Pandemic roller-coaster: birth trends in higher-income countries during COVID-19 pandemic

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Joint research of the Vienna Institute of Demography / Wittgenstein Centre and the Max Planck Institute for Demographic Research (Rostock)

Special thanks to Krystof Zeman, Aiva Jasilioniene, and Maria Winkler-Dworak

Pandemic Roller-Coaster? Birth Trends in Higher-Income Countries During the COVID-19 Pandemic

TOMÁŠ SOBOTKA, KRYŠTOF ZEMAN, AIVA JASILIONIENE, MARIA WINKLER-DWORAK, ZUZANNA BRZOZOWSKA, AINHOA ALUSTIZA-GALARZA, LÁSZLÓ NÉMETH AND DMITRI JDANOV

We use monthly birth data collected by the Human Fertility Database to analyze the impact of the COVID-19 pandemic on birth trends until September 2022 in 38 higher-income countries. We also present estimates of the monthly total fertility rate adjusted for seasonality. Our analysis reveals that the pandemic led to distinct swings in births and fertility rates. The initial pandemic shock was associated with a fall in births in most countries, with the sharpest drop in January 2021. Next, birth rates showed a short-term recovery in March 2021, following the conceptions after the end of the first wave of the pandemic. Most countries reported a stable or slightly increasing number of births in the subsequent months, especially in autumn 2021. Yet another, quite unexpected, downturn in births started in January 2022, linked with the conceptions in spring 2021 when the pandemic measures were mostly eased out and vaccination was gaining momentum. Taken together and contrary to some initial expectations, the coronavirus pandemic did not bring a lasting "baby bust" in most of the analyzed countries. Especially the Nordic countries, the Netherlands, Germany, and the United States experienced an improvement in their birth dynamics in 2021 compared with the prepandemic period.

Introduction

The Coronavirus 2019 (COVID-19) pandemic has profoundly affected every aspect of our lives, including family-related behaviors (Settersten et al. 2020; Mayer 2022). Some early media accounts suggested that the

Tomáš Sobotka, Kryštof Zeman, Maria Winkler-Dworak and Zuzanna Brzozowska, Vienna Institute of Demography (OeAW), Wittgenstein Centre for Demography and Global Human Capital (IIASA, OeAW, University of Vienna), Vienna, Austria. Aiva Jasilioniene, Ainhoa Alustiza-Galarza, Dmitri Jdanov and László Németh, Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. Zuzanna Brzozowska, Gesundheit Österreich GmbH (GÖG), Vienna, Austria. Dmitri Jdanov, National Research University, Higher School of Economics, Moscow, Russia.
Corresponding author: Aiva Jasilioniene; email: Jasilioniene@demogr.mpg.de

https://onlinelibrary.wiley.com/doi/full/10.1111/padr.12544

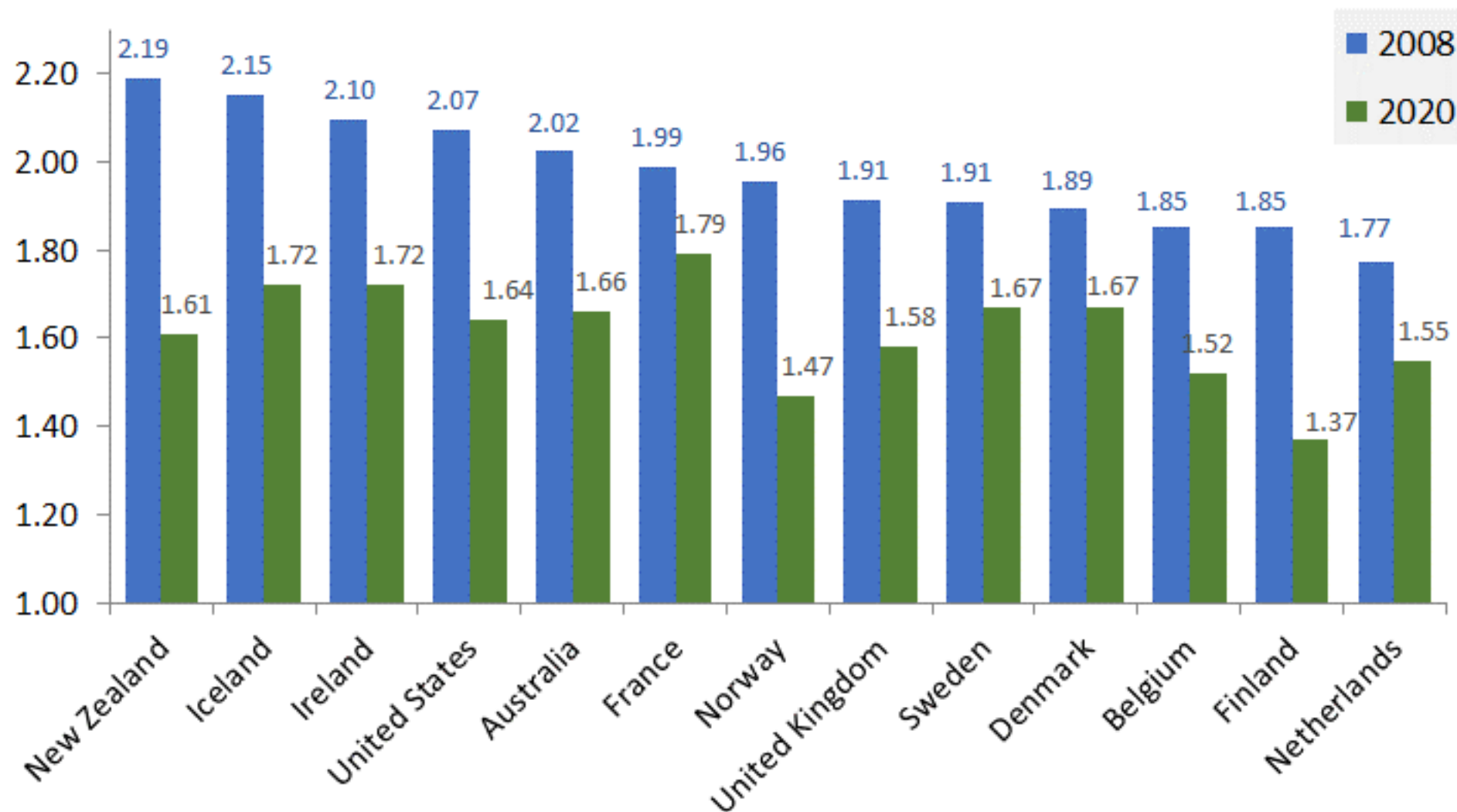# Longer-term fertility trends before the pandemic
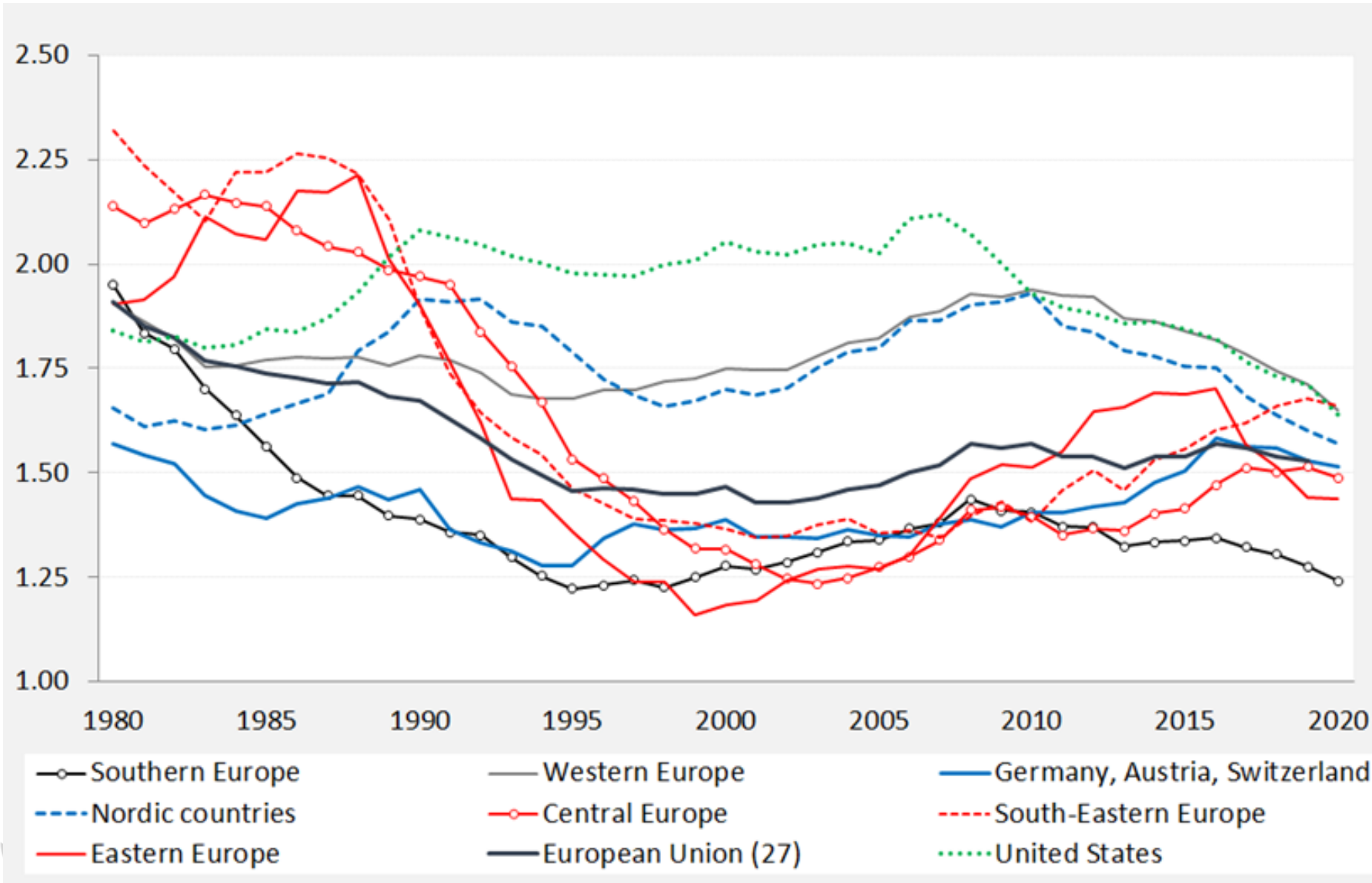
Period Total Fertility in broad European regions and the US: contrasting trends and convergence after 2010

Source: European Demographic Datasheet 2018 (updated with 2020 data); www.populationeurope.org

Fertility declines in the "higher-fertility" countries during the 2010s

Period Total Fertility in high-income countries with initially higher fertility level, 2008-2020

Legend:
- 2008
- 2020

Country	2008	2020
New Zealand	2.19	1.61
Iceland	2.15	1.72
Ireland	2.10	1.72
United States	2.07	1.64
Australia	2.02	1.66
France	1.99	1.79
Norway	1.96	1.47
United Kingdom	1.91	1.58
Sweden	1.91	1.67
Denmark	1.89	1.67
Belgium	1.85	1.52
Finland	1.85	1.37
Netherlands	1.77	1.55

Source: Human Fertility Database, Eurostat; national statistical offices

Past evidence: the impact of shocks and pandemics on fertility

- **Economic shocks and recessions:** mostly negative impact, including the Great Recession around 2008-12 (e.g., Sobotka et al. 2011; Goldstein et al. 2013); severity of the recession and welfare setting matter

- **Spanish flu:** fertility reduction & some later rebound (Boberg-Fazlic et al. 2017; Wagner et al. 2020), partly due to fetal loss

- **Large seasonal flu outbreaks:** short-term negative impact (Sardon 2014)

- **Zika epidemic in Brazil and other parts of Latin America in 2015-16:** strong negative effect on pregnancies and births (Rangel et al. 2020; Marteleto et al. 2020)

- **Disruptions to everyday life:** Blackouts and disasters: US: urban legend of a blackout baby boom, but positive evidence in developing countries (Fetzer 2013 for Colombia; Burlando 2014 for Zanzibar)

Fertility response to unemployment during the post-2008 *Great Recession*

Figure 10: Elasticity of age- and parity-specific fertility rate to female unemployment rate
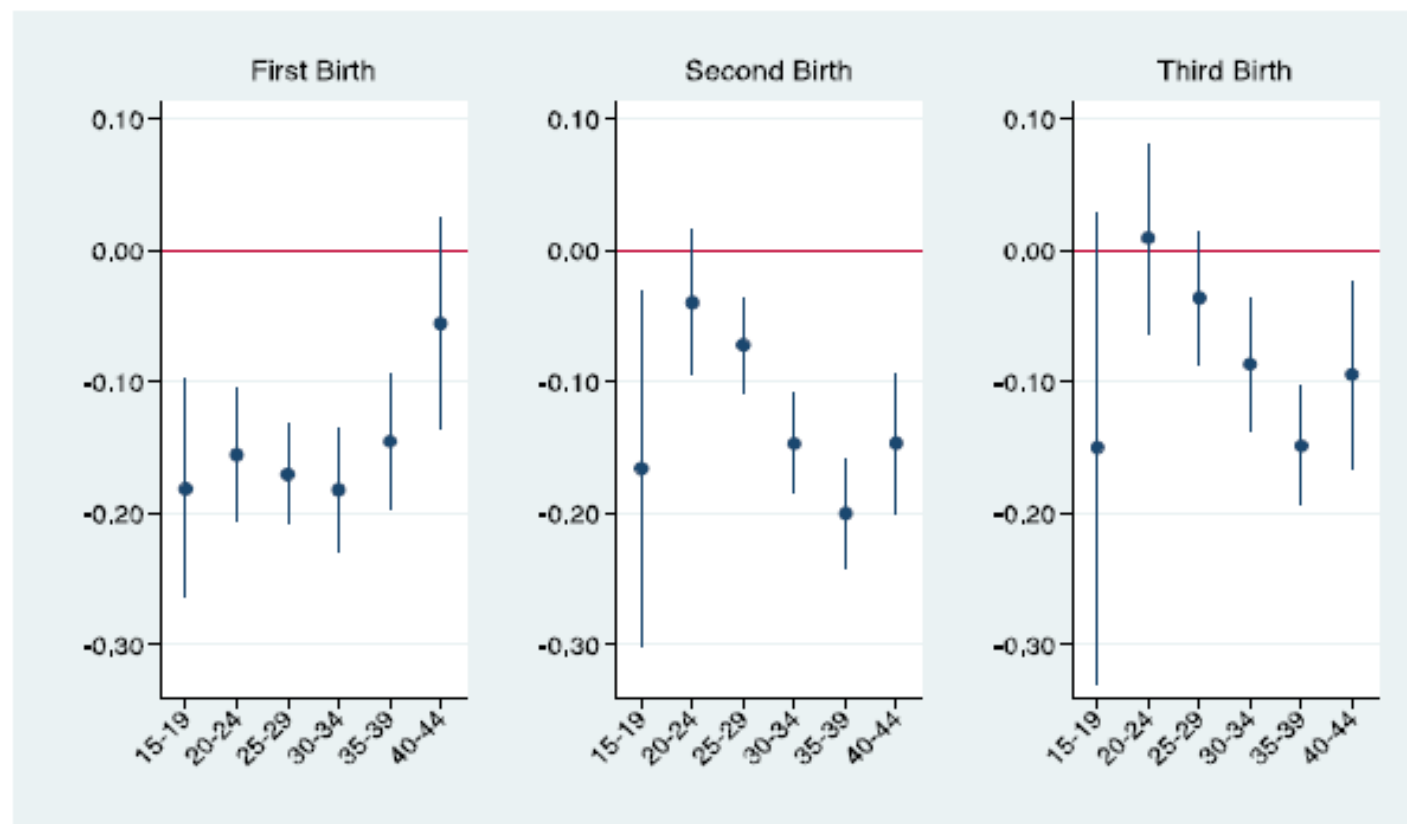
Source: Elaboration of the author based on data from Eurostat and US National Vital Statistics.
Note: 95% Confidence Intervals reported.

Source: Comolli, C L. 2017. "The fertility response to the Great Recession in Europe and the United States." Demographic Research 36(article 51)

The Economist

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Graphic detail

Daily chart

Will the coronavirus lockdown lead to a baby boom?

Deadly epidemics seem to depress birth rates in the short term

Pregnant pause
Birth rate, change from seasonal average, %

SARS (Hong Kong, 2002) · Zika (Brazil, 2015) · Ebola (West Africa, 2016)

Months after start of epidemic

Source: Institute for Family Studies

The Economist

Apr 3rd 2020

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The Covid Baby Bust Could Reverberate for Decades

The sudden drop in global fertility during the pandemic will have far-reaching consequences for businesses and economies

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LIFE

Baby Boom – Or Bust? How Covid Will Impact Birth Rates In 2021

For all the nudge nudge about lockdown baby making, the data tells a different story.

By Rachel Moss
07/01/2021 11:25am GMT

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France

The baby boom that never was: France sees sharp decline in 'lockdown babies'

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The coronavirus effect: Spain sees sharp decline in births

There was a 23% fall in registered newborns in the December-January period compared with the previous year, mirroring similar trends in neighboring countries

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The Washington Post

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Coronavirus baby boom or bust? How the pandemic is affecting birthrates worldwide.

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Thursday, 8 April 2021

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LIFESTYLE

Coronavirus baby boom: Will global lockdown see massive jump in Australia's birth rate?

Kelly Burke · 7NEWS · Published: Tuesday, 23 June 2020 2:47 pm AEST

The New York Times

Opinion

We Expect 300,000 Fewer Births Than Usual This Year

Signs are pointing to a sizable pandemic baby bust in the United States, with implications that will be with us for years to come.

By Melissa S. Kearney and Phillip B. Levine

Dr. Kearney is an economics professor at the University of Maryland. Dr. Levine is an economics professor at Wellesley College. In a report for the Brookings Institution last summer and an update in December, they predicted that the Covid pandemic would lead to a decline in U.S. births.

March 4, 2021

COVID-19 and fertility: effects, mechanisms

Negative impact expected especially in the highly developed countries with widespread use of and access to modern contraception (e.g., Aassve et al. 2020; Cohen 2021)

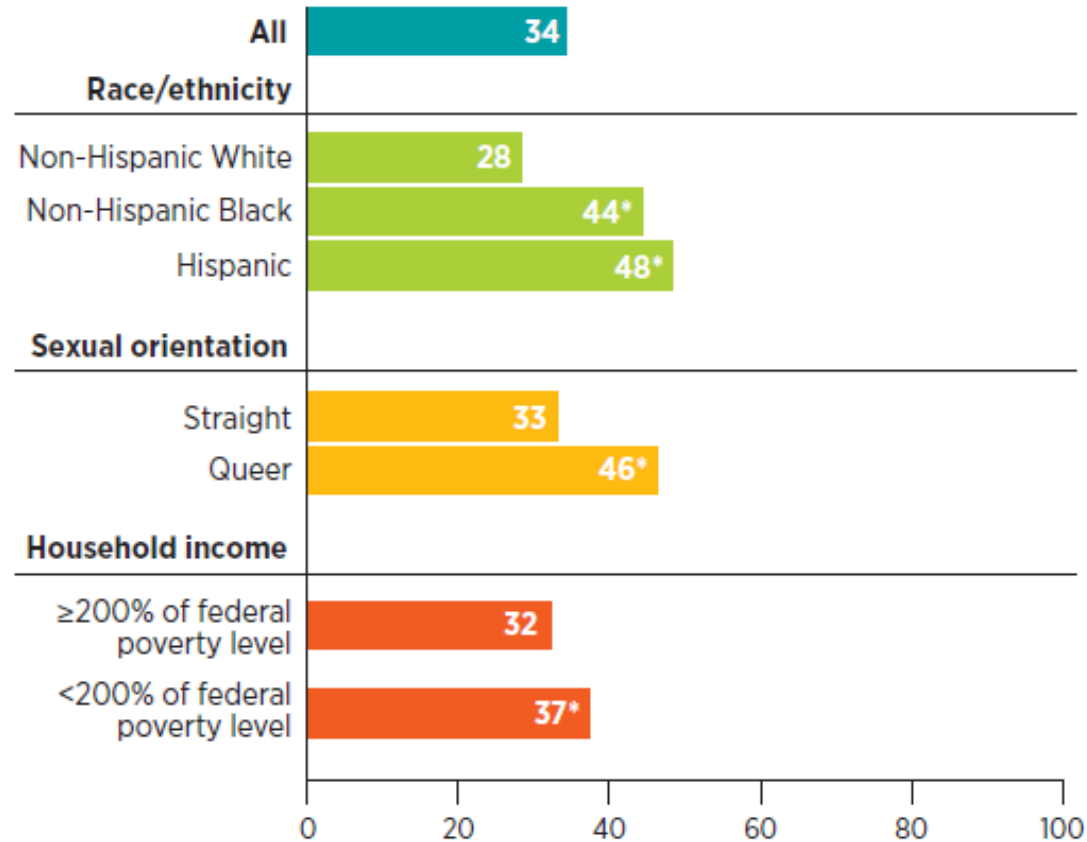## Selected mechanisms: negative impact (Berrington et al. 2021)

- Uncertainty about the future, especially the initial "shock" period
- Fear of infection and of getting pregnant during the pandemic
- Economic (income) and labour market impact
- Lockdown effects: higher stress, disruption to everyday life, loss of grandparental care and extra workload for parents; disruption to social contact and dating for the childless (Settersen et al. 2020)
- Disruption in the provision of assisted reproduction

Selected mechanisms: positive impact

- More "family time" spent together, more time for intimate relations and for family life among some couples
- Disruption in the supply of contraception in some countries

FIGURE 1. Many women report that their fertility preferences have shifted in response to the COVID-19 pandemic.

% of women reporting wanting to delay childbearing or have fewer children

All 34

Race/ethnicity

Non-Hispanic White 28
Non-Hispanic Black 44*
Hispanic 48*

Sexual orientation

Straight 33
Queer 46*

Household income

≥200% of federal poverty level 32
<200% of federal poverty level 37*

*Difference is statistically significant at p<.05. *Note:* Queer category includes responses of "gay or lesbian," "bisexual" and "other."

Early Impacts of the COVID-19 Pandemic: Findings from the 2020 Guttmacher Survey of Reproductive Health Experiences

Laura D. Lindberg, Alicia VandeVusse, Jennifer Mueller and Marielle Kirstein

COVID-19 and fertility in Europe and the US: early evidence

Decline in short-term fertility preferences reported in the US and Europe:

- **Luppi et al. (2020):** survey of fertility plans among young adults (18-34) in 5 European countries; late March and early April (N=6,000)

- **Arpino et al.** (follow-up survey in Italy in Oct 2020): couples experiencing income shock and with negative expectations about the future abandoning their fertility intentions

- **Lindberg et al:** Internet Survey of US women aged 18-44 (N=2,009) on 30 April-6 May 2020, Guttmacher Institute

- **Emery et al. (2021):** couples in Moldova initially had reduced access to contraceptive use, but also less likely trying to conceive. Intentions unchanged in medium-term

- **Malicka et al. (2021):** lower sense of financial security and worse mental well-being led some couples in Poland to decide to postpone or foregone childbearing

Later and longer-term evidence mixed: e.g., Buber-Ennser et al. 2023 for Austria

COVID-19 and fertility: early evidence

Early evidence from online searches:

- Wilde et al. (2020): expected sharp downturn in births (by up to 16%) in the US from November 2020 to February 2021 based on fertility and pregnancy-related Google searches
- Smaller disruption expected from Berger et al.'s (2021) analysis of European and US data

Initial work on birth trends

- Decline in births and fertility rates in Europe, Latin America, US, especially in December 2020 – January 2021 (Sobotka et al. 2021; Aassve et al. 2021; Lima et al. 2021, UN EGM 2021)

Questions

- *How did the COVID-19 pandemic affect birth and fertility trends in higher-income countries?*

- *How pandemic birth trends evolve over time?*

- *Are there similar fertility trends across countries?*
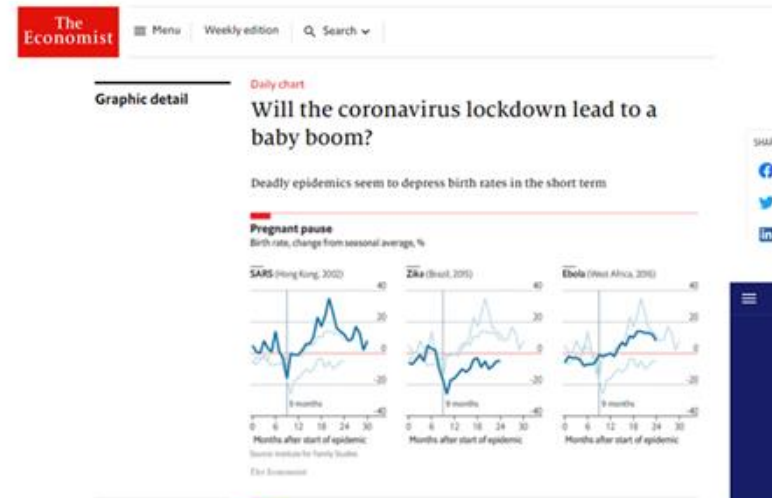
Data & Methods

Analytical focus, data issues

Key question:

- *How did birth & fertility dynamics change during the covid-19 pandemic?*

Analytical focus: monthly births by countries and broader regions

Initial expectations:

- A downward trend associated with the pandemic
- Stronger in more affected countries (and in countries with weaker welfare system?) (especially in Southern Europe)
- Ups and downs in births associated with the waves of the covid outbreak? (Possible short-term recovery; Goldstein 2020)

Data: The STFF (short-term fertility fluctuations) Data Series under the Human Fertility Database

HFD

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Short-Term Fertility Fluctuations

In response to the COVID-19 pandemic, the HFD team established a new data resource: Short-Term Fertility Fluctuations (STFF) data series. The STFF series complements the HFD by providing up-to-date data on live births by month for selected countries.

STFF data are published under CC BY 4.0 license.

For citing STFF data, please follow the HFD data citation guidelines.

STFF data can also be explored using our online STFF visualization toolkit.

Here you can download the following data and documentations:

- STFF Metadata: information about country-specific data and data sources.
- STFF Methodological Note: description of this data project, including data collection, data processing, and methodology.
- **Crude birth counts and TFR** (xlsx or pooled csv): monthly counts of live births and monthly and annual TFRs.

Crude indicators do not allow direct comparison across countries and over time as they are affected by seasonality in childbearing. To provide comparable indicators, we publish seasonally and calendar adjusted data.

- **Seasonally- and calendar-adjusted data** (xlsx or pooled csv): monthly counts of live births and monthly TFRs for selected countries.
- Original data (country-specific csv files in one zip file): original birth counts in standardized format.

Note: Data on monthly TFR are preliminary. We are still working on the methodology and may revise it soon.

Data availability

Last update: 19-12-2022

Country	Crude data	Seasonally- and calendar-adjusted data
Austria	01/2000–09/2022	01/2012–09/2022
Belgium	01/2000–09/2022	01/2012–09/2022

https://www.humanfertility.org/Data/STFF

STFF Data series

The Short-Term Fertility Fluctuations (STFF) Data Series

- Joint project of the Max Planck Institute for Dem Res. (Rostock) and the Wittgenstein Centre (VID, Vienna)

- Monthly number of births, from Jan 2000 to most recent (early 2023), 45 countries and regions

- Estimates of monthly Total Fertility Rates for about 25 countries

- High-income countries with good quality data

- Regularly updated

- Metadata: 50+page document with all information about the data, sources, coverage, notes, warnings

- Methodological Note

- STFF visualization toolkit in Shiny

STFF − Data availability
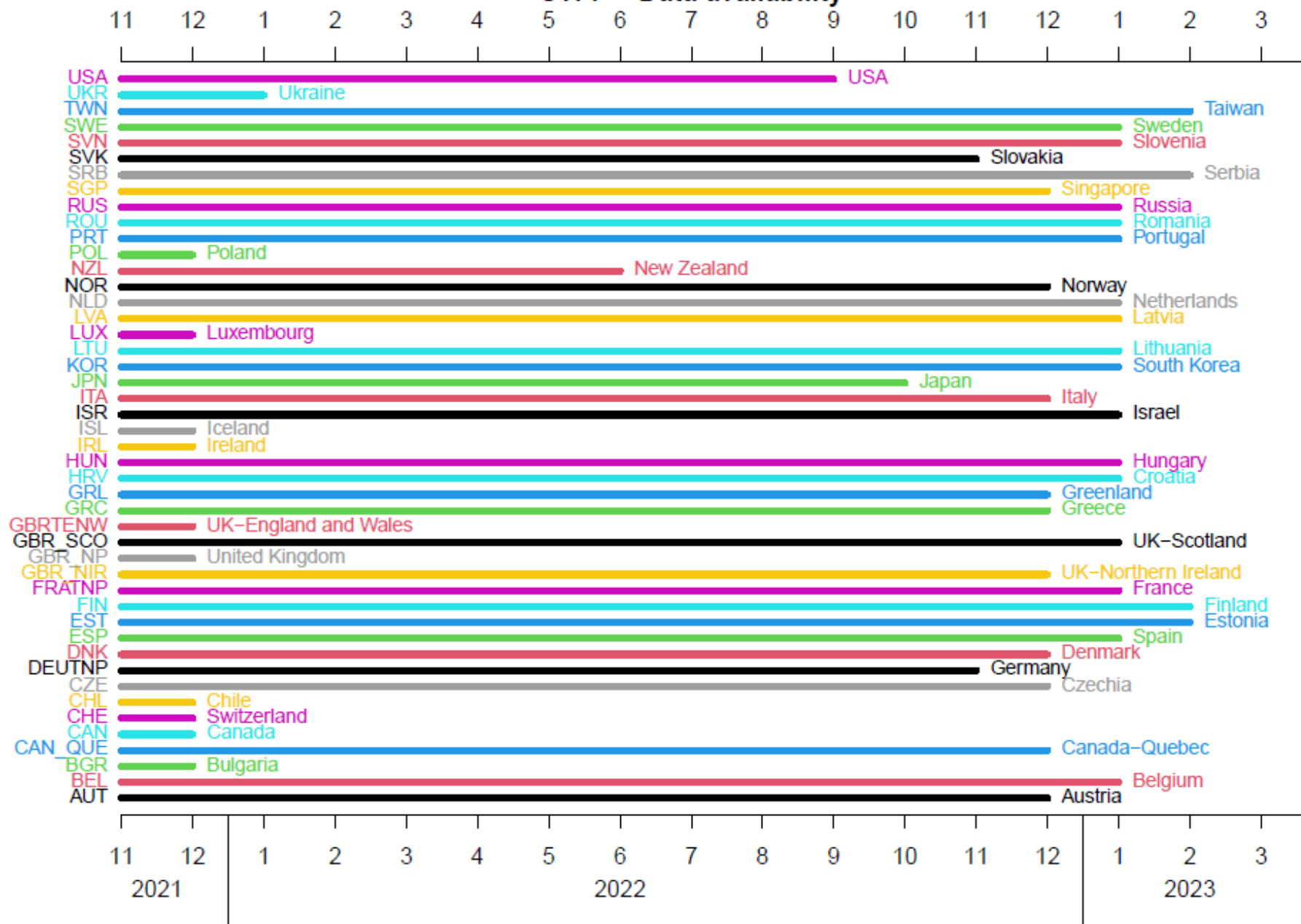
Data issues & adjustments

- **Data by month of occurrence vs. registration** (e.g. South Korea, Russia; also recent data for Germany)

- **Preliminary vs. final data** (also incomplete data for the latest months; e.g. Switzerland)

- **Fluctuations, irregularities** (also due to small N in some countries)

- **Monthly data: impact of seasonality**

- **Expected impact of the COVID-19:** from November 2020 onwards (pregnancies started in early March, based on average pregnancy duration of 266 days or 8.7 months from ovulation to delivery; Jukic et al. 2013)

Data & measurement

Key indicators and analytical methods

- *Relative change in the number of births* (%) compared with the same month in pre-pandemic period
- Estimated *monthly Total Fertility Rates*

ARIMA-based models:

- Deriving monthly births adjusted for seasonality and calendar factors
- Comparisons of observed and predicted births based on pre-pandemic trends

Methods: estimating monthly TFRs

Total Fertility by month in 2020-2022 estimated by combining data for the observed number of births by month and estimated annual population exposure by age and sex

1. Adjusting time series of monthly births for seasonality and calendar effects (no. of days and weekdays by month)

- We use the R package seasonal (Sax and Eddelbuettel, 2018), which provides an interface to the seasonal adjustment software X-13ARIMA-SEATS (US Census Bureau, 2021).

2. Obtaining monthly population exposures by using linear interpolation from annual exposure estimates for 2019-2023 (estimated for the Human Mortality Database / STMF series; Jdanov et al. 2021)

3. Computing monthly General Fertility Rate for women ages 15-44:   ($GFR(m) = B(m) / POP_{F(15-44)}(m)$)

4. Extrapolating the observed Ratio of TFR/GFR in 2016 to 2019 to 2020-2023, then using the estimated TFR/GFR ratios to derive monthly TFRs in 2020-2023

Data and methods: adjusted monthly trends (Spain)

Observed and seasonally–adjusted monthly number of births, Spain,
Jan 2010 to Sep 2021
Observed series (thin line) and adjusted series (thick line)

Monthly number of births, Spain, Jan 2020 to Jan 2022
Observed series (solid line) and forecast (dashed line) with 95% confidence limits
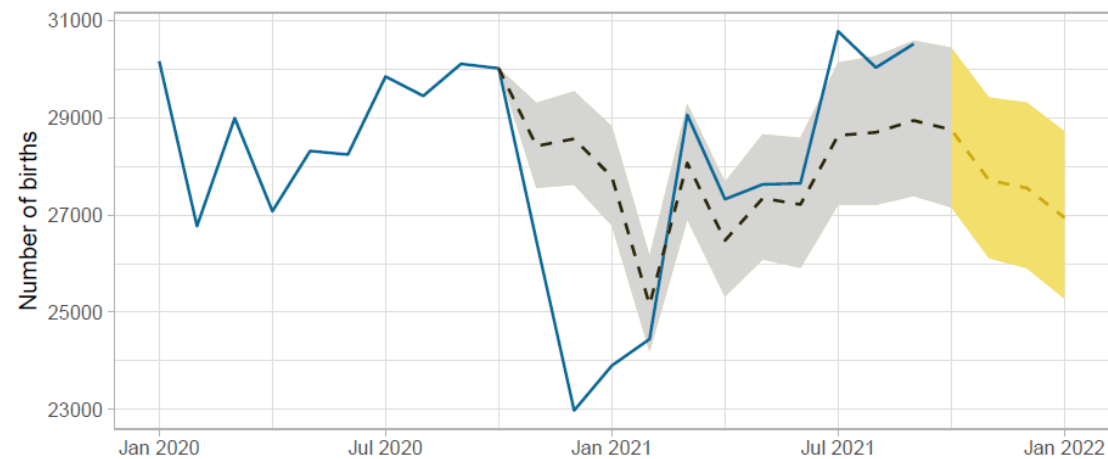
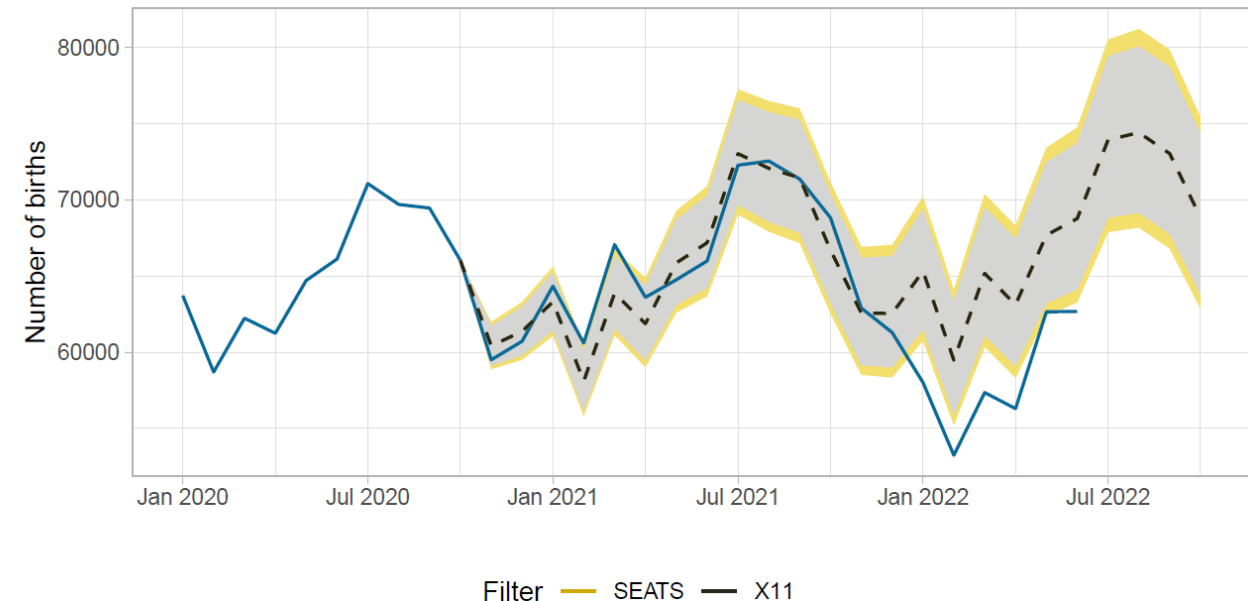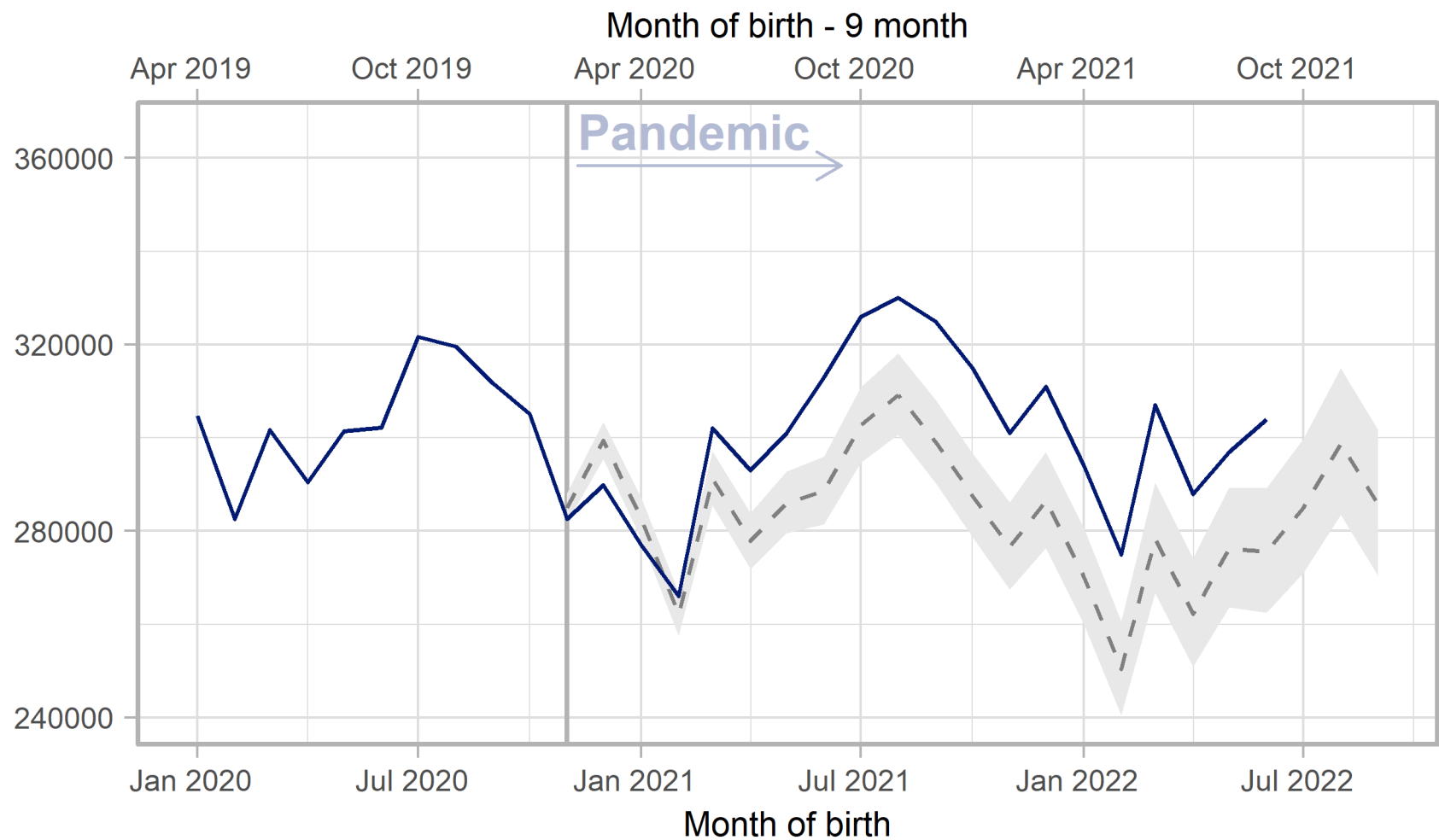Filter — SEATS — X11
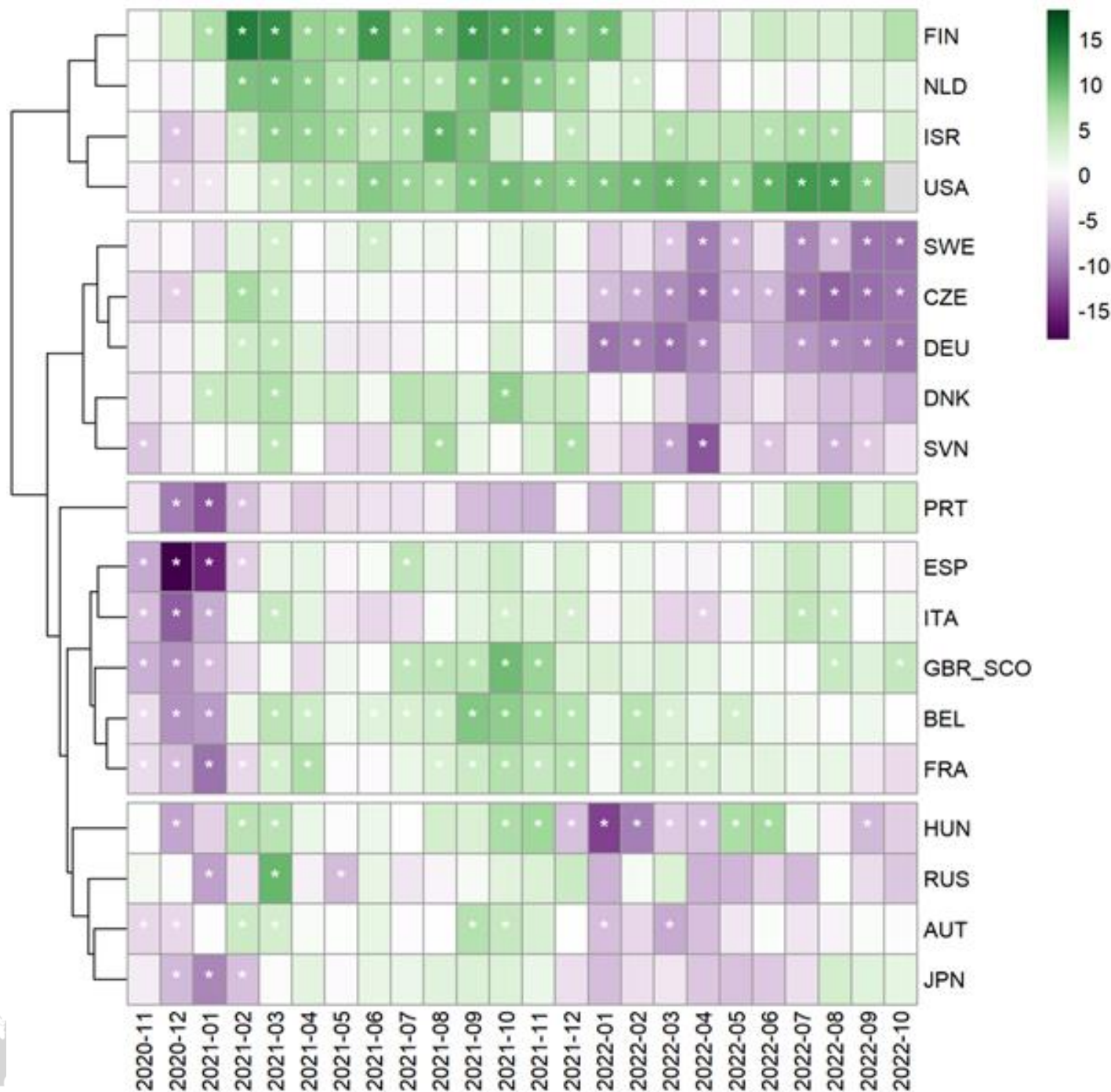
Calendar and seasonal adjustments using the seasonal adjustment software X-13ARIMA-SEATS & visualisation by Maria Winkler-Dworak

Trends in absolute and relative number of births

Monthly trends in absolute number of births
2012-2022, adjusted for calendar and seasonality

Observed and seasonally−adjusted monthly number of births, Spain,
Jan 2012 to Jul 2022

Observed series (thin line) and adjusted series (thick line)

Spain:
initial pandemic shock (Dec 20-Jan 21)

X-11 Arima model, computed by
Maria Winkler Dworak

Germany
baby bust in early 2022

Observed and seasonally−adjusted monthly number of births, Germany,
Jan 2012 to Jun 2022

Observed series (thin line) and adjusted series (thick line)

Pandemic birth trends: relative changes diversity across countries and during the pandemic
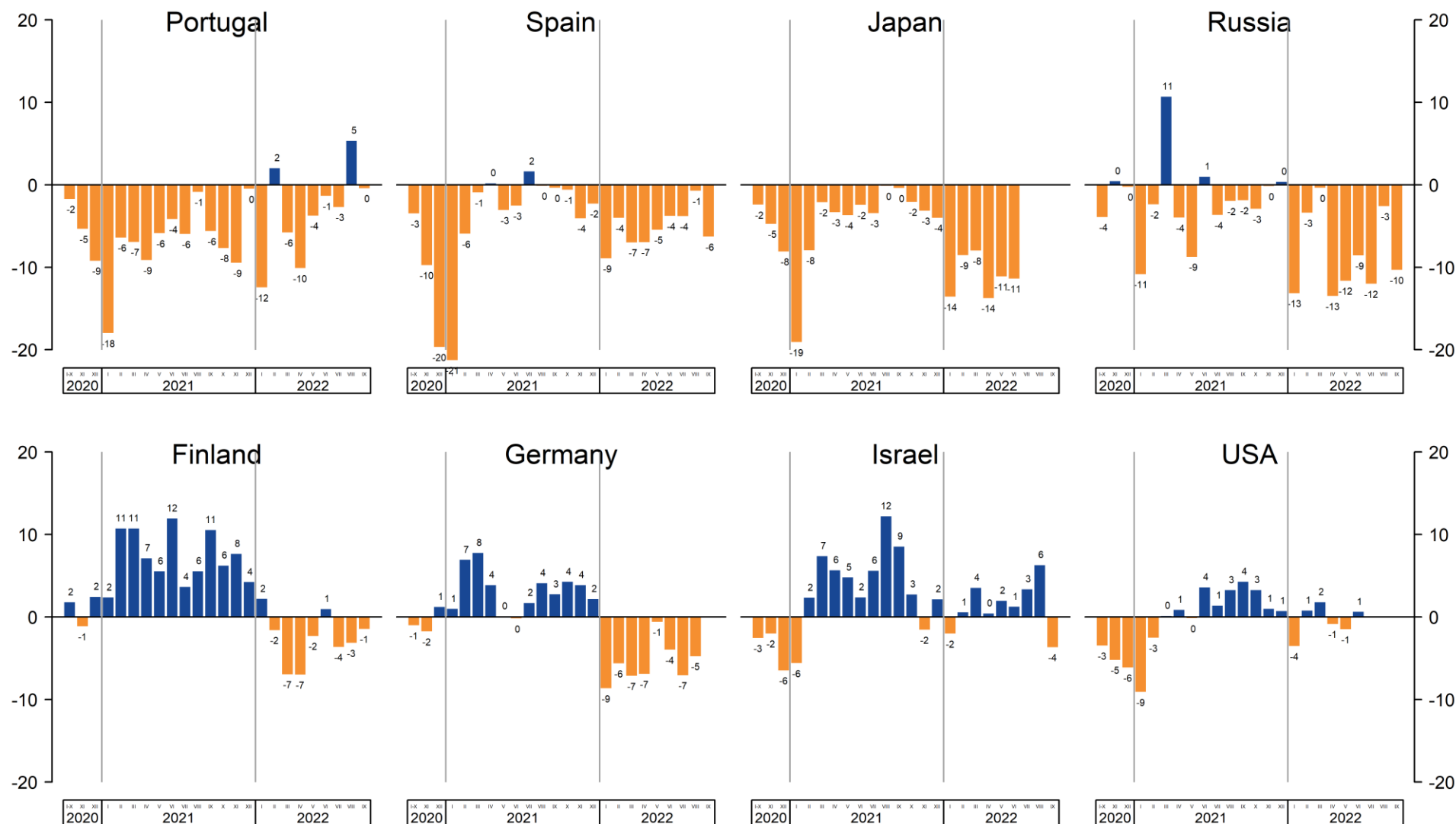
Relative change in the number of births by month compared to the same month in the pre-pandemic period (Nov 2019 to Oct 2020)
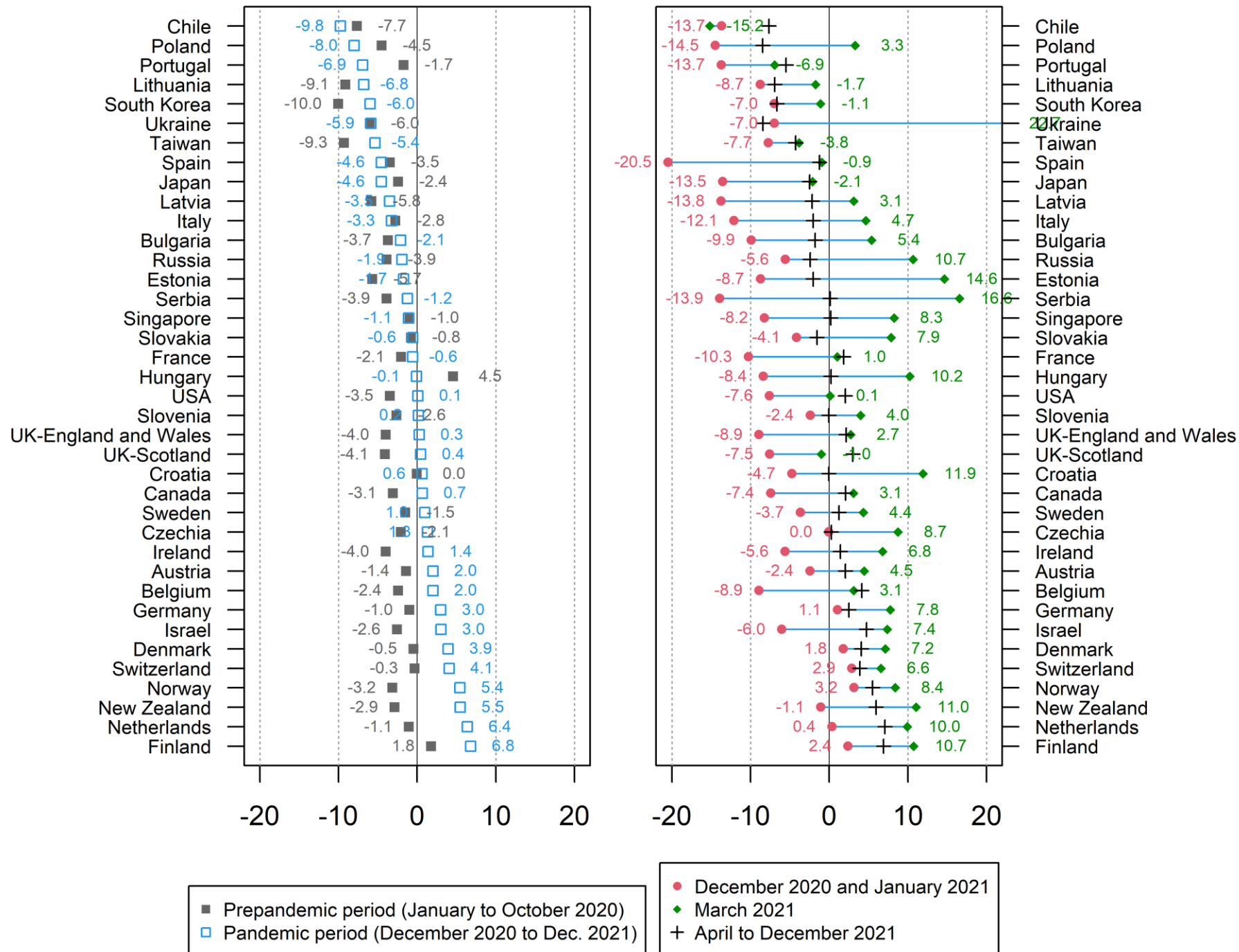
Pandemic birth trends: relative changes; summary for all analyzed countries

Relative change in the number of births by month compared to the same month in the pre-pandemic period (Nov 2019 to Oct 2020)

25

Pandemic birth trends: summary of birth dynamics
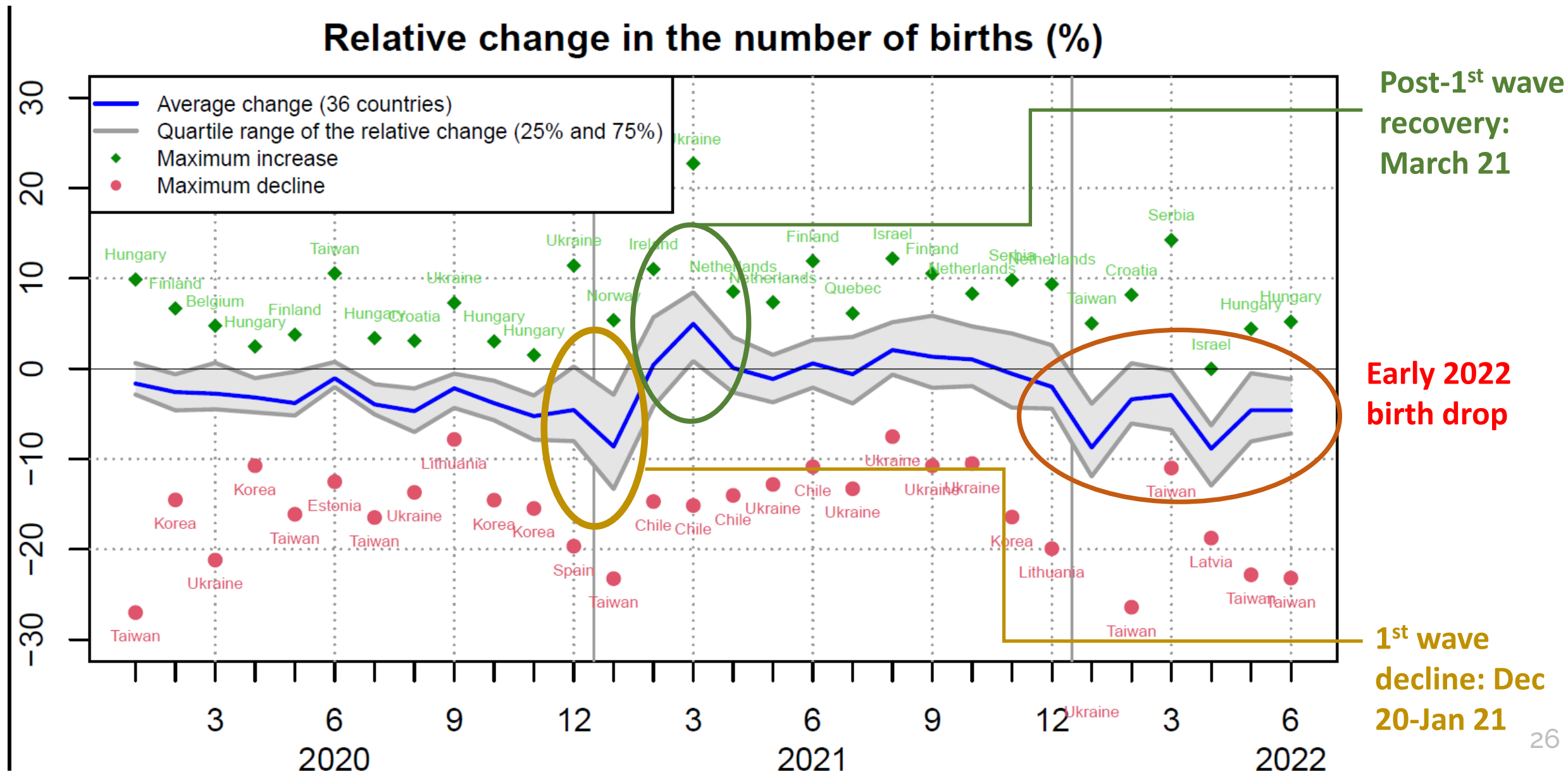
Relative change in the number of births (%)

Was the change in birth trend significant?
Checking the difference between the observed and projected birth trend based on the data until October 2020 (using seasonal ARIMA model with 90% CI)

Monthly number of births, Spain, Jan 2020 to Oct 2022
Observed series (solid line) and forecast (dashed line) with 90% resp. 95% confidence limits

Filter — SEATS — X11
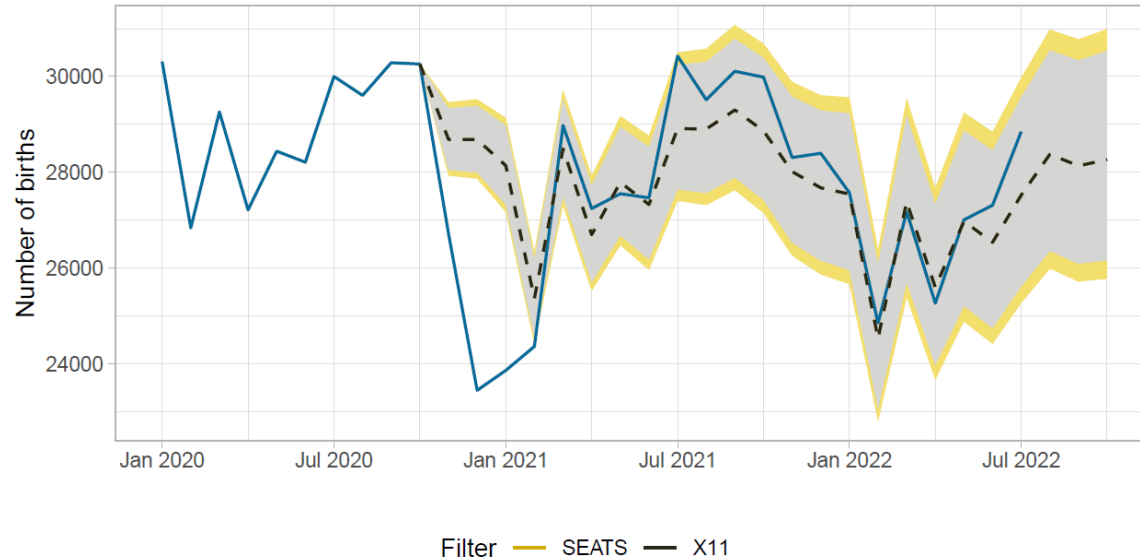
Spain

X-11 Arima model, computed by Maria Winkler Dworak

Monthly number of births, Germany, Jan 2020 to Oct 2022
Observed series (solid line) and forecast (dashed line) with 90% resp. 95% confidence limits

Filter — SEATS — X11

Germany

Was the change in birth trend significant?

Checking the difference between the observed and projected birth trend based on the data until October 2020 (using seasonal ARIMA model with 90% CI)

Trends in total fertility rates
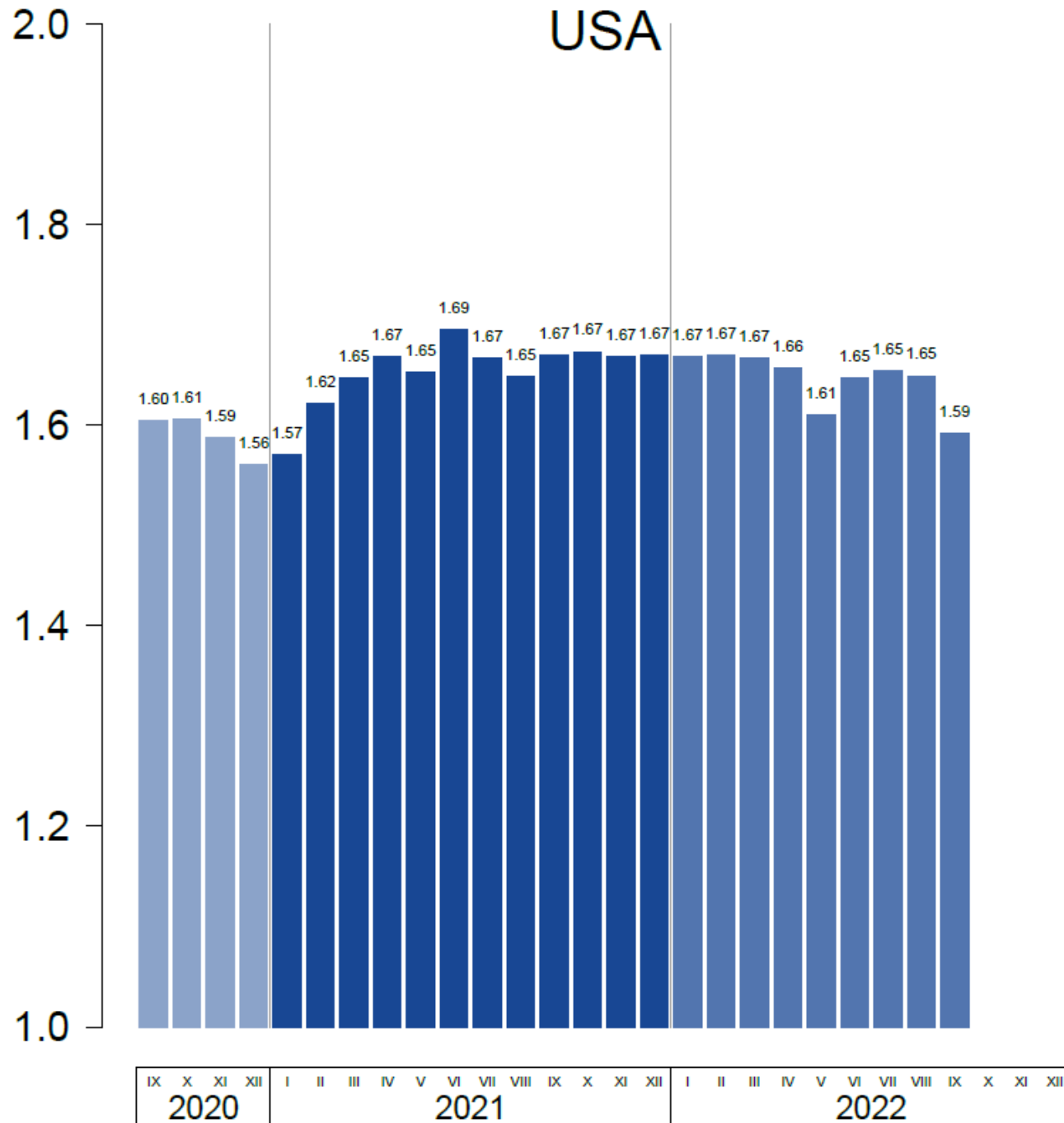
Pandemic fertility trends: estimated Total Fertility Rates in the US (Jan. 2020 – Sep. 2022)

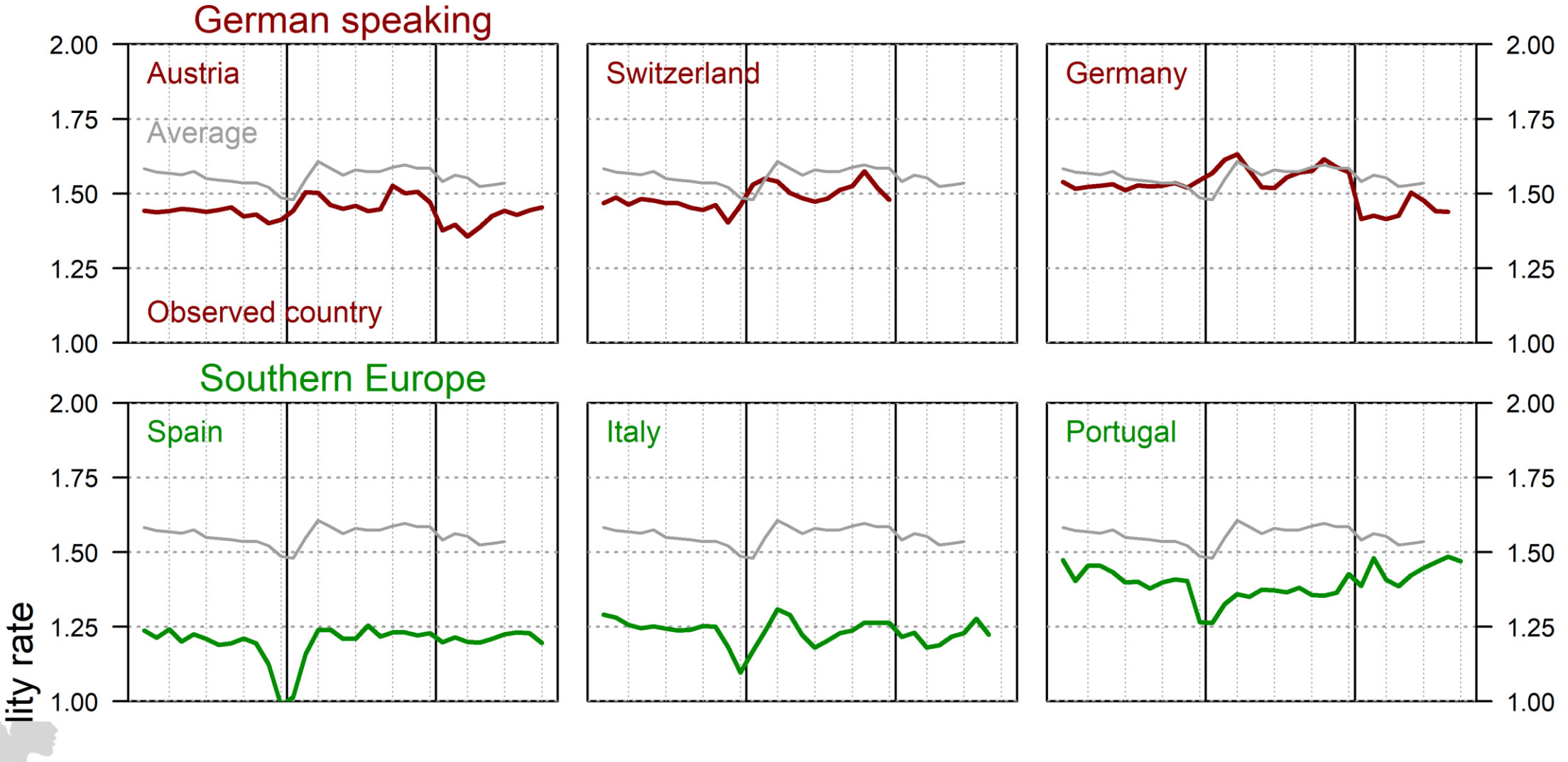# Pandemic fertility trends: estimated Total Fertility Rates until 2022
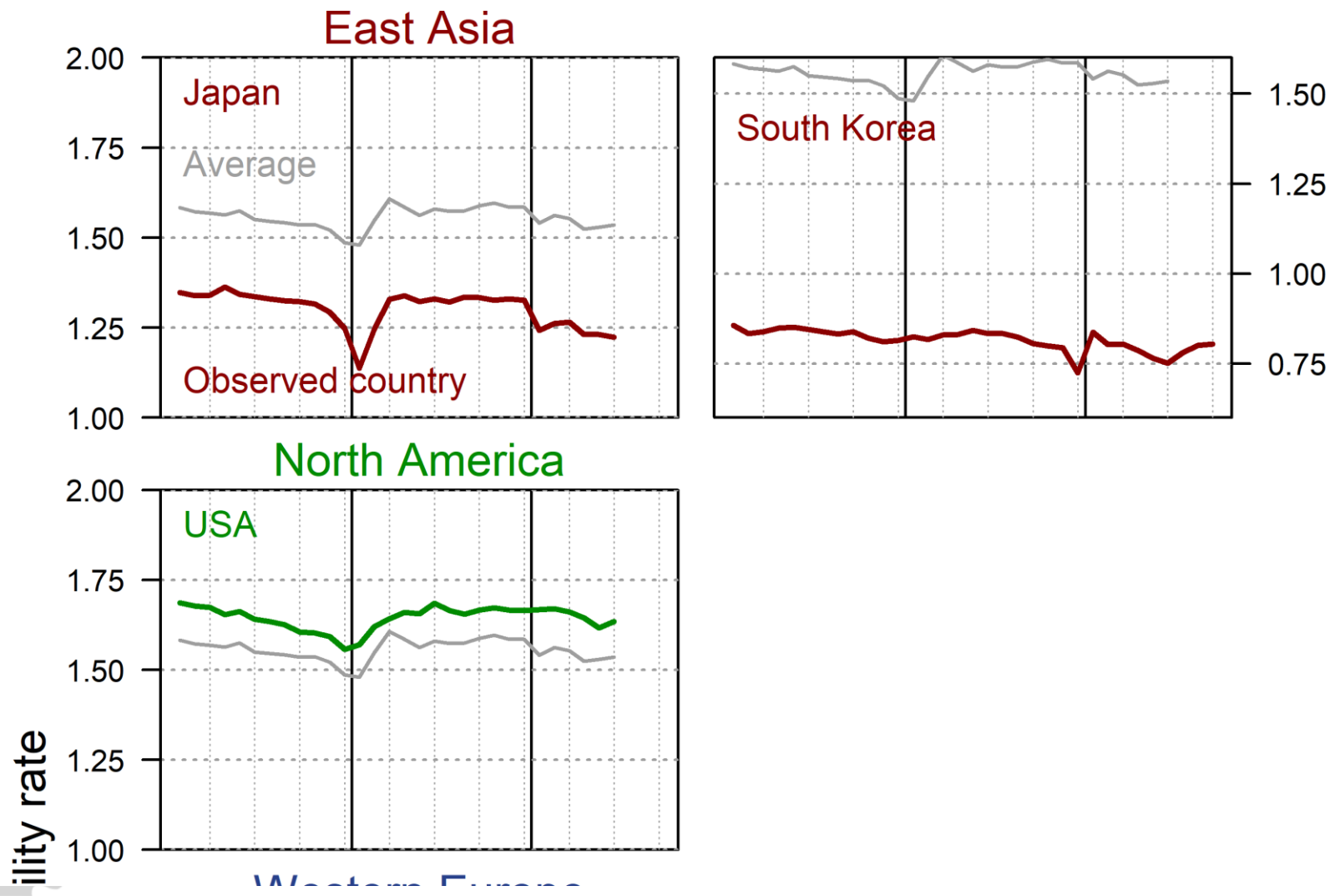
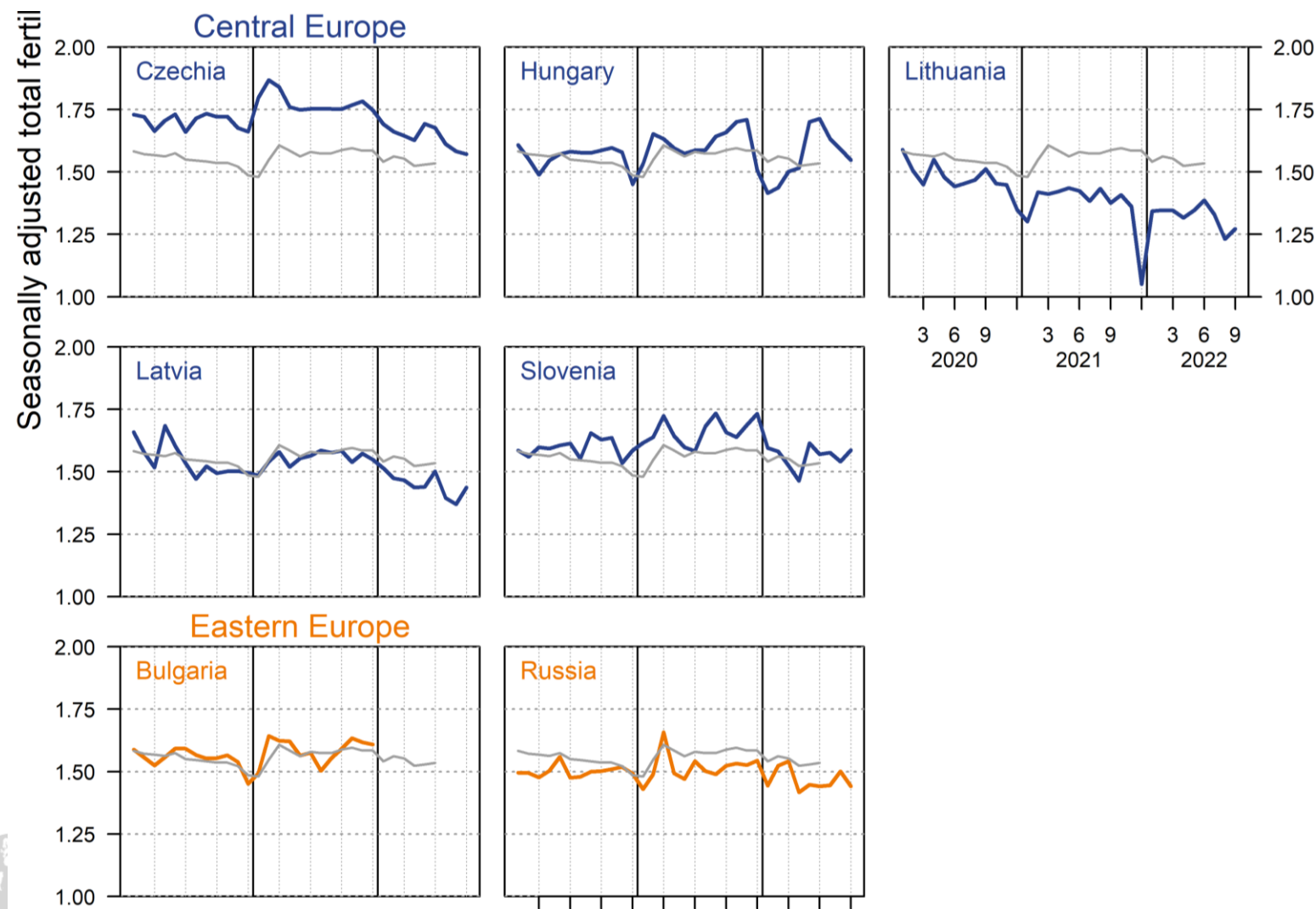# Pandemic fertility trends: estimated Total Fertility Rates until 2022
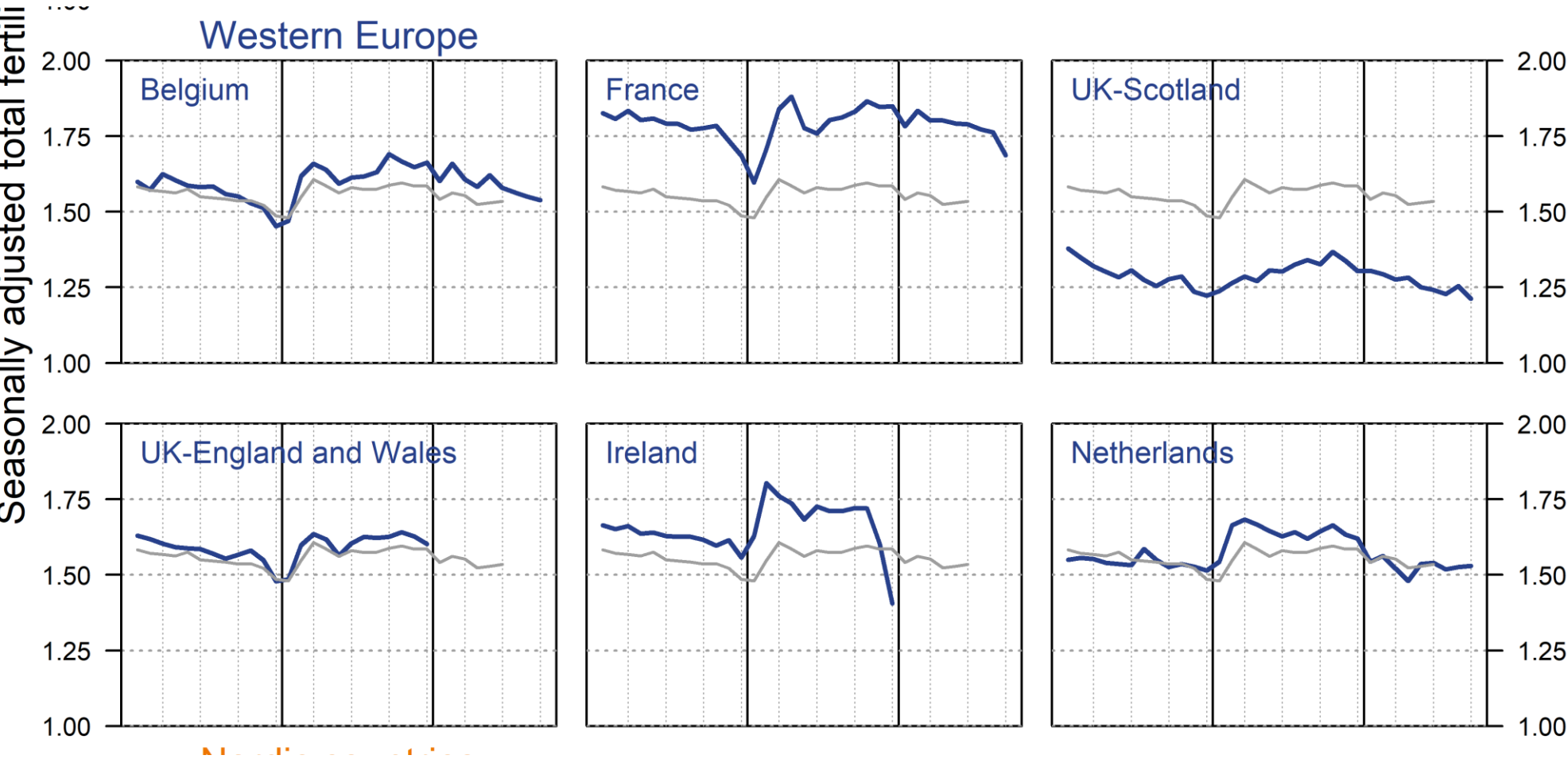
Pandemic fertility trends: estimated Total Fertility Rates until 2022
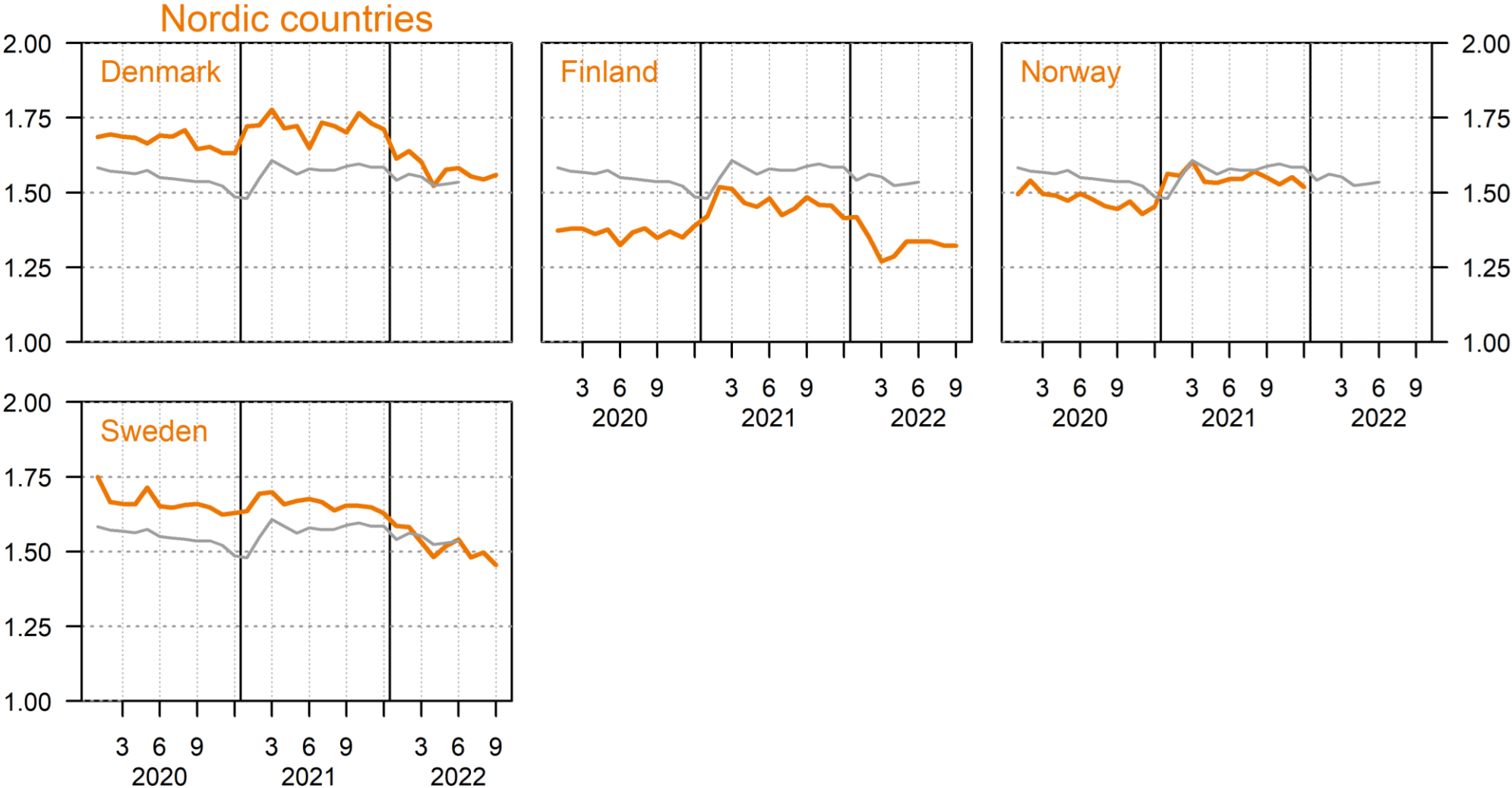
Pandemic fertility trends: estimated Total Fertility Rates until 2022

Pandemic fertility trends: estimated Total Fertility Rates until 2022

Pandemic fertility trends: estimated Total Fertility Rates across 17 EU countries with available birth data (Jan. 2020 – Nov. 2022)
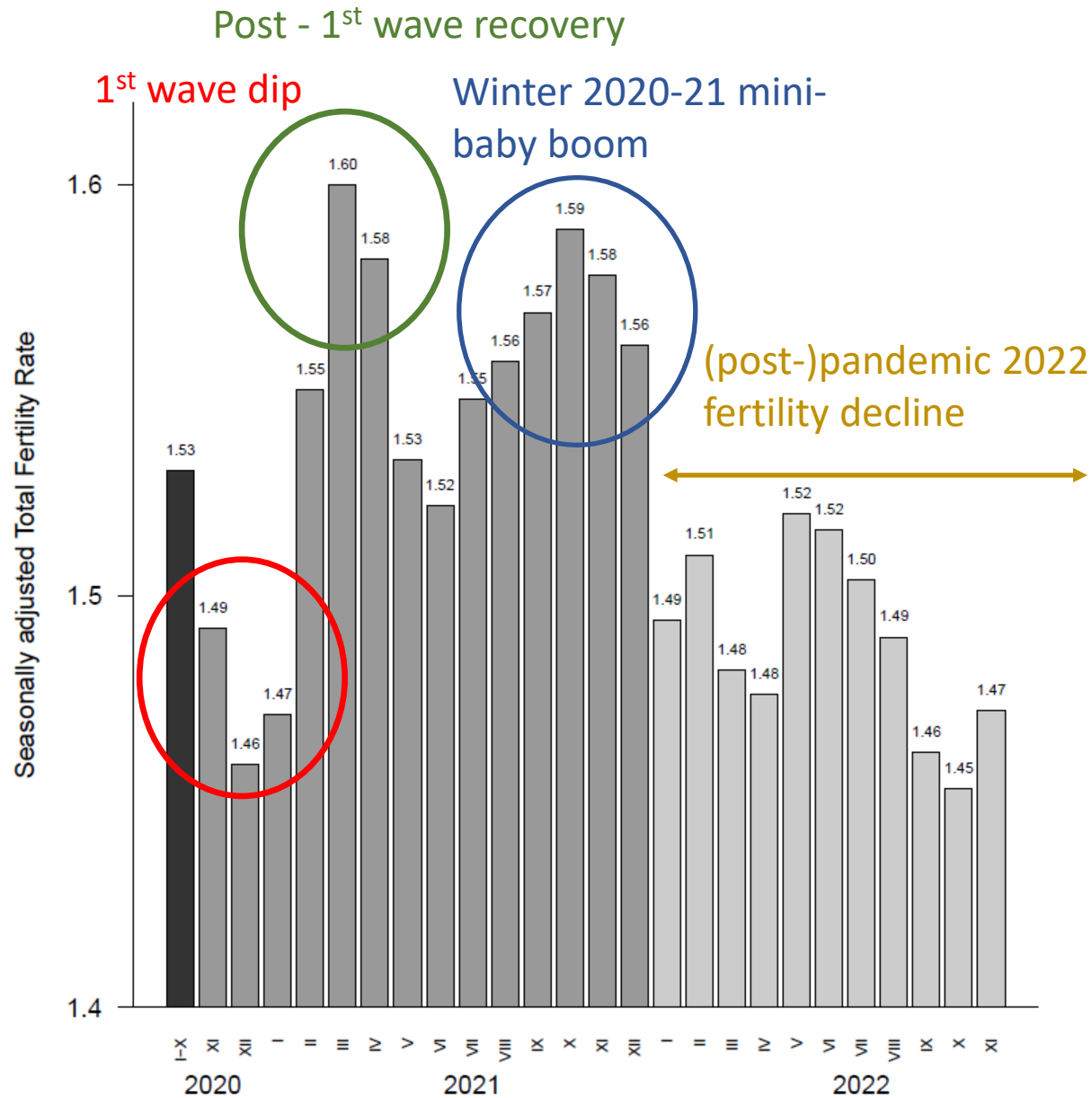
The puzzle of the 2022 fertility decline

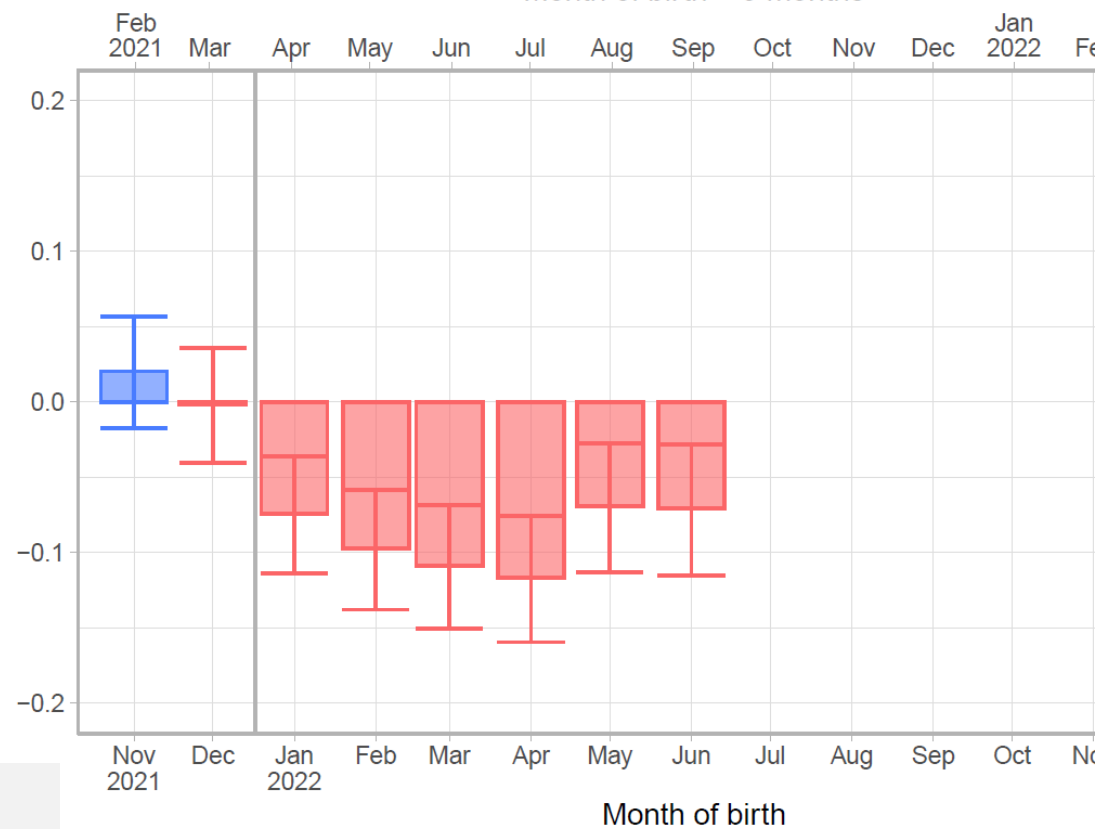# Unexpected fertility drop in early 2022 (Czechia)

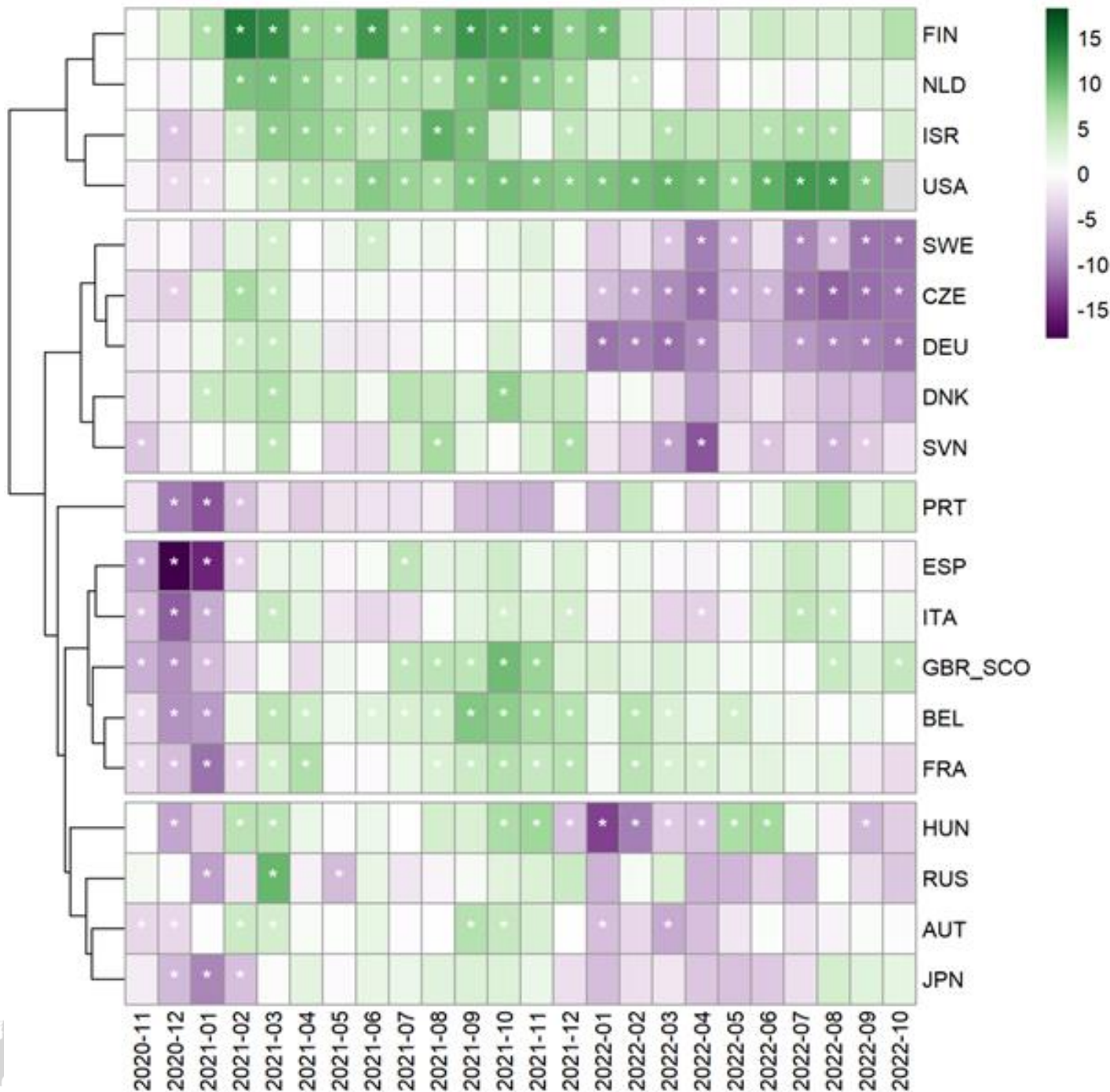Observed and forecasted monthly number of births with 90 % CI

Month of birth − 9 months
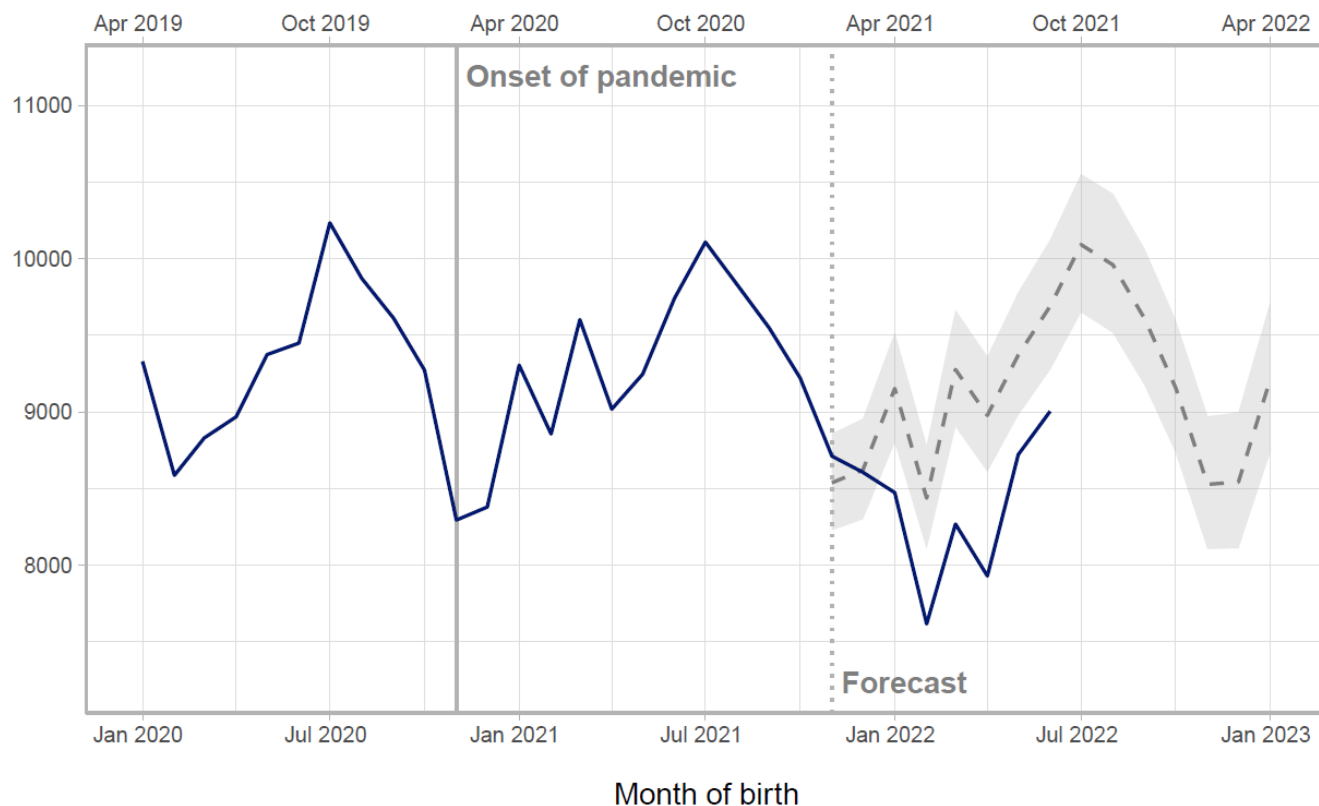
Relative difference of observed to forecasted number of births with 90 % CI

Month of birth − 9 months

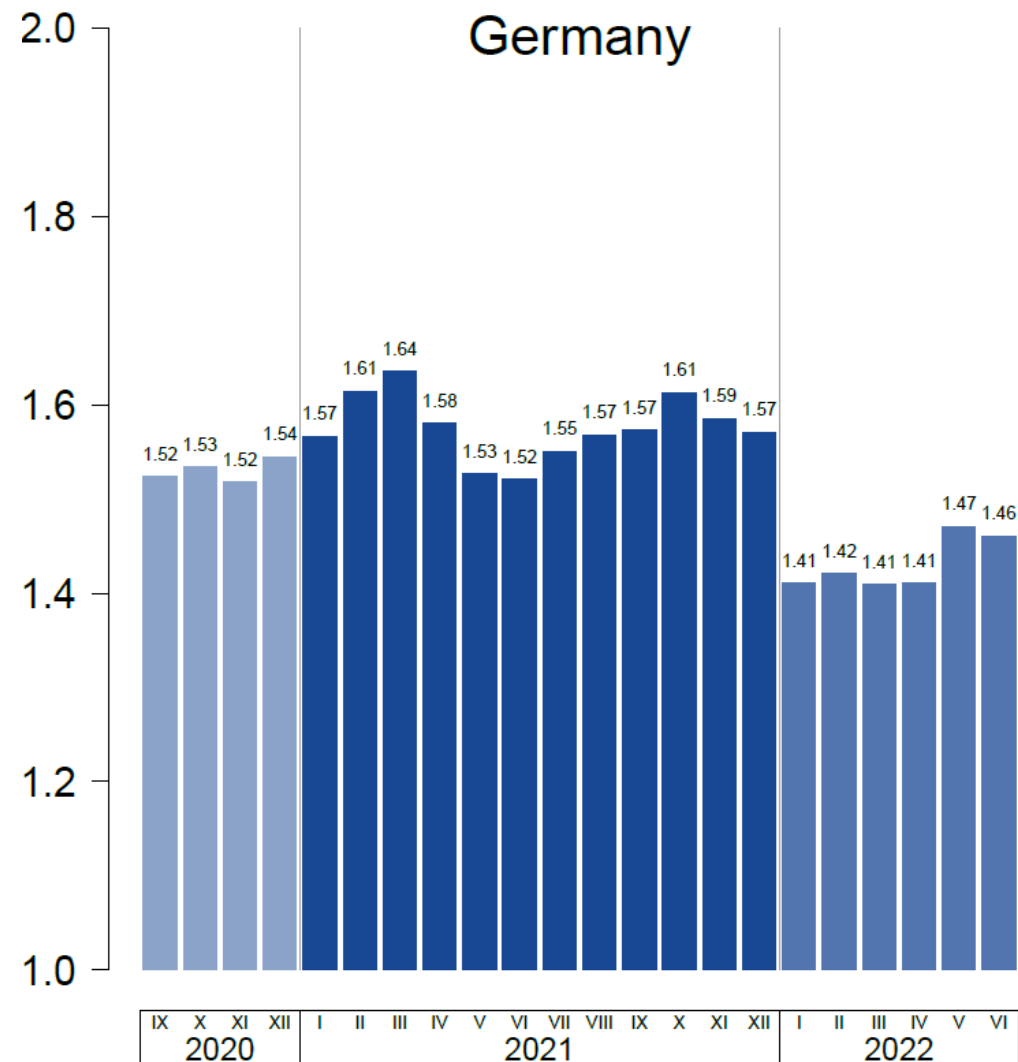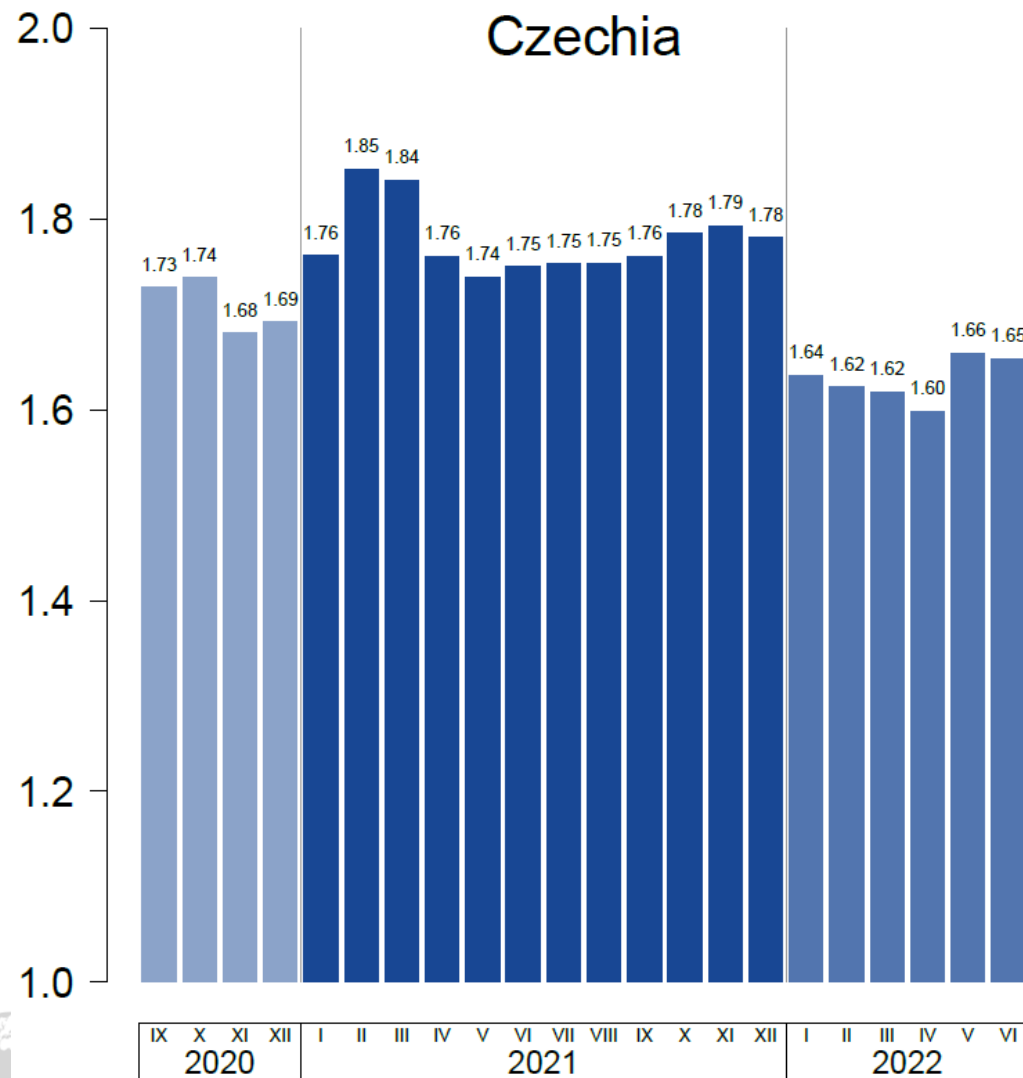Models, forecasts and graphs by Maria Winkler-Dworak (VID)

Was the change in birth trend significant?

Checking the difference between the observed and projected birth trend based on the data until October 2020 (using seasonal ARIMA model with 90% CI)

Monthly trends in the TFR (estimates)
TFR in first half of 2022 by up to 0.25 lower than in 2021

The (post-)pandemic puzzle of the 2022 fertility decline

Why was fertility declining in most countries since January 2022?

- Return to pre-pandemic trends after restrictions and lockdowns ended?

- Return to more busy work and social life not compatible with having kids?

- The impact of covid-19 vaccination? (*relatively close correlations with the TFR*)

- New economic pressures?

- Persistent disruptions to partnerships and families?

The (post-)pandemic puzzle of the 2022 fertility decline

Correlations of monthly adjusted TFRs