COVID-19 Policy Interventions and Fertility Dynamics in the Context of Pre-Pandemic Welfare Support

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This paper focuses on nonpharmaceutical interventions (NPIs) to explain fertility dynamics during the pandemic, while considering countries' institutional context. We argue that containment policies disrupted people's lives and increased their uncertainty more in countries with weak welfare support systems, while health-related and economic support NPIs mitigated such disruptions much more there, as they were less expected by citizens. We estimate monthly "excess" crude birth rates (CBRs) and find that countries with low public support—Southern Europe, East Asia, and Eastern Europe—experienced larger decreases and less of a rebound in CBRs than countries with histories of high public spending—Western, Central, and Northern Europe. However, in low support countries, NPIs are much more strongly associated with excess CBRs—containment NPIs more negatively and health and economic support NPIs more positively—with the exception of the one-month lag of containment NPIs, for which the opposite holds. When putting these coefficients into broader perspective, our findings suggest that the actual implementation of all NPIs taken together mitigated fertility declines. This is especially the case for low public support countries, whereas one might have seen a birth decline even in high support countries if the NPIs were not implemented.

Introduction

In January 2021, *Population and Development Review* launched a series of essays on how the COVID-19 pandemic would impact the research agenda in demography (MacKellar and Friedman 2021). In the issue, Beaujouan

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(2021) emphasized the need to move away from speculative comments and leverage freshly compiled data to understand how the pandemic would affect demographic variables in different countries. One year on, there is no question that the ongoing pandemic has, at least in the short term, affected not only deaths and life expectancy (Aburto et al. 2022) but also conceptions and births. Employing series from the Human Fertility Database (2022) for a set of 17 countries, Sobotka et al. (2021) found that the number of births recorded 10 to 12 months after the start of the pandemic fell in 12 out of 17 countries, by an average of 5.1 percent in November 2020, 6.5 percent in December 2020, and 8.9 percent in January 2021 when compared with the same months of 2019–2020.

This is expected. History points to the regularity that peaks in mortality led to birth troughs within a year, followed by surpluses in conceptions once mortality fell back either at or below pre-crisis levels (Livi Bacci 2000; Palloni 1988). Despite such historical comparisons being at best heuristically useful, demographers, throughout the COVID-19 pandemic, warned that the pandemic would alter childbearing decisions, not so much due to mortality spikes per se (as was the case for the Spanish Flu where mortality was highest among reproductive ages), but mainly because of disruptions to economic and family life and people's increased feeling of uncertainty (Aassve et al. 2020). They also pointed to policies both as a source for these disruptions and as a way of moderating the pandemic's impacts on people's childbearing decisions (Aassve et al. 2020). Governments employed an extensive set of policy interventions, also known as nonpharmaceutical interventions (NPIs) to curb the pandemic. Containment and closure NPIs (e.g., restrictions to movement and gatherings; school and workplace closures) caused disruptions, increased people's sense of uncertainty, and interrupted social support networks (Douglas et al. 2020). Conversely, economic support NPIs (income support and debt relief) cushioned financial pressures and economic uncertainty for many. Likewise, health-related NPIs (e.g., information campaigns, COVID-19 testing, and contact tracing) decreased perceived risks and uncertainty in terms of health access, potential COVID-19 infection, and potential pregnancy and neonatal complications due to infections. This paper focuses on these policy interventions and investigates their role in explaining the observed fertility dynamics during the pandemic.

Although birth rates on average fell during the pandemic (Sobotka et al. 2021), there were large differences between countries. Sobotka et al. (2021) found that Spain experienced the sharpest drop in the number of births with 20 percent declines in both December 2020 and January 2021 compared to the same months in the year before, while in the Nordic countries there were hardly any changes in birth trends until January 2021. Aassve, Cavalli, et al. (2021) find similar results. Accounting for seasonally adjusted trends in crude birth rates (CBRs) by country and testing a potential discontinuity in this trend with the start of the pandemic, they found that birth rates dropped during the pandemic in seven out of 22 countries—beyond what would have been predicted if countries followed their estimated country-specific time trend. They find particularly strong declines in the southern European countries (–9.1 percent in Italy, –8.4 percent in Spain, and –6.6 percent in Portugal).

We hypothesize that this country variation in fertility dynamics during the pandemic relates to the implementation of NPIs in two ways.

First, the level and type of NPIs used varied. For example, countries that traditionally offer poor unemployment support, could be more hesitant to employ economic support NPIs during the pandemic. This is in part due to higher public debts and more constrained budgets, but also driven by their welfare organization more generally and the norms that come with it. These countries might, instead, have relied more extensively on containment NPIs to curb the pandemic and health-related NPIs to bolster otherwise weak health systems. In so far containment NPIs are detrimental for fertility, while health-related and economic support NPIs mitigate fertility declines (H1), the differences in NPI implementation strategies would explain part of the fertility variation across countries (H2).

Second, uncertainty matters to a host of areas of human decision making and interacts with the institutions in which individuals experience it (Dequech 2003). Vignoli et al. (2020a) conceptualized the relationship between economic uncertainty and fertility arguing that individuals act *according to or despite* uncertainty based on their "narrative of the future," which is shaped by the social and institutional surrounding (see also Vignoli et al. 2020b). Resonating with these arguments, Aassve, Le Moglie, et al. (2021) empirically show that social trust and public childcare provision are positive moderators for potential negative effects of uncertainty, here in the context of the Great Recession, on fertility.

We thus hypothesize that public support policies already in place before the pandemic will matter not only for the NPI implementation rates but also for how strongly NPIs reduced fertility or mitigated such declines (H3). We argue that what mattered to potential parents was not so much the NPIs employed per se, but rather, how they were experienced *relative* to the support system already in place and what potential parents therefore *expected* from their governments.

The level of public support before the pandemic is, of course, not merely a measure of the economic support potentially provided to citizens: culture, in particular, plays an important role. There is an extensive literature in sociology and social policy arguing that cultural ideas have mattered for the evolution of the welfare regimes—which closely reflect differences in actual public support (Rothstein 1998, 2005; Pfau-Effinger 2005; Edlund 2006). This literature raises the concepts of social trust and family ties. One argument is that strong family ties has not only crowded out the role of the state in terms of providing support, but since it is a long-standing cultural trait it has also shaped the way welfare regimes as we observe them today are organized. One could then argue that culture should be another moderating variable in this analysis. However, compared to trust and family ties, the level of public support is rather tangible and measured by a great deal of precision, and, obviously, having a very real impact when faced with the implications of the pandemic. Still, one should keep in mind that the variable reflects a broader concept than simply the economic transfers made.

In any case, in countries with a tradition of strong public support, there would be an expectation of economic support being provided through NPIs. Given these expectations and the already high level of support, the relative impact of such NPIs may have been modest. Conversely, in low public support countries there would be larger uncertainty about the government's role in mitigating the economic impact of the pandemic on young adults and families. Therefore, the effectiveness of economic support NPIs in this setting, if implemented, would be stronger compared to those countries where government action to support families in economic crisis is routine. In the same vein, health-related NPIs would be perceived as less urgent in countries with already high public spending on health systems. Thus, the same NPIs may have mitigated fertility declines more strongly when implemented in countries with less extensive health systems—where citizens observed underfunded health facilities became overwhelmed more quickly. A similar argument goes for containment NPIs, which would be perceived as more threatening, causing more uncertainty in countries where public support has been traditionally low, with the result of depressing fertility (further).

We test these hypotheses in two steps. First, we estimate, using five years of data before the pandemic, a trend in CBR by country, which allows us to calculate "excess CBRs" by country and month, meaning how the observed CBRs differed from the projected trend during the pandemic. Second, we estimate the relationship between NPIs and excess CBRs, first overall and then by groups of countries, which, as we show descriptively, reflect differences in pre-pandemic welfare support and thus in citizens expectations.

We find that, across all the 25 high-income OECD countries considered, monthly excess CBRs were negatively related to containment NPIs and positively related to economic support NPIs, with no association found for health-related NPIs. However, for low pre-pandemic public support countries, we find a strong negative relationship between excess CBRs and containment NPIs and a strong positive relationship between excess CBRs and both health and economic support NPIs, while we find no such relationships in high public support countries. We also study the impact of the lagged NPIs (i.e., the NPIs one month before). Here we find a strong positive association with excess CBRs, which suggests that in low public support countries, containment NPIs led to fertility-postponement, while in high public support countries, fertility increased one month later even in the absence of the initial containment polices resulting in (large) previous declines. These results hold once countries are divided in seven regions, broadly consistent with the welfare state literature, arguing for a clustering of countries into a Nordic social democratic, an Anglo-Saxon liberal, and a continental conservative-corporatist welfare regime (Esping-Andersen 1990); and further proposing an East Asian (Jones 1993, p. 214), southern European (Ferrera 1996), and eastern European welfare regime (Fenger 2007).

We then put these estimates into broader perspective by considering how the actual implementation rates of all NPIs taken together were associated with excess CBRs. We do this by estimating coefficients on country-group dummies in two models, one without and one with NPIs, and considering how coefficients on country-groups differ. We find that the overall magnitude (meaning how much larger the observed CBRs during the pandemic were compared to when accounting for NPIs) is positive within all groups of countries, though it is more positive in low public support countries. The highest magnitudes are found in Southern Europe and East Asia, but also in Western and Northern Europe (were a positive coefficient on health-related NPIs is an exception to the general pattern). This suggests that if the NPIs were not implemented, we would have seen birth rate declines in high public support countries (where they did not), and we would have seen much larger declines in low public support countries. The analysis concludes with a set of robustness checks of the model specification in the estimation of CBR-trends.

Data and methods

Data

Data on monthly live births come from the Human Fertility Database, which compiles high-quality statistics on live births from national sources for a select number of countries (Human Fertility Database 2022).[1] We restrict our sample to countries in the OECD in 2022 and that were high-income according to the World Bank definition from 2021 (The World Bank 2021). We include all countries that had birth data available through at least November 2020, except Estonia and Lithuania, due to data quality issues (Sobotka et al. 2021), and Israel, due to comparability issues. Our data set includes live birth data from November 2020 to December 2020 for Canada, Iceland, New Zealand, and Poland; to March 2021 for the United Kingdom (England and Wales only); to June 2021 for Czechia, Japan, Norway, and the United States; to August for Belgium, Germany, Italy, Latvia, Portugal, South Korea, and Switzerland; and to September 2021 for Austria, Denmark, Finland, France, Hungary, the Netherlands, Slovenia, Spain, and Sweden. This sums up to a total of 214 country-months. For most countries, live birth counts for from 2021 are provisional and are likely to be marginally updated, with updates usually far below 1 percent (Aassve, Cavalli, et al. 2021).

To compute CBRs, we matched data on live births with mid-year population estimates (United Nations (UN) Population Division 2019). For population data for 2021, we use the medium projection variant. Monthly CBRs per 1,000 population per year were computed as follows: $(Monthly\ Live\ Births\ /\ Mid{-}Year\ Population) \cdot 1,000 \cdot 12$.

Our explanatory variables include three NPI indices (containment and closure; health-related; economic support) calculated from the implementation and lifting of 15 NPIs to counteract the pandemic. The data are sourced from the Oxford COVID-19 Government Response Tracker (OxCGRT) on a country and on a daily basis (Hale et al. 2021). The single NPIs are described in Table 1.

In addition, we include excess deaths in our analysis that are available by week and country (Ritchie et al. 2020). Excess deaths refer to the difference between the reported and the projected number of deaths from all causes as a ratio to the projected number of deaths from all causes estimated using five years of pre-pandemic data. This is the so-called *P*-score, which we also use to estimate excess CBRs.

Methods

The methodology follows in two steps. First, we assess the fertility changes during the pandemic across countries by estimating the pre-pandemic CBR trends using the following model for each country on five years of pre-pandemic data: $relCBR_{c,t} = \sum_{i=1}^{3} \gamma_i\, t^i + \varepsilon_{c,t}$, where t refers to the month-year in country c. The pandemic is defined to start in February 2020, days after the World Health Organization (WHO) declared the Coronavirus outbreak an international public health emergency (WHO 2020). Conceptions in that month refer to births in November 2020. The dependent variable *relCBR* represents the monthly CBR relative to the mean for the respective month in the five years before the pandemic. That means, we control for any seasonality in birth trends. The month-year variable t is included in linear, quadratic, and cubic form to allow for flexibility in the estimated time-trend. $\varepsilon_{c,t}$ is the error term.

We then project the estimated trend into the pandemic months to assess how the actual data differ from this trend. These differences we call "excess CBR," formally defined as: $\frac{relCBR_{c,t} - \widehat{relCBR}_{c,t}}{\widehat{relCBR}_{c,t}}$. To put the difference between actual and projected relative CBRs into perspective, it is divided by the estimated trend in relative CBRs to obtain the so-called *P*-score of excess CBRs, representing the percentage deviation of CBRs from the trend.

Second, we use these excess CBRs to assess the relationship of fertility changes with NPI implementation rates by estimating the following model

TABLE 1 Description of the single NPIs used to calculate the containment and closure, health, and economic support indices

Containment NPIs:	
Stay at home requirements	Not leaving the house required with some exceptions (daily exercise, grocery shopping and "essential" trips) or with minimal exceptions (e.g., allowed to leave only once a week, or only one person can leave at a time, etc.).
Internal movement restrictions	Imposed restrictions on movement within country (between regions/cities).
International travel restrictions	Imposed restrictions on arrivals from some or all regions or total border closure.
Gathering restrictions	Imposed restrictions on gatherings already for groups of 10 people or less.
Public events cancelling	Imposed cancellation of public events.
School closure	Imposed closure of some or all school levels.
Workplace closure	Imposed closure of some sectors or all-but-the essential school levels.
Transport closure	Imposed closure of public transport or prohibited use for most citizens.
Health-related NPIs:	
Public information campaigns	Public information campaigns including public officials urging caution about COVID-19 or coordinated public information campaign (e.g., across traditional and social media)
Testing policy	Testing anyone showing symptoms of COVID-19 or open public testing.
Contact tracing	Comprehensive contact tracing for all identified cases.
Facial coverings	Imposed facial coverings in some or all shared/public spaces with other people present or imposed facial coverings at all times.
Vaccination availability	Vaccine available to key workers, clinically vulnerable groups (nonelderly), and elderly groups.
Economic support NPIs:	
Income support	Government replacing lost income (covering 50% or more of lost salary or providing a flat sum greater than 50% median salary).
Debt/contract relief	Government providing broad debt/contract relief (freezing financial obligations, e.g., stopping loan repayments or banning evictions, etc.).

on data during the pandemic.

$$
\begin{aligned}
ExcessCBR_{c,t+9} &= \sum_{g=1}^{G} \beta^{g}\, CountryGroup^{g} + \gamma_1\, ContainmentNPIs_{c,t} \\
&+ \gamma_2\, HealthNPIs_{c,t} + \gamma_3\, EconomicNPIs_{c,t} + \gamma_4\, ContainmentNPIs_{c,t-1} \\
&+ \sum_{g=1}^{G} (\delta_1^{g}\, ContainmentNPIs_{c,t} + \delta_2^{g}\, HealthNPIs_{c,t} + \delta_3^{g}\, EconomicNPIs_{c,t} \\
&+ \delta_4^{g}\, ContainmentNPIs_{c,t-1}) \cdot CountryGroup^{g} + \lambda\, ExcessDeaths_{c,t} + \varepsilon_{c,t},
\end{aligned}
$$

where the dependent variable, $ExcessCBR_{c,t+9}$ is the excess CBR from country c in month-year $t + 9$. Excess CBRs are shifted by nine months to reflect conceptions. We employ this methodology of analyzing by month whether and by how much CBRs deviated from the estimate pre-pandemic trend instead of identifying one potential discontinuity at the start of the pandemic in the CBR trend over the whole observation period (as in Aassve, Cavalli, et al. 2021) because of the emergence of larger amounts of live birth data during the pandemic (81 country-months in Aassve, Cavalli, et al. 2021 vs. 214 country-months here). This allows us to examine how NPIs were associated with births on a monthly basis as the pandemic unfolded.

$CountryGroup^{g}$ represents a set of dummy variables, categorizing the countries in our data set into groups (g), reflecting different levels of public support before the pandemic. We do this, first, by low versus high pre-pandemic support, and, second, by seven more fine-grained regions.

$ContainmentNPIs_{c,t}$, $HealthNPIs_{c,t}$, and $EconomicNPIs_{c,t}$ represent indices for the implementation rate of containment and closure, health-related, and economic support NPIs in country c and month-year t.[2] The NPI indices are constructed from, respectively, eight containment and closure NPIs (stay-at home requirements; internal movement restrictions; international travel restrictions; private gathering restrictions; public events cancellations; school closures; workplace closures; public transport closures), five health NPIs (public information campaigns; testing policies; contact tracing; facial coverings; vaccine availability), and two economic support NPIs (income support; debt/contract relief). The variables of single NPIs are dummy variables equal to 1 if the policy has been implemented in country c on a certain day, and 0 if the policy was not in place. From these, the three NPI indices are built as daily averages of the single NPIs by country. Then, these daily averages are aggregated to the month by country. The single NPIs are described in Table 1.

$ExcessDeaths_{c,t}$ represents the P-score of excess deaths of country c and month-year t, controlling for the severity of the pandemic in the respective country. $\varepsilon_{c,t}$ is the error term.[3]

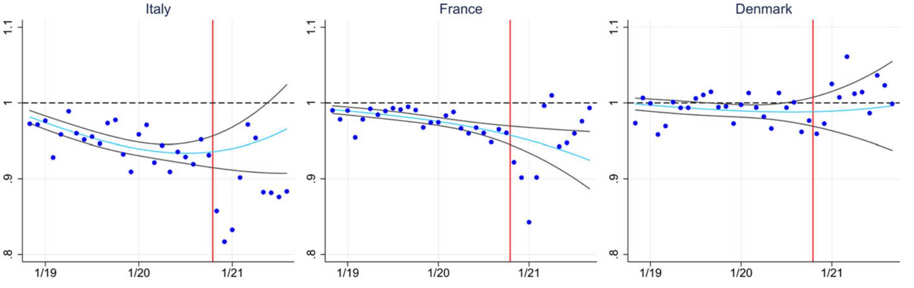
The β coefficients represent differences between groups of countries in excess CBRs during the pandemic. The γ coefficients estimate the association of excess CBR with the three NPI indices. Of particular interest are the δ coefficients that represent differences between groups of countries in the association of NPIs with excess CBRs.

Excess CBRs, pre-pandemic public support, and NPIs

Excess CBRs during the pandemic and public support before

Figure 1 shows monthly changes in CBRs for three prototypical countries: Italy, France, and Denmark. Monthly CBRs relative to the mean for the

FIGURE 1 CBRs relative to the average in the respective month in the five years before the pandemic for selected countries



NOTE: CBRs as a ratio to the mean for the respective month in November 2015 to October 2020. The red vertical line is the pandemic cutoff for births (between October and November 2020). Time trends (fitted light blue lines) are estimated based on the OLS model: $relCBR_{c,t} = \sum_{i=1}^{3} \gamma_i\, t^i + \varepsilon_{c,t}$ on data from November 2015 until the most recent observation of birth data by country. Excess CBRs are the difference between actual CBRs and the trend as a ratio to the trend, i.e. the percentage deviation of CBRs from the trend.

respective month in the five years before the pandemic are displayed as dark blue dots. The estimated time trend in these relative CBRs is illustrated as a light blue line with the 95 percent CIs around the trend as black lines. The pandemic is defined to have started in February 2020. The red vertical line cuts between October 2020 and November 2020, latter referring to conceptions in February 2020 and thus the first month fertility could have been affected by the pandemic.

Italy experienced a large decline of CBRs in the first three months of the pandemic. Smaller drops of CBRs in the same months can be observed for France. By contrast, Denmark experienced almost no CBR changes during this first pandemic phase. After the first three months, when the first pandemic wave had eased considerably, all three countries experienced CBR rebounds with Italy returning to trend levels, while in France and Denmark CBRs even exceeded the trends there. In the next few months, around when the second pandemic wave hit Europe, CBRs fell again to below trend levels in Italy, while France and Denmark saw no large changes in CBRs, staying around or slightly above trend levels. Over the first 10 pandemic months, there was a 6.6 percent mean monthly decline in CBR relative to trend in Italy (hereafter referred to as "excess CBR"; for details see "Methods" section), a slight increase of 0.4 percent in France and a larger increase of 1.7 percent in Denmark (both over eleven pandemic months). Figures A1 and A2 and Table A1 in Appendix A.1 (in the Supporting Information) document parallel results for all countries in our data set.

What accounts for these large variations in excess CBRs across countries? Table 2 presents the mean excess CBRs per month during the pandemic for 25 of the 35 OECD countries the World Bank classifies as high-income countries (The World Bank 2021) as well as a number of other relevant characteristics of those countries. Countries are grouped into

TABLE 2 Mean excess CBRs during the pandemic, and public social expenditure and institutional trust before the pandemic by country

	Excess CBRs from November 2020		Public Social Expenditure (in 2017)			Institutional Trust (<2020) (1–4)	
	Mean	Freq.	Family	Health	Unempl.	Parliament	Year
Italy	−6.6%	10	756	2440	3079	2.16	2005
Portugal	−3.6%	10	378	1796	2300	2.18	2020[a]
Spain	−4.5%	11	441	2336	3456	2.17	2011
Southern Europe	**−4.9%**	**31**	**525**	**2191**	**2873**	**2.17**	
Japan	−5.2%	8	657	3157	2276	2.11	2019
South Korea	−3.2%	10	441	1646	3113	1.89	2018
East Asia	**−4.1%**	**18**	**549**	**2402**	**2682**	**2.00**	
Czechia	1.4%	8	721	2135	5585	1.93	1998
Hungary	−8.2%	11	782	1343	2054	1.77	2009
Latvia	−2.8%	10	592	920	1749	1.94	1996
Poland	−7.3%	2	751	1296	1464	1.83	2012
Slovenia	−3.7%	11	630	2020	2467	1.67	2011
Eastern Europe	**−3.9%**	**42**	**695**	**1543**	**2544**	**1.83**	
Canada	−3.9%	2	721	3440	4031	2.27	2006
New Zealand	−2.0%	2	956	2757	2276	2.26	2011
United Kingdom	−2.6%	5	1412	3348	1454	2.23	2005
United States	0.2%	8	362	4885	2065	1.91	2017
Anglo-Saxon	**−1.4%**	**17**	**873**	**3607**	**2438**	**2.16**	
Belgium	2.6%	10	1295	3742	11848	.	.
France	0.4%	11	1208	3677	6801	2.18	2006
The Netherlands	4.9%	11	780	1365	9284	2.23	2012
Western Europe	**2.6%**	**32**	**1094**	**2928**	**9311**	**2.21**	
Austria	−3.4%	11	1326	3368	8736	.	.
Germany	−0.5%	10	1144	4030	10972	2.4	2018
Switzerland	−3.7%	10	1183	2000	11177	2.6	2007

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TABLE 2 (Continued)

	Excess CBRs from November 2020		Public Social Expenditure (in 2017)			Institutional Trust (<2020) (1–4)	
	Mean	Freq.	Family	Health	Unempl.	Parliament	Year
Central Europe	**−2.6%**	**31**	**1218**	**3133**	**10295**	**2.52**	
Denmark	1.7%	11	1734	3594	11286[a]	.	.
Finland	−0.1%	11	1287	2499	9922	2.57	2005
Iceland	−2.5%	2	1714	2710	6607	.	.
Norway	2.4%	8	1991	3964	6091	2.63	2007
Sweden	2.4%	11	1701	3234	2238	2.59	2011
Northern Europe	**1.4%**	**43**	**1685**	**3200**	**7229**	**2.60**	
SE/EA/EE	**−4.3%**	**91**	**615**	**1909**	**2670**	**1.97**	
WE/CE/NE	**0.6%**	**106**	**1397**	**3108**	**8633**	**2.46**	
Overall	−1.6%	214	1000	2708	5256	2.17	

NOTE: SE/EA/EE refers to Southern Europe, East-Asia, and Eastern Europe (low pre-pandemic public support), while WE/CE/NE refers to Western, Central, and Northern Europe (high pre-pandemic public support). Excess CBRs refer to the difference between the actual CBR and the estimated trend divided by the trend by month. CBRs are first put into relation to the mean for the respective month in the five years before the pandemic to account for seasonality. Means by country-groups for excess CBRs are weighted by country-months of available live birth data during the pandemic. (The means for public social expenditure and trust are not weighted.) CBR data for the United Kingdom include only data for England and Wales (Human Fertility Database 2022). Social Expenditure for family is per head, at constant prices (2015) and constant PPPs (2015), in USD (OECD 2022b). For unemployment, this is divided by the unemployment rate (OECD 2022c; Eurostat 2022), which results in an approximate measure of unemployment support per unemployed person (this multiplied by ratio of labor force to total population). Data on institutional trust come from the most recent World Value Survey (WVS) wave by country (Haerpfer et al. 2021). It is measured on a 4-point Likert scale (1 = *Not at all*, 2 = *Not very much*, 3 = *Quite a lot*, 4 = *A great deal*).

[a] The social expenditure on unemployment for Denmark includes voluntary unemployment insurance, that is, private expenditure and is calculated from official country sources (Statistics Denmark 2022) and OECD PPP data (OECD 2022a).

southern European, East Asian, eastern European, Anglo-Saxon, western, central, and northern European countries. Column 1 presents the mean excess CBRs during the pandemic for each country and for different groups of countries, while column 2 shows the number of country-months of birth data available. Columns 3–5 provide levels of public social expenditures in 2017 in three policy areas—family, health, and unemployment support (OECD 2022b). Column 6 presents the mean level of trust by residents in a country's parliament, typically the body that passes emergency relief and aid legislation, while column 7 provides the year these data were collected for each country (Haerpfer et al. 2021). Both public spending and institutional trust are measured before the pandemic, meaning they are not affected by public policy during the pandemic.

Table 2 establishes three important facts. First, countries can be relatively neatly grouped into having low versus high pre-pandemic levels of public support using any of the three measures provided. Putting aside Anglo-Saxon countries for the moment, almost all countries in Southern Europe, East Asia and Eastern Europe, have levels of public social expenditures in 2017 lower than countries in Western, Central, and Northern Europe. If we group countries below and above the mean for family support ($1,000 per person in 2015 USD), the only country with a level of support below this average in Western, Central or Northern Europe is the Netherlands; no country in Southern Europe, East Asia or Eastern Europe is above this mean. Doing the same for health care and unemployment support, the only country with a level of public support above the mean in Southern Europe, East Asia or Eastern Europe is Japan for health care and Czechia for unemployment support; while in Western, Central or Northern Europe the only countries below the mean are the Netherlands and Switzerland for health care and Sweden for unemployment support.

This grouping of countries into those with histories of low versus high public support is substantiated by a more formal cluster analysis (Stata command "cluster completelinkage") on the three variables of public spending—family, health, and unemployment support—shown in Table 2. The cluster tree is illustrated in Figure A6 in Appendix A.3 (in the Supporting Information). Based on this methodology, Sweden is the only country that would be classified differently, namely into the low public support group (due to low expenditure on unemployment support). When including the Anglo-Saxon countries in this cluster analysis, they are allocated to the low pre-pandemic public support cluster.

But looking at Table 2, the Anglo-Saxon countries do not clearly fit into either the low or the high public support group of countries. For example, the United Kingdom is above the mean in public spending on family and health care but well below the mean on unemployment support. The United States is well below the mean on family support and unemployment support but well above the mean on public expenditure on health care, partly reflecting the high cost of health care in the United States. Because of this ambiguity we exclude the Anglo-Saxon countries from our analysis on low versus high pre-pandemic public support groups of countries.[4]

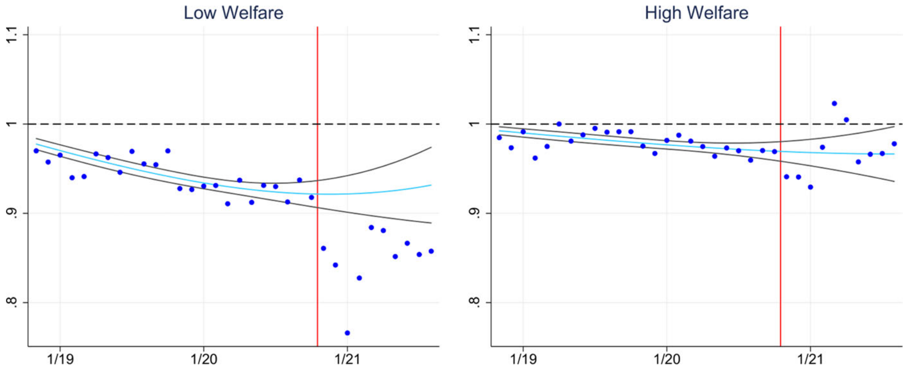
We also present results by regions that reflect varying levels of pre-pandemic welfare spending: Southern Europe, East Asia, Eastern Europe, Anglo-Saxon, Western Europe, Central Europe, and Northern Europe. Although much of the variation in public expenditures is between the high versus low expenditure groups, there remains some variation across regions within these groups and across countries within regions.[5] For example, southern European countries tend to have the lowest public spending, while northern European countries tend to the highest public social expenditure especially in family support. We will, therefore, also present our analysis by each of these more fine-grained groups of countries, unpacking the more broad analysis on the cost of explanatory power within groups.

Table 2 establishes a second fact: a country's history of public social expenditure is reflected by the trust residents have in the country's parliament, which in turn might reflect citizens' expectations around NPIs during the pandemic. The measure provided in column 6 is the average response to the question "[...] how much confidence [do] you have in [the parliament]: is it a great deal of confidence, quite a lot of confidence, not very much confidence or none at all?" measured on a 4-point Likert scale. Generally the residents of countries in Western, Central, and Northern Europe have higher levels of trust in their legislatures than in Southern Europe, East Asia, and Eastern Europe.[6]

Finally, Table 2 establishes a third fact: countries with a history of low public expenditures had larger average monthly declines in CBRs during the pandemic compared to their trend (–4.9 percent in Southern Europe, –4.1 percent in Asia, and –3.9 percent in Eastern Europe.) Conversely, countries with a history of high public expenditures had small or no drops, or even slight increases in CBRs: 2.6 percent in Western Europe and 1.4 percent in Northern Europe. There are, of course, exceptions to this tendency. Central European countries, or at least Austria and Switzerland, experienced mean monthly declines in CBRs despite having a tradition of high social support. Czechia, instead, had mean monthly increases in CBRs despite a tradition of rather low public spending except for unemployment support. Likewise, the Netherlands showed the largest increase in CBRs despite having the lowest public spending, with the exception of unemployment support, in the high welfare group.

Figure 2 shows monthly seasonally adjusted relative CBRs and their estimated trend for countries classified as low versus those classified as high pre-pandemic public support (Southern Europe, East Asia, Eastern Europe versus Western, Central, Northern Europe). For the low public support countries, we observe large drops of CBRs relative to the trend from November 2020 to February 2021, corresponding to conceptions from February

FIGURE 2 CBRs relative to the average in the respective month in the five years before the pandemic for low and high welfare spending countries from November 2018 to August 2021



NOTE: CBRs as a ratio to the mean for the respective month in November 2015 to October 2020. The red vertical line is the pandemic cutoff for births (between October and November 2020). Time trends (fitted light blue lines) are estimated based on the OLS model: $relCBR_{c,t} = \sum_{i=1}^{3} \gamma_i \, t^i + \varepsilon_{c,t}$ on data from November 2015 until the most recent observation of birth data by welfare group. Excess CBRs are the difference between actual CBRs and the trend as a ratio to the trend, i.e. the percentage deviation of CBRs from the trend. The seasonally adjusted monthly CBRs and the trend are presented as population weighted averages across countries in each of the groups. Low welfare refers to Southern Europe, East-Asia, and Eastern Europe, while high welfare refers to Western, Central, and Northern Europe.

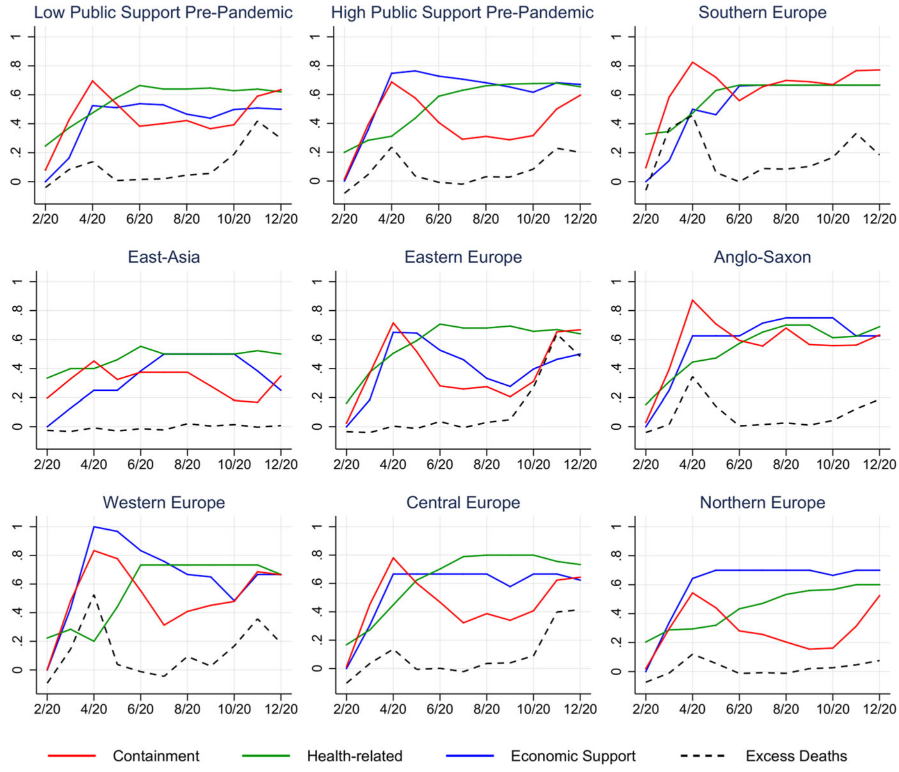
to May 2020. CBRs in these countries are found below trend during the pandemic period throughout August 2021, and despite a rebound between March and April 2021 (conceptions in Summer 2020). Conversely, the high public support group shows smaller declines from November 2020 to January 2021, rebounds above trend levels in March and April 2021, and a return to trend-levels until August 2021.

The timing and spatial variation in NPI implementation during the pandemic

Countries public support level prior to the pandemic is likely correlated with the strategy followed to mitigate the pandemic. Figure 3 illustrates NPI implementation rates across groups of countries by month, from February 2020 (the start of the pandemic) to December 2020 (corresponding to births in September 2021, the most recent country-month of live birth data). The first two panels summarize the mean NPI implementation rates across the ten countries with low pre-pandemic public support (Southern Europe, East Asian, and Eastern Europe) and the eleven countries with high public support (Western, Central, and Northern Europe).

The mean implementation rate of containment NPIs follows a rather similar pattern across both of these groups. Countries, on average, extensively used these policies in the first wave of the pandemic with a peak in April 2020; lifted them during summer when the pandemic eased; and put them back into place with the second pandemic wave in autumn. Low

FIGURE 3 Nonpharmaceutical interventions over time by country groups



NOTE: The NPI indices refer to the monthly mean implementation rate calculated from the daily mean implementation of the single NPIs. The monthly implementation rate by country is aggregated to different groups of countries. The indices are containment and closure (stay-at home requirements; internal movement restrictions; international travel restrictions; private gathering restrictions; public events cancellations; school closures; workplace closures; public transport closures); health-related (public information campaigns, testing policies; contact tracing; facial coverings, vaccine availability); and economic support (income support; debt/contract relief). An implementation rate of 1 would indicate the implementation of all NPIs for the respective index on all days of the month in all countries in the respective group. Low public support pre-pandemic refers to Southern Europe, East-Asia, and Eastern Europe, while high public support pre-pandemic refers to Western, Central, and Northern Europe. The respective countries comprising each country-group are listed in Table 2.

pre-pandemic support countries were, on average, slightly faster with the first implementation of containment NPIs; more reluctant in summer to lift them; and again slightly faster to re-implement them in autumn than countries with high social spending before the pandemic. Stronger containment strategies in low public support countries may have been necessary as countries with high public spending were more able to rely on recommendations and voluntary action due to high institutional trust and strong health systems.

Looking at health-related NPIs, low pre-pandemic public support countries again show an earlier increase in implementation rates than high public support countries, before reaching similar levels in summer 2020.

This again suggests that stronger health systems—with, for instance, more intensive care units—made health-related NPIs less urgent than in countries with low public spending.

The clearest differences in NPI implementation is with respect to economic support. Throughout 2020, these policies were implemented, on average, at a much higher rate in countries with histories of high public spending than those with low public spending. A reasonable interpretation is that countries that routinely step in to provide economic support in times of unemployment simply extended this practice to the unemployment induced by the pandemic. In addition, although economic support NPIs might have been more needed in countries with histories of low public support, these countries might have faced restricted budgets due to higher public debt—one possible reason for why they provided lower pre-pandemic support in the first place.

The other seven panels of Figure 3 illustrate NPI implementation rates by the more fine-grained welfare regions, displayed from low to high pre-pandemic public spending. Although the NPI implementation patterns are roughly similar to the ones just discussed with regard to low versus high public support groups of countries, there is considerable heterogeneity. Southern European countries were the fastest to put in place containment NPIs and were the strictest over the three stages of the first pandemic year. Other countries were less strict in the first pandemic wave, in particular the East Asian countries—which throughout the pandemic implemented fewer NPIs, arguably because they did not experience strong surges of COVID-19 cases—and the northern European countries. In addition, containment NPIs were lifted more rapidly and re-implemented at a lower rate in most countries (especially Eastern, Western, Central, and above all Northern Europe) than in Southern Europe.

As for health-related NPIs, southern European countries again tended to implement those NPIs quickly and extensively, but so did the eastern European and Anglo-Saxon countries. Western European countries were slower to implement health NPIs but from June 2020 also put extensive health NPIs in place, as did the central European countries but more gradually. Northern European countries, instead, were again less active with respect to health NPIs.

Looking at economic support NPIs, the pattern tends to be the opposite. Southern European countries were slower to implement these NPIs, while East Asian countries showed low levels of economic support throughout 2020 and eastern European countries considerably lifted economic support policies from summer 2020. Conversely, the northern and central European countries were much *faster* to implement these NPIs and did not lift them throughout 2020. That means, despite the potentially lower necessity for economic support NPIs, due to strong public support systems already in place, they nonetheless put more emphasis on economic support. What is striking is that western European countries even showed higher levels of economic support than the Nordics. Anglo-Saxon countries also implemented economic support despite a weaker tradition of unemployment support prior to the pandemic.

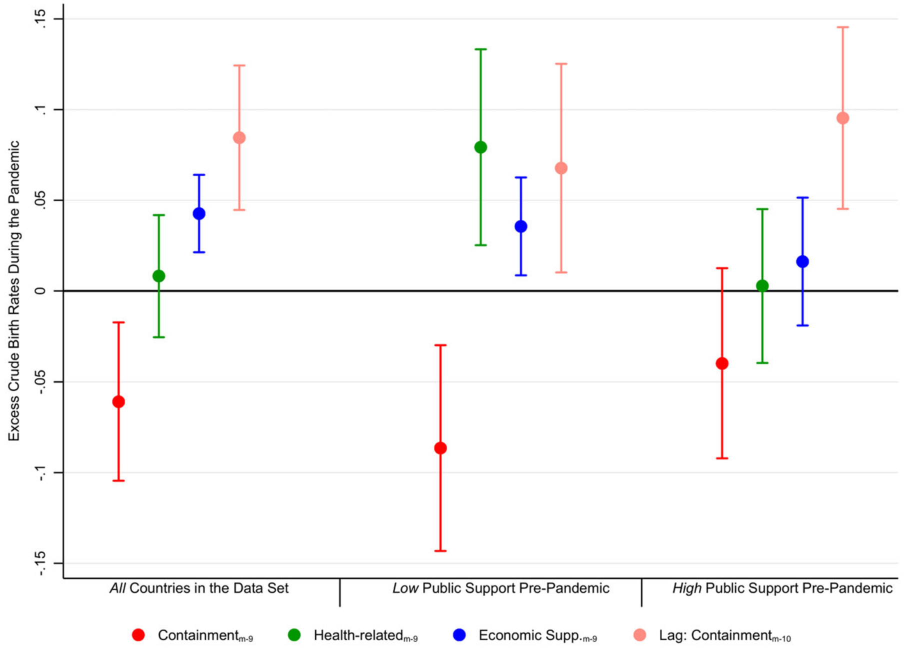
However, there is a great deal of variation in implementation rates over time not only between but also within regions.[7] This is because the patterns in implementation rates are not all that distinct between groups of countries—potentially because higher traditional tendencies of public policy were often counterbalanced by lower necessity to intervene, exactly because of past policies—and because there is still considerable variation within these groups. Table A.2 and Figures A7 and A8 in Appendix A.4 (in the Supporting Information) document parallel results for all countries in our data set. Consequently, even if NPIs mattered for fertility dynamics during the pandemic, the variation in NPI implementation rates between groups of countries unlikely will explain much of the variation in excess CBRs between them. This suggests that the association of NPIs and excess CBRs itself might indeed vary between groups of countries, reflecting pre-pandemic public support levels.

Association of NPIs with excess CBRs during the pandemic

Figure 4 plots the coefficients of the average marginal effects for the relationship between implemented NPIs and excess CBRs during the pandemic for all countries in our data (column 1) and for the groups of countries with histories of, respectively, low and high public social expenditure (columns 2 and 3). We find that across all countries pooled together the implementation rate of containment NPIs was negatively associated with excess CBRs nine months later. The coefficient is –0.061 (with standard error [SE] of 0.022), which implies that if all containment NPIs had been in place for a full month, on average, an excess CBR of –0.061 would have occurred nine months later, that is, a 6.1 percent lower relative CBR than the trend. Conversely, economic support NPIs were overall positively related to excess CBRs (0.043, SE: 0.011), while health-related NPIs were not linked to excess CBRs (0.008, SE: 0.017).

To what extent is the negative association between containment NPIs and excess CBRs a postponement of childbearing versus forgone births? One approach to tap into this aspect is to introduce a variable that measures the NPI implementation in the month before. A positive coefficient on such lagged NPI would reflect an adjustment, or, recuperation. Across all countries in our data set, we find that a one-month lag of containment NPIs (i.e., a total shift of ten months with respect to births) is positively related to excess CBRs (0.084, SE: 0.020). This is about the same magnitude as the negative coefficient on the containment NPI itself, and suggests that the drop in fertility related to containment NPIs was, in part, a displacement

FIGURE 4 The relationship between NPIs and excess CBRs overall and by low versus high public support before the pandemic

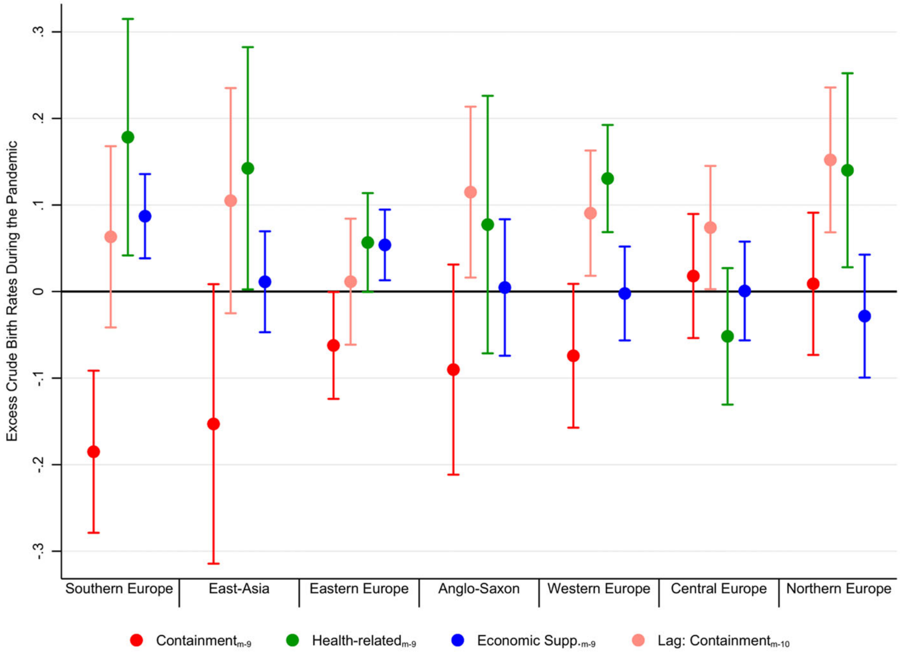


NOTE: Excess CBRs refer to the difference between the actual CBR and the estimated trend divided by the trend by month, representing the percentage deviation of CBRs from the trend by month. CBRs are first put into relation to the mean for the respective month in the five years before the pandemic to account for seasonality. The group of countries with low public support before the pandemic includes southern European, East Asian, and eastern European countries, while the one with high public support before the pandemic includes western, central, and northern European countries.

from the months when containment policies were in place to the months just after they were lifted.

Because health and containment NPI implementation rates were similar, but economic support NPI implementation rates were higher in high pre-pandemic support countries, we would presume that NPIs played a larger role there than in low support countries. Still, we have to consider whether and how NPIs were associated differently with fertility between high and low pre-pandemic support countries. Column 2 of Figure 4 shows the association between NPIs and excess CBRs for low support countries and column 3 for high support countries. We find that containment NPIs are negatively associated with excess CBRs during the pandemic in the low pre-pandemic support group (–0.086, SE 0.029), while no link is found in high social support countries (–0.040, SE: 0.027). Health-related and economic support NPIs are positively related to excess CBRs in the low social support countries (0.079, SE: 0.027; 0.036, SE: 0.014) but not in the social support countries (0.003, SE: 0.021; 0.016, SE: 0.018).

FIGURE 5 The relationship between NPIs and excess CBRs by groups of countries



NOTE: Excess CBRs refer to the difference between the actual CBR and the estimated trend divided by the trend by month, representing the percentage deviation of CBRs from the trend by month. CBRs are first put into relation to the mean for the respective month in the five years before the pandemic to account for seasonality. The respective countries comprising each country-group are listed in Table 2.

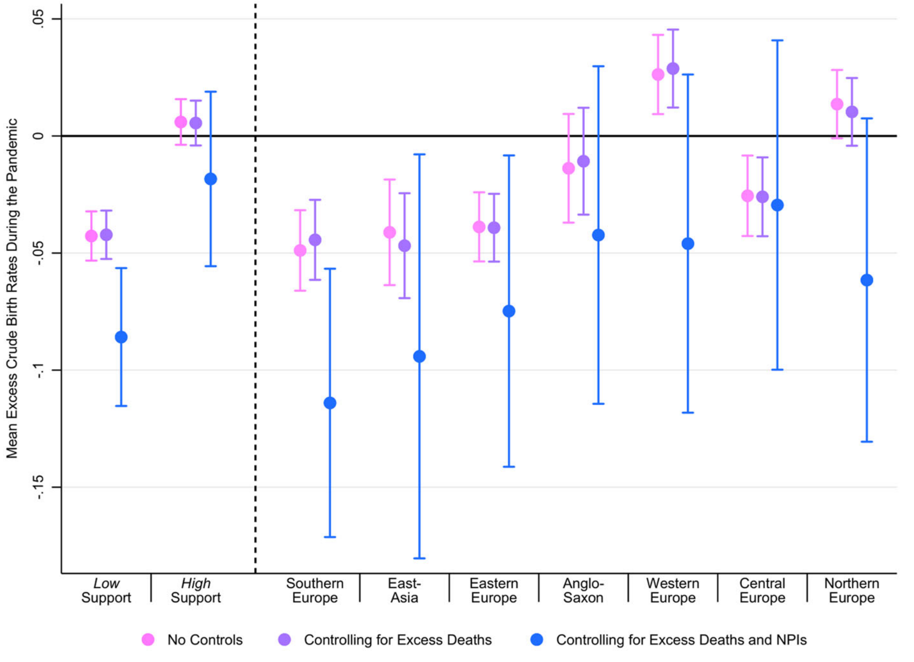
Finally, the coefficient on the one-month lag of containment NPIs in both groups of countries is positive but its magnitude is smaller for low pre-pandemic support countries than for high support countries (0.068, SE: 0.029; 0.095; SE: 0.025), despite the absence of a negative association between containment NPIs and excess CBRs in the latter group. This may explain the increase in CBRs, without a preceding decline, that was observed in some of these countries.

Figure 5 extends this analysis to the more fine-grained regions, reflecting different levels of public support. The advantage of analyzing regions is to take advantage of potential variation across region within the high and low public support regimes. The cost is each region has fewer data points implying that correlations must be larger in magnitude to have the power to detect it. The overall pattern emerging from this analysis confirms what is found for the low versus high public spending groups: the associations between NPIs and excess CBRs are strong for groups of countries with traditions of low public support and absent for those with high pre-pandemic public support; and the opposite holds for the one-month lag of containment NPIs. The relationship between containment NPIs and excess CBRs is strongly negative in southern European countries (-0.185, SE: 0.047) and, though much less, also in eastern European countries (–0.062, SE: 0.031; the coefficient is large in magnitude but not significant at 5 percent level for East Asian countries). Health-related NPIs are strongly positively related to excess CBRs in Southern Europe (0.178, SE: 0.047), but also in East Asia (0.142, SE: 0.071), and, going against the general pattern, in western (0.131, SE: 0.031) and northern European countries (0.140, SE: 0.057). The association of economic support NPIs with excess CBRs is again strongly positive for Southern Europe (0.087, SE: 0.025), and less so for Eastern Europe (0.054, SE: 0.021). The coefficients on one-month lag of containment NPIs again shows the opposite tendency. This variable is only related to excess CBRs in Anglo-Saxon (0.115, SE: 0.050), western (0.091, SE: 0.037), central (0.074, SE: 0.036), and northern European countries (0.152, SE: 0.042).

To assess the overall association of the actually employed NPI implementation strategies with excess CBRs, we first estimate the coefficients on country-group dummies in a model not including other explanatory variables, and then do the same for the full model used in our analysis, including NPIs. The difference between the respective coefficient in both models captures the magnitude of the relationship between actual NPI implementation strategies and excess CBRs across country-groups. Coefficients from these regressions are illustrated in Figure 6. The pink coefficients are from a model including only country-group dummies. They capture the mean monthly excess CBRs by country-groups. Violet coefficients come from a model that adds excess deaths. They illustrate the scenario of the mean monthly excess CBRs if no excess deaths had occurred. The light-blue coefficients come from our full model and include excess deaths, NPIs, and interactions between NPIs and country-groups. They represent the estimates of the mean monthly excess CBRs if no excess deaths had occurred and no NPIs were implemented.

The small changes in coefficients when including excess deaths still suggests that in a scenario with no excess deaths we would have seen similar excess CBRs to what we actually observed. But when we add NPIs to the model, we see that compared to the first two models the coefficients change considerably. This suggests that NPIs indeed made a large difference, especially in countries with histories of low public support, particularly in Southern Europe; but they likely also made a difference in Western and Northern Europe. With an alternative method of multiplying the coefficients from Figures 4 and 5 with the actual mean monthly NPI implementation rates by country-groups (see Table B1 in Appendix B.4 in the Supporting Information), we find that actual mean monthly NPI implementation rates by country-group are associated with excess CBR of 4.7 percent in low pre-pandemic support countries and 2.8 percent in countries with histories of high public support. By welfare region, we find overall magnitudes of 7.6

FIGURE 6 Excess CBRs by low versus high pre-pandemic public support and country-groups, both without and with controlling for excess deaths and NPIs



NOTE: Pink, violet, and light blue dots (and corresponding 95% CIs) refer to the coefficients on country-group dummies in the model with, respectively, solely country-group dummies; country-group dummies and excess deaths; and country-group dummies, excess deaths, NPI implementation rate indices, and interactions between NPI indices and country-groups (our full model). An alternative method is shown in Table B1 in Appendix B.4 (in the Supporting Information). Here we multiply the coefficients from Figures 4 and 5 with the actual mean monthly NPI implementation rates by country-groups (illustrated in Figure 3).

percent excess CBRs for Northern Europe, 7.4 percent for Western Europe, 6.7 percent for Southern Europe, and 5.3 percent for East Asian countries.

These large magnitudes have different reasons. For low pre-pandemic support countries, especially Southern Europe, large negative coefficients on containment NPIs—despite the large implementation rates—are more than off-set by large positive ones for health and economic support NPIs and the one-month lag of containment NPIs. Conversely, for Western and Northern Europe, there are no negative coefficient on containment NPIs to offset, and no positive one on economic support NPIs; but there are positive coefficients on health NPIs and on the one-month lag of containment NPIs.

Robustness analysis: CBR trend model specification

We analyze the robustness of our results with respect to the specification of the model estimating the CBR trends by country in several ways. First, we “test down” the time-variables in the cubic CBR-trend model to assess the model fit for each country over the five years of pre-pandemic data used to estimate the CBR time-trends. We did this by running the cubic model and testing the cubic term; then the cubic and quadratic term; and then (for completeness) all terms. The model with cubic time trend was preferred in 11 of the 25 countries in our sample, the quadratic one in 3, and the linear one in 11.[8] This analysis makes us confident about using the cubic time-trend specification as a means to settle for one common specification for the countries considered. Operating with one common specification avoids overcomplicating the estimation of excess CBRs and defocusing from the purpose of using excess CBRs to consider the role of NPIs. We however acknowledge that for some countries other specifications, in particular the linear one, might be the better choice. We thus replicated the estimation of CBR trends with linear models for all countries. The linear CBR-trend figure by country are shown in Appendix A.2 in the Supporting Information (Figures A4 and A5) and can be contrasted with the corresponding cubic version in Appendix A.1 in the Supporting Information (Figures A1 and A2).

Second, we replicated the analysis on the relationship between NPIs and excess CBRs, and how it differs between groups of countries, using excess CBRs calculated from different CBR-trend model specifications than the cubic one. We start by using linear trends for all countries. The results are shown in Figures B2 and B3 in Appendix B.2 (in the Supporting Information). Although some coefficients vary slightly, the overall conclusions remain rather stable. We then use country-specific model specifications preferred by "testing down" the model fit by country. The results, illustrated in Figures B4 and B5 in Appendix B.3 (in the Supporting Information), are even closer to the one using the cubic model for all countries. As a whole these robustness checks thus suggest that while the cubic model might not be the best choice for all countries, the conclusion about the relationship between NPIs and fertility during the pandemic, and that this relationship was significant for certain groups of countries—those leaning to low pre-pandemic welfare support—and not significant for others—those leaning to high pre-pandemic welfare support—remains robust.

Discussion

Over the past five decades, women's rising levels of education and increased participation in the labor force led to an outsourcing of childcare arrangements according to three broad "ideal-typical" systems (Esping-Andersen 1990): childcare is provided by the state, through universal childcare provision; or by the private sector, through market and firm-based services; or through the extended family helping in child rearing. During the current pandemic, prolonged containment NPIs such as school closures and restrictions to movement collapsed these arrangements, caused re-internalization of childcare within the couple, and most likely, halted or postponed fertility parity progression (Aassve et al. 2020; Trinitapoli 2021).

But these NPIs also caused economic disruption that pushed many adults in reproductive age toward financial hardship, thereby introducing uncertainties over lifelong earnings. In addition, the health emergency itself imposed risks and uncertainty around health access, potential COVID-19 infection, and potential pregnancy and neonatal complications due to infections. For example, fertility treatment services (e.g., artificial reproductive technology) were in parts suspended during the first pandemic months, reducing the number of births (Scaravelli et al. 2022). As is well-documented, perceived uncertainty matters for family formation (Rica and Iza 2005; Gutiérrez-Domènech 2008; Mills and Blossfeld 2013) and fertility (Grusky et al. 2011; Kreyenfeld et al. 2012; Goldstein et al. 2013; Schneider 2015; Graham et al. 2016; Comolli 2017). Government intervention to counteract these disruptions followed suit providing income support and debt relief and addressing the health emergency, reducing adversities and uncertainties connected to the pandemic and containment NPIs. But the jury is still out over the impact of NPIs on fertility choices.

This paper characterizes the relationship between these government interventions and reproductive behavior during the COVID-19 pandemic, for a subset of 25 high-income, OECD countries. Our results indicate that containment NPIs are on average negatively associated with excess CBRs, while economic support and health NPIs are positively related to them. This suggests that the latter helped to offset the detrimental effect of the pandemic and disruptive containment NPIs on people's lives.

As emphasized in the literature, however, "countries have not been evenly exposed to the pandemic, they differ in social organization and demographic structure, and have not reacted in the same way" (Beaujouan 2021, 9). Furthermore, countries vary in their institutional structure and public support provision, which interact with how individuals experience uncertainty (Dequech 2003; Vignoli et al. 2020a; Aassve, Le Moglie, et al. 2021). This includes whether and how uncertainty was arising from the pandemic and the containment NPIs coming with it, and whether and how this uncertainty was reduced through health-related and economic support NPIs.

We find that countries characterized by lower pre-pandemic public support experienced larger decreases and less of a rebound in CBRs than countries with high public spending before the pandemic. The low pre-pandemic support countries are the "usual suspects"—Southern and Eastern Europe, South Korea, and Japan—which were already characterized by very low fertility rates. On the other hand, high pre-pandemic support countries, especially Western and Northern Europe, experienced milder losses in CBRs from 10 to 12 months after the pandemic began (i.e., conceptions of the first pandemic trimester), and strong recuperation afterward—in some cases leading to on average positive excess CBR.

The COVID-19 pandemic and the connected containment NPIs likely led to large corrections in the life courses due to disruptions to economic and family life and unmitigated uncertainty. We find that, ironically, in low pre-pandemic public support countries, NPIs are much more strongly associated with excess CBRs—containment NPIs more negatively and health and economic support NPIs more positively—than in countries having a history of high public spending. In countries with extensive support systems already in place before the pandemic, citizens likely expected to be provided with public support in case of adversity. Thus, citizens would have perceived containment NPIs as less disruptive and health-related and economic support NPIs were less critical in mitigating emerging uncertainties. Conversely, in low public support countries, disruptions and uncertainty caused by the pandemic and the containment NPIs led people to postpone childbearing. Here, health-related and economic support NPIs, thus, likely had a critical role in mitigating the emerging disruptions and uncertainty.

Our analysis suggests that, as a whole, countries' NPI implementation strategies played an important role in mitigating fertility declines, making them smaller than they would have been if not implemented. This is especially the case for countries with low pre-pandemic public support. But also in high pre-pandemic support countries, there might have been fertility declines if the NPIs were not implemented—although much less so than in low welfare support countries. Given already strong public support, NPIs likely had a smaller "direct" role both in causing and in mitigating fertility declines—with the exception of health-related NPIs in Western and Northern Europe. But especially in high pre-pandemic support countries, births might have become a positive reframing mechanism, signaling a return to normalcy. Such an argument is supported by the larger positive association of the one-month lag of containment NPIs than in low pre-pandemic support countries.

Clearly, there are caveats to this article. First, differences in data availability between countries—or rather, groups of countries—might have biased our results. The Anglo-Saxon countries (especially Canada, New Zealand, the United Kingdom, and though less the United States) as well as Poland and Iceland (and though less Japan, Czechia, and Norway) were observed for fewer months than the other countries (see Table 2). It can be expected that the length of observation periods is correlated with fertility responses and NPI implementation rates. For instance, the months of the first pandemic wave were usually those with the largest drops in CBRs and those with rather extensive NPI implementation rates. The question then is if changes in excess CBRs over pandemic months reflect changes in NPI implementation strategies or if the association between NPIs and excess CBRs changed over the pandemic months. In the latter case differences in data availability would lead to differences in the obtained coefficients. For instance, one might expect that the uncertainty induced by containment NPIs was stronger in the first pandemic months and that people developed coping strategies that decreased disturbance from those NPIs in later pandemic waves (Toffolutti et al. 2022). In this case, NPI-induced fertility responses might be larger for countries with smaller observation periods, resulting in larger obtained coefficients—for both containment and mitigating health-related and economic support NPIs—than if more data were observed. We however find nonsignificant coefficients in Anglo-Saxon countries (those with shortest observation periods) and northern European countries (at least for containment and economic support NPIs, for which the implementation rates were high in the first pandemic wave). In addition, 17 of the 25 countries in our analysis were observed 10 or 11 months, while three were observed eight months and only five have shorter observation periods. For these two reasons, we are confident that differences in data availability is only a minor concern for the reliability of our results.

Second, observed differences in the fertility dynamics of countries and country-groups during the pandemic might have been driven by differences in the overall severity of the pandemic, which might correlate with both CBRs and differences in pre-pandemic public support (e.g., due to different investment in health and pandemic preparedness) and thus with NPI implementation rates. In our model, we have controlled for excess deaths, which certainly eases this concern. We found that a 10 percent excess death was associated, on average, with an excess CBR of –0.57 percent (see Figure B1 in Appendix B.1 in the Supporting Information). When considering the actual mean excess deaths by month in our data (8.5 percent), the mean magnitude of the association of excess deaths with excess CBRs was –0.48 percent excess CBRs per month. Though this represents a considerable decline of fertility and would account for over a quarter of the average decrease in excess CBRs during the pandemic across country-months (–1.6 percent), it is still of a rather small magnitude when compared to those of the implemented NPIs (see Figures 4–6).

Third, we are not able to consider all such potential confounding factors. Social organization in terms of social trust and family ties differs across countries, and we know that social networks are an important driver of fertility (Madhavan et al. 2003; Bernardi and Klaerner 2014; Lois and Arránz Becker 2014; Lois 2016). At the same time, social organization might be connected to the institutional landscape and thus the NPI implementation strategy of a country. Countries also differ in the organization of the labor market. For instance, countries varied in the way they enabled home office work schemes, which in turn relates to the way labor markets are organized, and ultimately, relates to gender equality and parental work–life balance, both important drivers of fertility (McDonald 2000b, 200ba, 2013; Goldscheider et al. 2015; Esping-Andersen and Billari 2015). Such features may also relate to NPI implementation rates. Our analysis partly addresses this by using as an outcome variable excess CBRs. That means, we are considering how fertility deviated from the country-specific estimated trend during the pandemic "shock," thus in part accounting for factors responsible for those trends.

Our estimates do, however, not offer a causal interpretation. As we have alluded to, public support may very well correlate with family ties, social trust, or gender equality, all important drivers for fertility. These cultural factors do not only induce spurious correlations but likely are crucial *mediators* for how NPIs affected fertility. Thus, even if observed, we could not easily control for them in our models. For instance, containment NPIs affected gender equality (Carli 2020), which in turn might have affected fertility during the pandemic.

Fourth, as mentioned before, these cultural factors might also be crucial *moderators* for the NPI–fertility relationship. Our analysis classifies countries in groups by which we assess differences in the NPI–CBR relationship. As we show, this classification reflects the countries' pre-pandemic welfare support. We cannot in any way isolate the moderating role played by welfare spending alone as opposed to cultural, social, and demographic factors. Instead, countries histories of welfare support, and the corresponding need for NPIs and citizens expectations, should be seen as *one* potential explanation of moderation for the NPI–fertility relationship. But, as we mentioned before, the country-groups and the welfare regimes they represent, reflect more than the actual welfare provided: countries with histories of high welfare support, are typically leaning toward greater gender equality and weaker family ties, both (besides citizens' expectations) contributing to maintain fertility during the pandemic.

Future research should address these limitations. But scholars and policy-makers should also consider the fact that institutions and welfare philosophies can themselves be shaped by the pandemic. There could be a change of approach from mitigation toward prevention and resilience. This resonates with our finding that in those countries with already high pre-pandemic welfare support, containment NPIs seem to have been less disruptive, and health and economic support less beneficial for fertility. In a similar vein, culture could also be permanently affected by the pandemic: disrupted social networks may not return to the way they were prior to the pandemic, or, fathers spending more time at home through lockdowns and new flexible work schemes may give rise to persistent changes in gender roles and the division of tasks within the household. In the same vein as welfare provision and citizens' expectations moderated the NPI–fertility relationship, cultural and institutional change arising from this pandemic will shape the way future crises and disruptions will affect fertility.

Acknowledgments

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Data Availability Statement

All data used in our analyses are publicly available at the given sources.

Notes

1 We adjust data from Finland for March to September 2021 (Statistics Finland, 2022).

2 We explored whether lags of other NPI indices and of other timings than the one-month lag of the containment index increased the model fit. Using *F*-tests, we fail to reject that other lags and leads are equal to 0.

3 The "default" standard error estimator is used after conducting a post-estimation analysis in which the homoskedasticity assumption was not rejected by the Breusch–Pagan and White test on our models, except for the model for the seven regions in which only the Breusch–Pagan test rejects homoskedasticity.

4 This exclusion of Anglo-Saxon countries, however, does not change the overall findings and conclusions from the analysis compared to when including them in the low public support group (as suggested by the formal cluster analysis). For a replication of our findings with inclusion of Anglo-Saxon countries in the low support group, see Figure A3 in Appendix A.1 and Figure B1 in Appendix B.1 (in the Supporting Information).

5 Looking at adjusted R^2 for the six regressions of, respectively, public spending for family, health, and unemployment support on dummy variables for, respectively, low versus high pre-pandemic support groups (0.68, 0.37, 0.64) and the seven regions (0.71, 0.35, 0.67), we find that the largest differences between countries in their histories of public support are between the two groups of low versus high spending; but some additional variation is still explained by the grouping into seven groups.

6 The correlation coefficients between this institutional trust measure and public social expenditure in the three areas are 0.74 for family support, 0.37 for health support, and 0.61 for unemployment support. The coefficients from three univariate OLS regression models are all significant at the 1 percent level, while a multivariate regression yields significant coefficients only for health and unemployment support (both at 1 percent level).

7 Looking at adjusted R^2 for the six regressions of, respectively, containment, health-related, and economic support NPIs on dummy variables for, respectively, low versus high pre-pandemic support (0.00, 0.01, 0.04) and the seven regions (0.18, 0.15, 0.05), we find that actually not all that much of the variance in NPI implementation rates between countries can be explained by these country groups.

8 The linear trend was preferred in Belgium, Denmark, Latvia, New Zealand, Nor-

way, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States; the quadratic one in Czechia, the Netherlands, and South Korea; and the cubic one in Austria, Canada, Finland, France, Germany, Hungary, Iceland, Italy, Japan, Poland, and Portugal.

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