem, in their aftermath, to affect birth rates in directly affected municipalities, but not in other regions (Davis 2017, Rodgers, John & Coleman 2005, Nobles et al. 2015, Ruther 2010). Even more spatially generalized crises, like recessions, have been shown to trigger spatially heterogeneous effects on birth rates (Goldstein et al. 2013, Matysiak, Sobotka & Vignoli 2020). Moreover, regional fertility variation within countries is often larger than cross-country fertility variation, also in non-crises times (Campisi et al 2020), further buttressing the need for sub-national analysis.

Sub-national differences in the fertility response to the COVID-19 pandemic in general and the first pandemic wave in particular can therefore be expected, due to several circumstances. First, the spread of the virus showed pronounced within-country spatial variation during the first pandemic wave. If changes in birth rates in the aftermath of the first pandemic wave are due to behavioral changes that are triggered by the regional exposure to the virus and mortality threat, regional birth rate responses should be correlated with regional variation in Covid-19 infection and mortality rates. Second, the health crisis rapidly translated into an economic recession, which has affected regions differently, and may have had spatially diverse effects on birth rates. These may be tied to regional changes in unemployment and a regions' economic strength coming into pandemic, given that regional GDP is an important predictor of regional variation in birth rates across Europe (Fox et al, 2019, Campisi et al. 2021). If the fertility response was triggered by economic factors related to the Covid-19 recessions, regional variation in the fertility response may be predicted by factors such as the pre-pandemic GDP of a region and changes in a region's unemployment rate during the pandemic.

At the same time, the Covid-19 pandemic represents a unique event that differs from previous disasters and crises. Not only did the pandemic unify a health crisis, a mortality inducing event, and a recession, but also lead to unprecedented disruption to public and social life through virus containment and social distancing measures. During the first pandemic wave across Europe, the Covid-19 spread was rather regionalized, but social distancing and lockdown measures such as mask wearing, school closures, were imposed

nationwide within a few weeks in many European countries (Hale et al 2021). If containment measures, such as social distancing, school closures, and other disruptions to public life and other nationalized factors such as media exposure affected birth rates, a more nationally homogeneous and less regionally diverse fertility response to the first pandemic wave may be present (Comolli and Vignoli 2021).

Our study addresses these issues and has three objectives. First, we describe regional variation, measured on the NUTS2 level, in the monthly fertility response to the first wave of the COVID-19 pandemic across Europe, for the birth months November 2020 until May of 2021. The period covers births that were conceived between February 2020 and September 2020—in other words, conceptions that occurred during the first pandemic wave and the summer months between the first and the second wave in the Northern Hemisphere. We assess changes by comparing the observed monthly birth rates to the average birth rate in the same month in the three previous years. Further, we compare observed to expected birth rates based on longer term fertility trends to assess whether post-pandemic birth rate changes remain significant once we control for longer term fertility trends in the regions.

Second, we assess how regional responses differed from average country-level responses. This analysis aids in assessing whether the fertility response was spatially heterogeneous within each country—In other words, whether response was related to factors at the sub-national regional rather than the national level. Third, we shed further light on the effect of potential sub-national regional factors on the fertility responses by investigating the effect of regional Covid-19 infection- and mortality rates, and pre-pandemic regional GDP levels on the regional fertility response.

Throughout all analyses, we study whether the regional fertility response, and the factors affecting it, were the same throughout the whole first wave and first reopening period, or whether there were time-varied responses, such as stark birth rates decreases during the first wave, followed by pronounced increases during the reopening time in regions more strongly affected by Covid-19 cases and deaths.

In sum, country-level assessments of the fertility response to the pandemic may mask regional variation, thereby drawing an imprecise average picture in particular for countries with large regional disparities in the fertility response. Regional-level analyses enrich our understanding of national trends in birth rates in the Covid-19 pandemic aftermath. Moreover, the first wave of the Covid-19 pandemic offers a unique moment in time to study the extent of regional diversity in the fertility response to a multi-faceted crisis, and to analyze the factors which may predict this diversity. Our study will thus offer both a descriptive account of regional variation in the fertility response to the first wave of the Covid-19 pandemic across Europe, and a step forward in the investigation of the mechanisms through which the pandemic affects fertility.

Data

The birth rate data come from the national registers or national statistical offices in each of the countries. With the aim to document the subnational fertility response of the Covid-19 pandemic across Europe, we started an extensive data collection effort in early 2021 by

reaching out to collaborators from the Register-Based Fertility Research Network (EAPS 2021) and statistical offices in all member countries of the European Union, Norway, the UK, and Switzerland, to obtain monthly NUTS2 regional level data on the number of births and the female population aged 15-49 for January 2000 to June 2021. Data collection is ongoing, and will be finalized in the late fall of 2021. Figure 2 shows the current and envisioned sample coverage. Data for 149 regions of 17 countries marked in dark green are already included in our sample and preliminary analyses. Data from regions marked in light green will soon follow, regions marked in yellow are expected (but not yet confirmed) to be added to the sample.

Data for our predictors of interest for the models addressing our third objective consist of regional indicators of GDP, unemployment, and Covid-19 infection- and mortality rates come from Eurostat, the COVID19-European-Regional-Tracker (European Regional Tracker 2021), Our World in Data (Our World in Data 2021) and Public Health England (Public Health England 2021). The analyses for the third objective further control for regional population density, and the proportion of tertiary educated individuals, with measures from Eurostat's regional database.

Analytic Plan and Method

In a first step, we assess pandemic-induced changes in the monthly birth rate by comparing the observed monthly birth rates in the months 11/2020 – 5/2021 to the average birth rate in the same month in the previous three years. We further explore if these effect estimates differ from those estimated based on predicted birth rate values derived from estimating longer-term fertility trends using multi-level models with regions and month fixed effects. We present regional birth rate changes in maps depicting month-by-month changes. Maps depicting monthly birth rate changes between births in November 2020 to May 2021 and the average birth rate in the same month in the previous three years are presented in the preliminary findings, the other analyses will follow in the next version of this paper.

In a second step, we formally test whether regional responses differed from the country-level average responses, to address our second research aim. In a third step, we assess whether monthly birth rate changes are associated with the regional intensity of the SARS-COVID-19 virus, and whether regional variation in pre-pandemic economic well-being predicts birth rate changes for each of the three phases during the first wave. The regional intensity of the SARS-COVID-19 virus will be measured as a confirmed number of cases and as COVID-19 related deaths, whereas pre-pandemic economic strength of regions will be measured using 2019 data on GDP. We use multi-level region and month fixed effects models. Throughout the analysis, we summarize births into three time periods: conceived during 1) the first wave peak and lockdown phase (March to May 2020), 2) the opening phase (June and July 2020), and 3) the later summer months pre-second wave (August and September 2020). We also test differences in fertility responses and in the effect of sub-national regional factors between these three periods.

Preliminary Findings

Figures 3 to 8 speak to our first research aim. They show percentage changes in birth rates among women aged 15 to 49 by NUTS2 regions, for each of the months December 2020 to May 2021, compared with the average birth rate in each region in the same month during the three years prior (2017-2019 for December 2020, 2018-2020 for January to May 2021). These first findings are preliminary and purely descriptive. No formal measures of regional response-heterogeneity, comparison to expected values based on longer term time trends, or analyses of factors predicting these changes are included in this version, but will be added to the next version of the paper. These first findings therefore need to be interpreted with caution. Birth rates are subject to change over time, which is why prior trends need to be taken into account based on longer-time trend modeling when assessing the fertility response to an event such as the pandemic. Our first descriptive findings thus summarize the observed regional birth rates in comparison to the three years prior, but do not yet allow us to assess whether and how much of this variation is caused by the pandemic.

Three main preliminary findings come to the fore. First, there is large sub-national variation in the fertility response to the first pandemic wave. Second, the extent of the regional variation varies by country and also by month/first wave phase. Third, there seems to be an association between within country regional disparities of the fertility response to the first wave and the country's overall affectedness by Covid-19 infections and deaths during that time (Kontis et al. 2020, Our World in Data 2021), a first descriptive finding which needs to be further investigated in the next version of this paper.

Figures 3 and 4 indicate that in our current sample, Germany, Denmark, the Netherlands, the Czech Republic, Hungary and Slovakia (only January 2021) present large regional variation of fertility change for December 2020 and January 2021 births compared with the average rate in the same month during the three years prior, which were conceived during the height of the first lockdown in April 2020. Pronounced decreases in births in some and large increases of births in other regions are present in these countries. Germany stands out with particularly large regional disparities between its Eastern and Western regions. Interestingly, the countries with large regional disparities in birth rate changes in these two months are among the countries with lower overall Covid-19 affectedness (in terms of excess mortality) during the first pandemic wave (Kontis et al. 2021). Slovenia is an exception to this pattern, experiencing low Covid-19 case numbers and slight birth rate decreases across all regions, which were the largest in the region bordering Italy. Sweden, Italy, France and Portugal, which all experienced higher excess mortality during the first wave (ibid.), show regionally homogenous birth rate declines throughout the country in January 2021 births, as do the Baltic states.

Figures 5 and 6 show birth rate changes in February and March 2021, which correspond to May and June 2020 conceptions, when lockdowns began to be eased. Large regional birth rate change variation persists in Germany between the Eastern and Western regions, however, the other countries with large regional disparities in December and January births start to show more regionally homogeneous increases in birth rates during these two months, compared with birth rates in the same months in previous years. Regional

disparities also emerge in France, Italy, Portugal, and Sweden, in particular during March 2021, when some regions appear to catch up first lockdown related baby busts, while other regions in these countries continue to see declines.

Figures 7 and 8 depict birth rates in April and May 2021, which correspond to conceptions in the summer months of July and August between the first and second pandemic wave in Europe. France and Hungary stand out as countries with regionally homogeneous birth rate increases, Portugal and the Baltic as countries with regionally homogeneous decreases compared to the summer months in the previous years, the other countries again show greater regional disparities in birth rate changes. Iceland stands out throughout the first pandemic wave with pronounced increases in births compared to the years before, ranging from 10 percent in February to around 25 percent in most other months between January and May 2021.

Conclusions and Outlook

As expected, birth rates have been affected across high-income countries in the aftermath of the Covid-19 pandemic. Initial studies reported heterogeneous fertility responses across countries, yet, country level assessments likely mask regional variation, and may draw an imprecise average picture. Regional level analyses are thus needed to deepen our understanding of the fertility response to Covid-19. Our study fills this gap. Based on ongoing large-scale data collection effort, we report how the first pandemic wave has affected birth rates across European sub-national regions, in 24 European countries.

Preliminary analyses show large sub-national variation in the birth rate response between December 2020 and May 2021, which appears to be more pronounced in countries less affected by Sars-Cov-2 during the first wave. Germany, Denmark, the Czech Republic and Hungary all show large regional disparities in their fertility responses during the early months of 2021, with both pronounced increases but also decreases in birth rates. Countries with larger affectedness by excess mortality during the first wave saw more regionally homogeneous declines in birth rate in January 2021, but started to show larger regional disparities later in birth rates in the Spring of 2021, when some regions caught up on postponed lockdown conceptions while others did not. However, these are first descriptive findings, which do not yet take larger birth rate time trends and random yearly fluctuations into account. Moreover, they are based on preliminary data in some countries (e.g. Germany), which may still be subject to change. Thus, only future versions of this paper, which will take longer time trends into account when interpreting birth rate changes during the pandemic, will be able to answer the question of whether these changes are due to the pandemic.

Our future analyses will be based on the data collection to be finished in fall 2021. These analyses will also examine more formally how regionally diverse the fertility response has been within countries and over the course of the pandemic, and whether the observed regional fertility response variation is predicted by sub-national regional Covid-19 infection-rates or economic indicators.

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Figure 1

Percent changes in the monthly number of births, relative to the number of births in the same month of the previous calendar year, in selected European countries

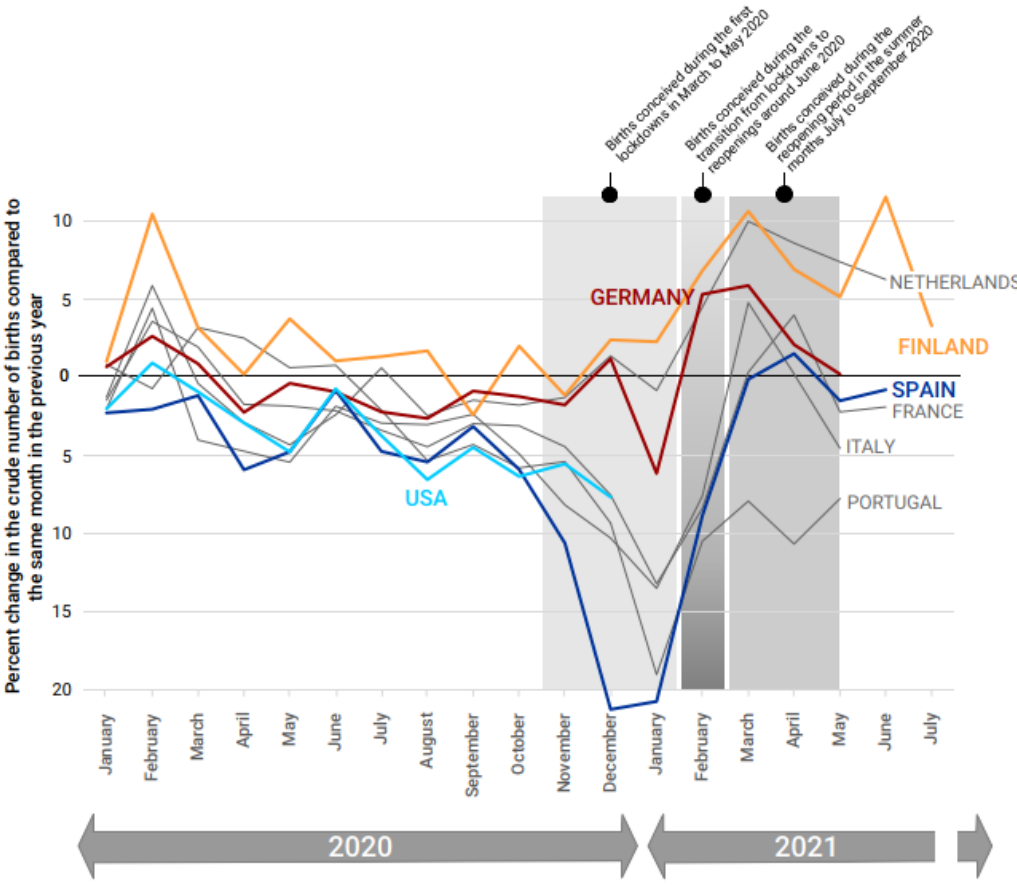


Figure 2

Sample Coverage

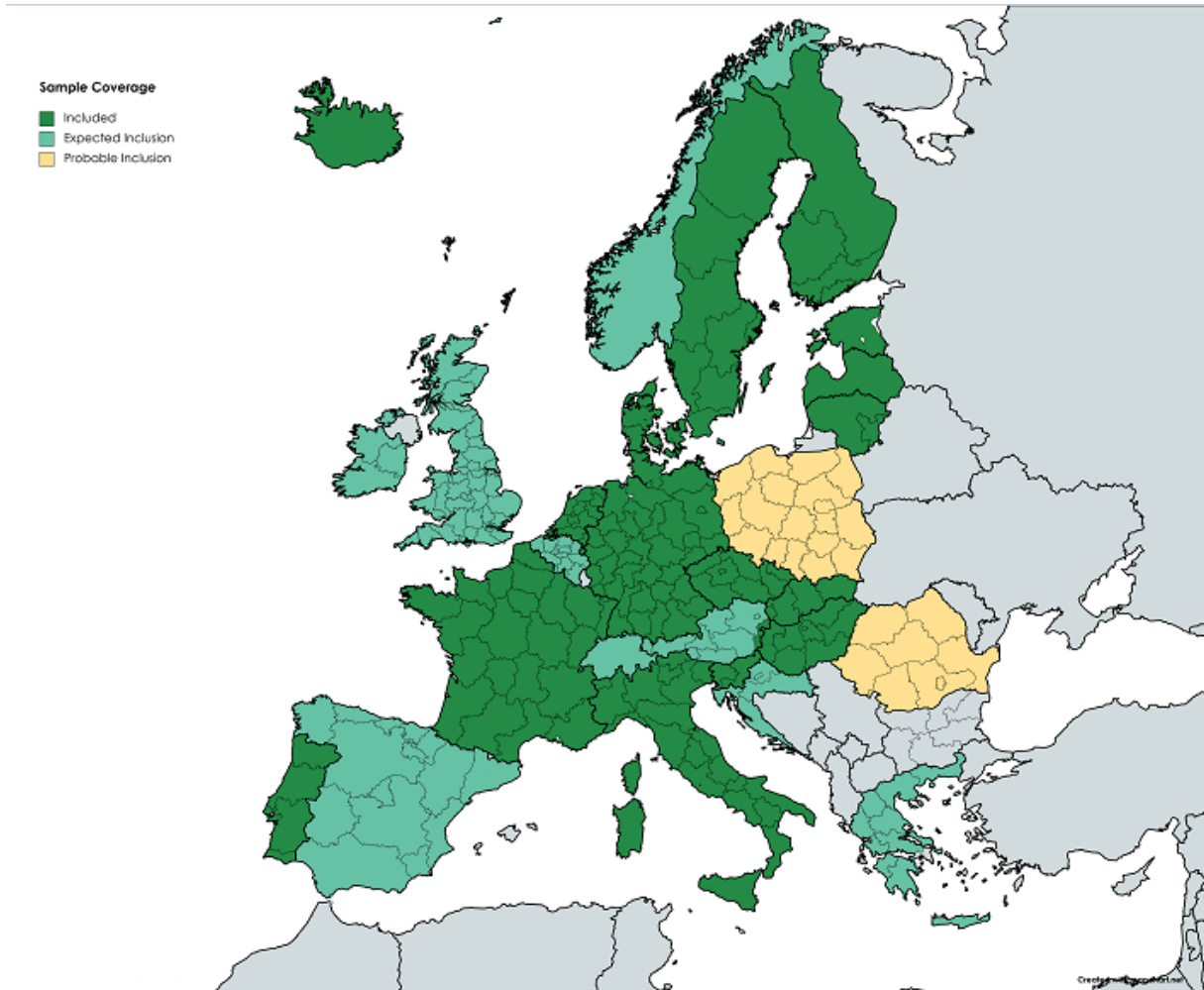


Figure 3

Percent changes in the birth rate of women aged 15-49 in December 2020, compared with the average birth rate in December 2017-2019

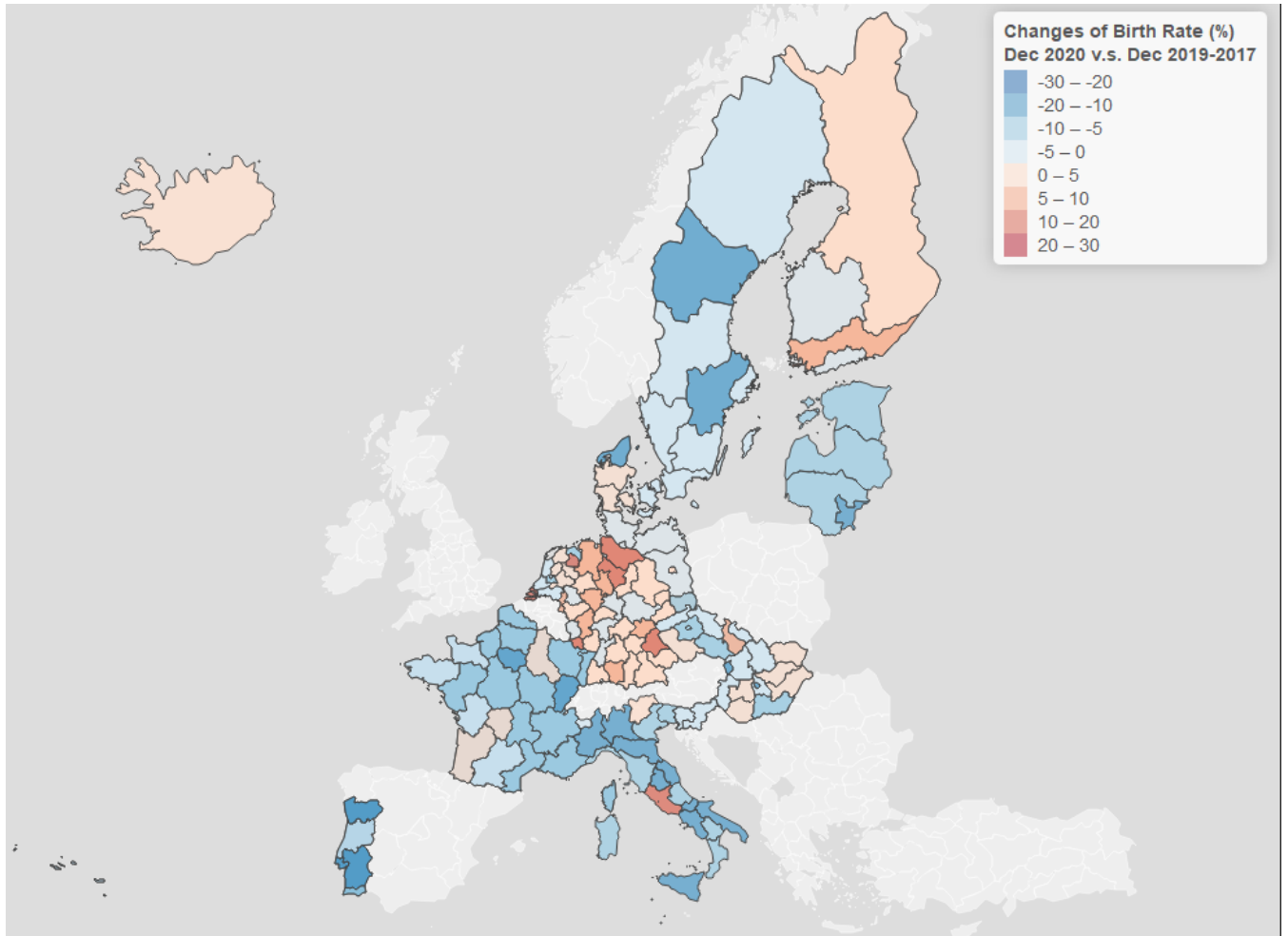


Figure 4

Percent changes in the birth rate of women aged 15-49 in January 2021, compared with the average birth rate in January 2018-2020

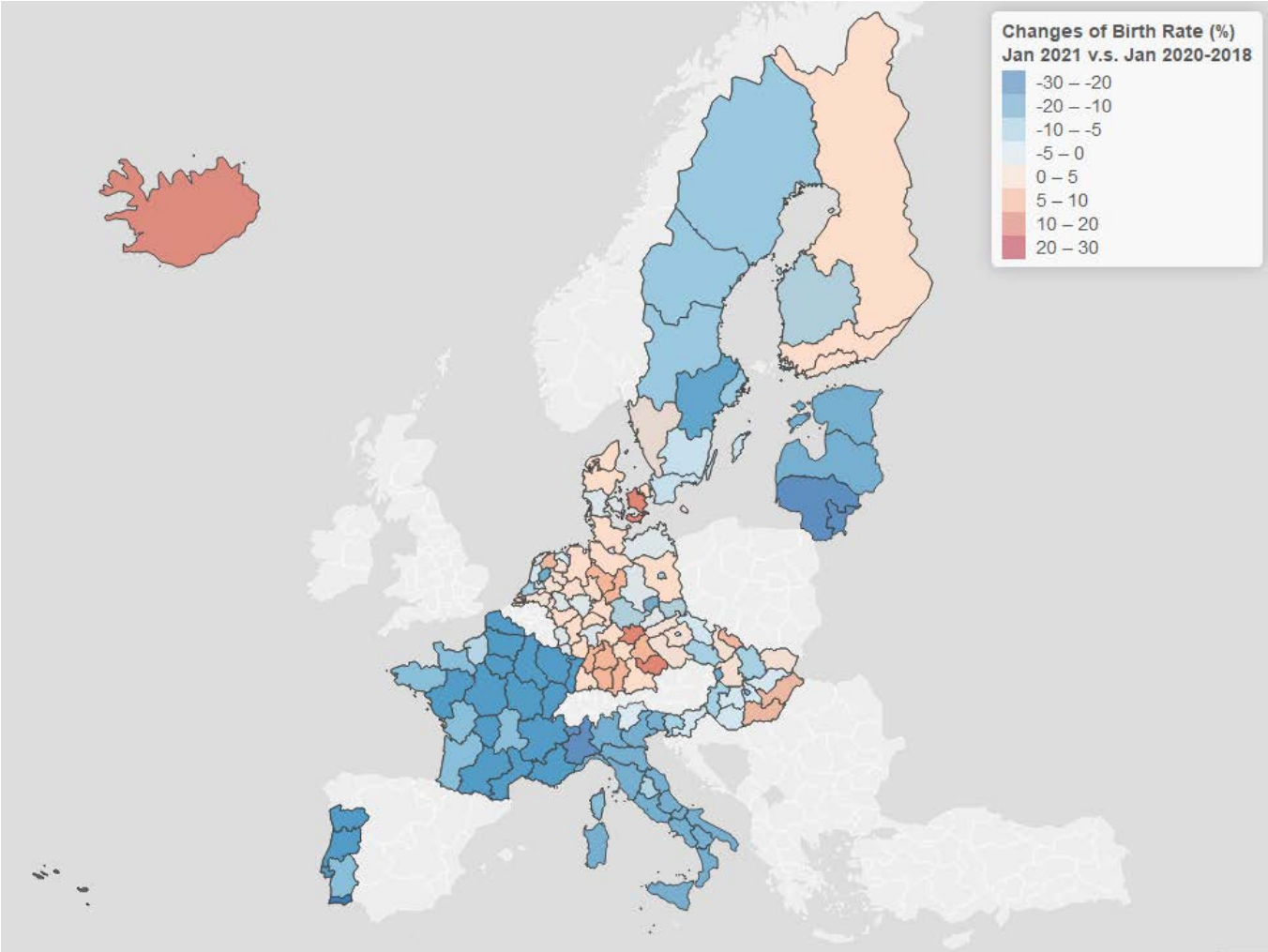


Figure 5

Percent changes in the birth rate of women aged 15-49 in February 2021, compared with the average birth rate in February 2018-2020

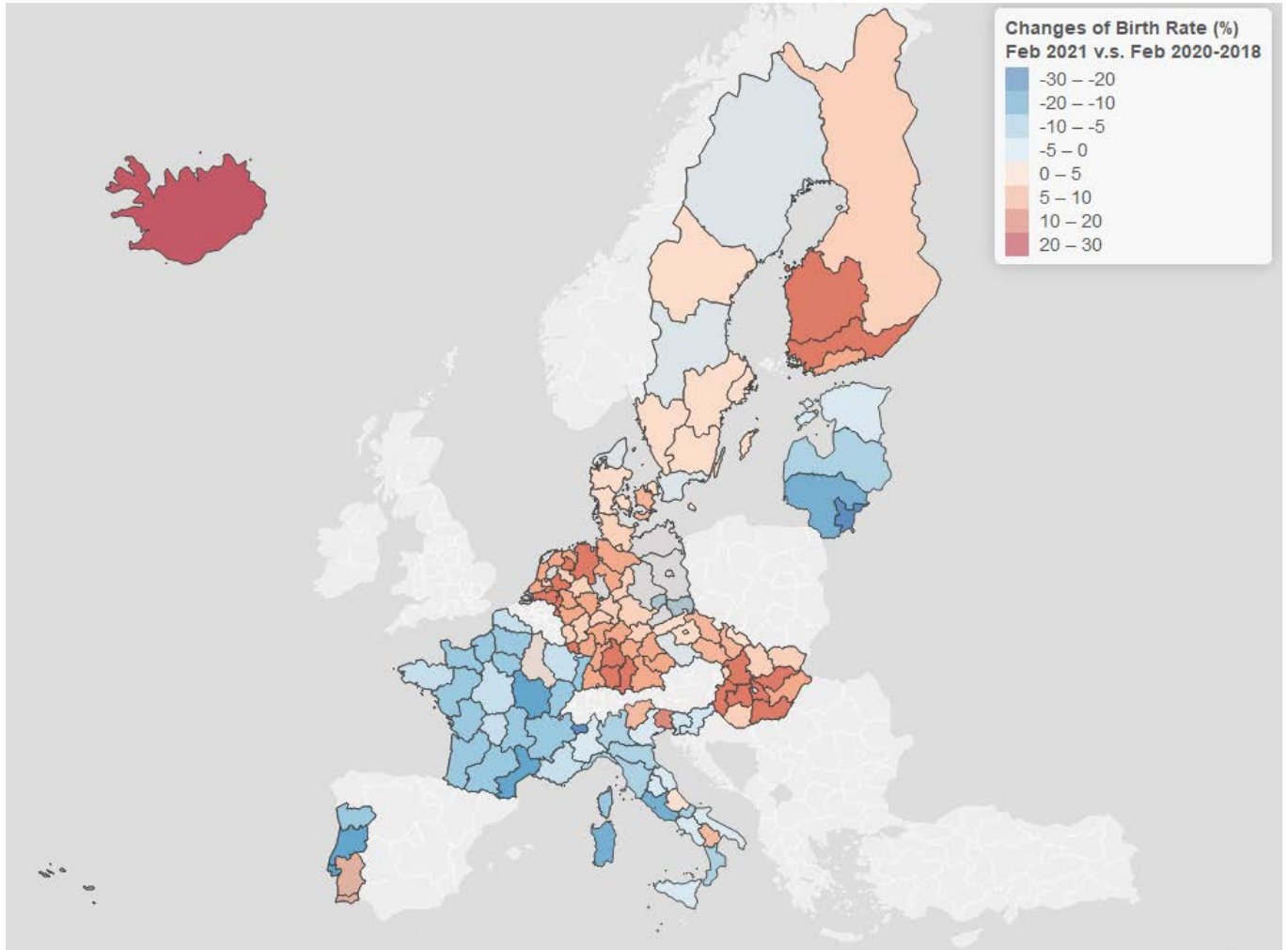


Figure 6

Percent changes in the birth rate of women aged 15-49 in March 2021, compared with the average birth rate in March 2018-2020

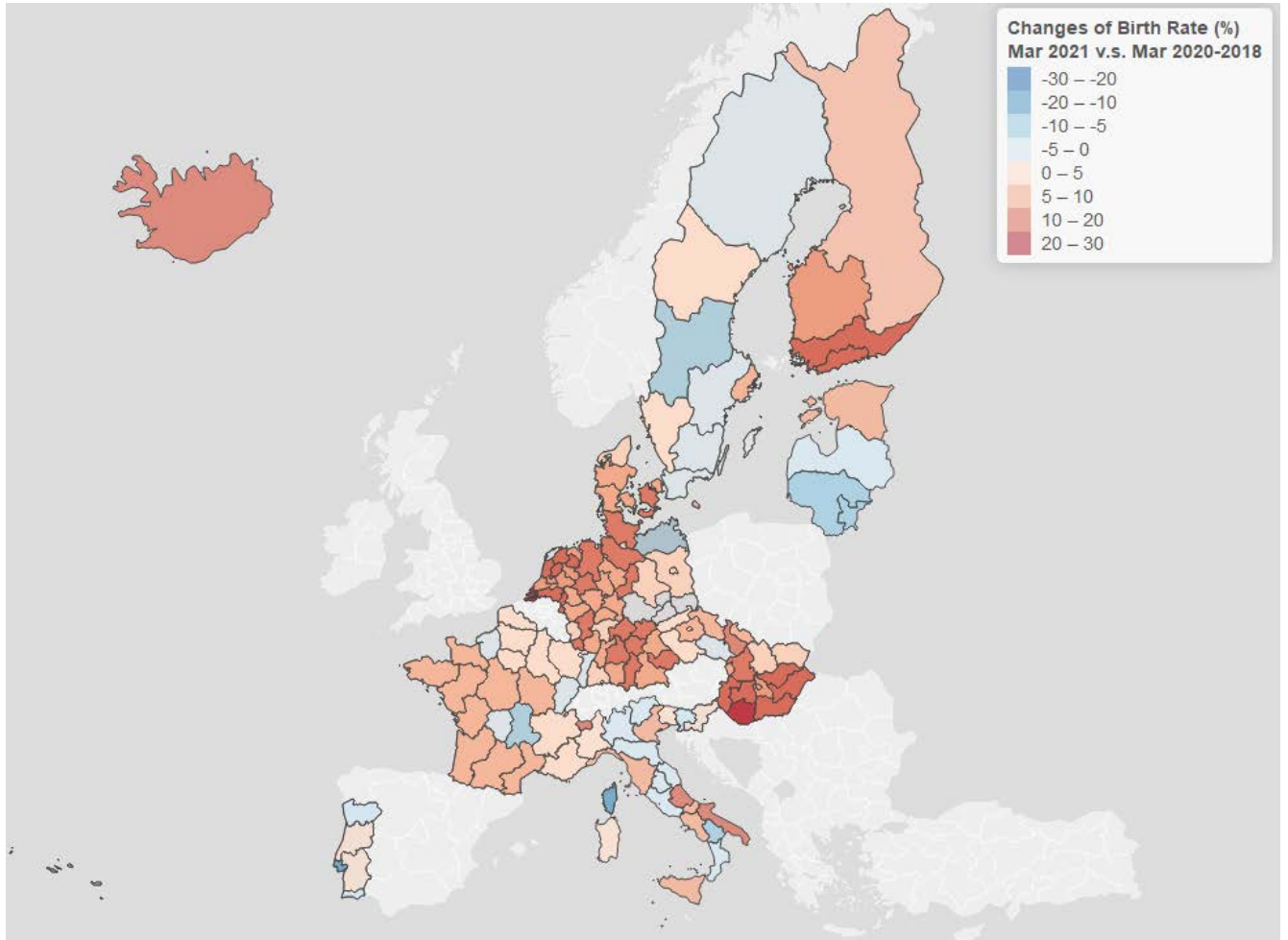


Figure 7

Percent changes in the birth rate of women aged 15-49 in April 2021, compared with the average birth rate in April 2018-2020

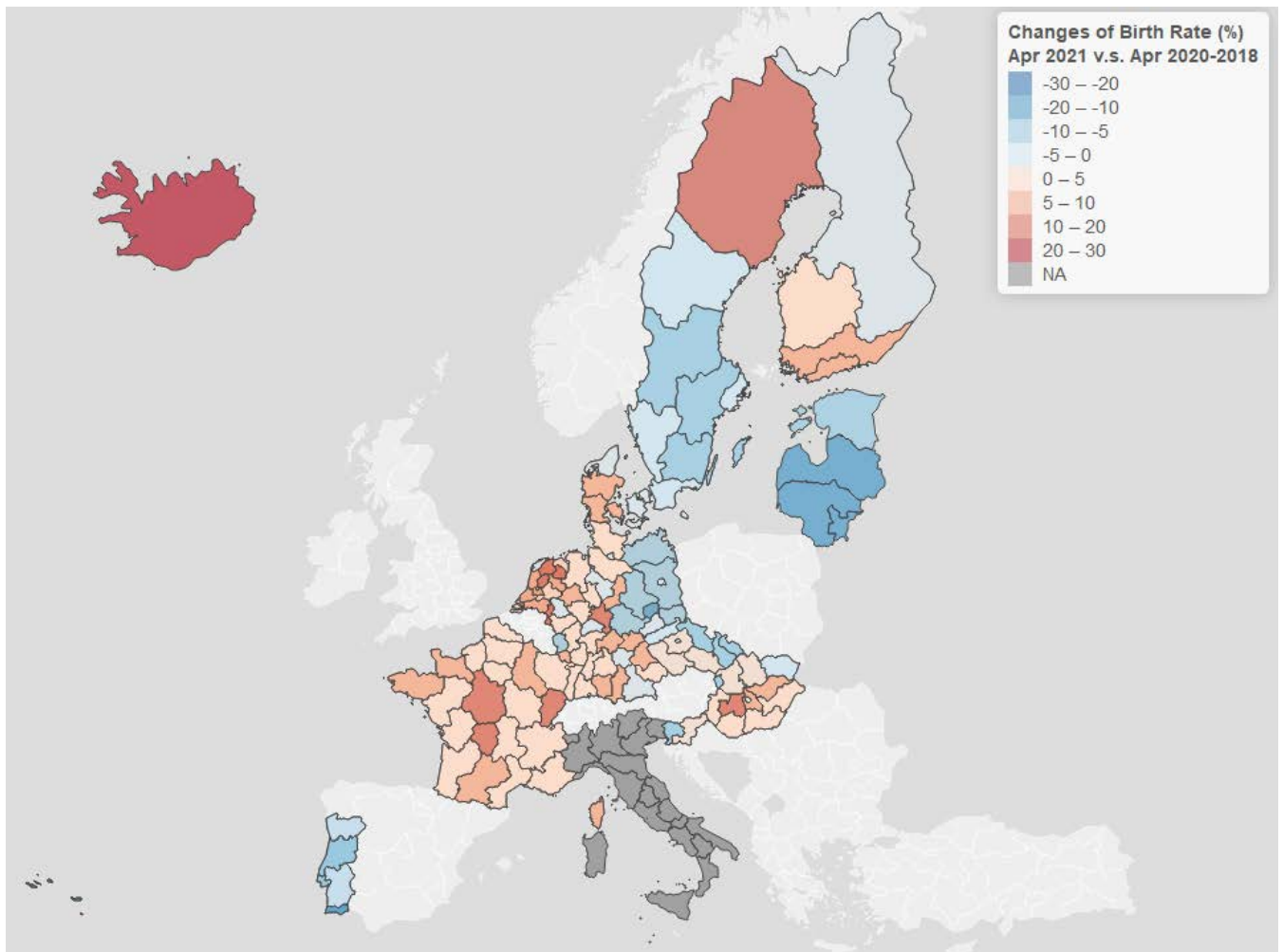


Figure 8

Percent changes in the birth rate of women aged 15-49 in May 2021, compared with the average birth rate in May 2018-2020

