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Fertility declines near the end of the COVID-19 pandemic: Evidence of the 2022 birth declines in Germany and Sweden

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Fertility declines near the end of the COVID-19 pandemic: Evidence of the 2022 birth declines in Germany and Sweden

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Abstract

Following the onset of the COVID-19 pandemic, several countries faced short-term fertility declines in 2020 and 2021, a development which did not materialize in Scandinavian and German-speaking countries. However, more recent birth statistics show a steep fertility decline in the aftermath of the pandemic in 2022. We aim to provide data on the unexpected birth decline in 2022 in Germany and Sweden and relate these data to pandemic-related contextual developments which could have influenced the post-pandemic fertility development. We rely on monthly birth statistics and present seasonally adjusted monthly Total Fertility Rates (TFR) for Germany and Sweden. We relate the nine-months lagged fertility rates to contextual developments regarding COVID-19 mortality and morbidity, unemployment rates, and COVID-19 vaccinations.

The seasonally adjusted monthly TFR of Germany dropped from 1.5-1.6 in 2021 to 1.3-1.4 in 2022, a decline of about 14 %. In Sweden, the corresponding TFR dropped from about 1.7 in 2021 to 1.5-1.6 in 2022, a decline of almost 10 %. There is no association of the fertility trends with changes in unemployment, infection rates, or COVID-19 deaths. However, there is a strong association between the onset of vaccination programmes and the fertility decline nine months after of this onset. The fertility decline in the first months of 2022 in Germany and Sweden is remarkable. Common explanations of fertility change during the pandemic do not apply in its aftermath. The association between the onset of mass vaccinations and subsequent fertility decline indicates that people adjusted their behaviour to get vaccinated before becoming pregnant, as societies were opening up with post-pandemic life conditions. Our study provides novel information on fertility declines in countries previously not affected by any COVID-19 baby bust. We provide a first appraisal of the COVID-19-fertility nexus in the immediate aftermath of the pandemic.

Keywords

Fertility, birth decline, COVID-19, economic uncertainty, vaccination, fertility plans

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1. Introduction

With the onset of the COVID-19 pandemic many scholars expected the pandemic to have a negative impact on fertility developments (Aassve et al., 2020; Berrington et al., 2022b). Two main mechanisms were assumed to be at play: the direct impact of the health crisis and the indirect impact of pandemic-induced economic uncertainties on fertility plans. Current knowledge on the influence of the COVID-19 pandemic on fertility patterns is mixed and findings vary between countries and the timing of infection waves, shutdown policies, and pre-existing fertility changes. For several high-income countries, monthly birth counts declined between November 2020 and January 2021, i.e., nine months after the onset of the pandemic during March to May 2020. The declines were particularly strong in southern Europe (Aassve et al., 2021; Sobotka et al., 2021) and occurred with considerable within-country heterogeneity (Arpino, Luppi, and Rosina, 2021). In Spain, the monthly Total Fertility Rate (TFR) declined with some 20 % to a level below 1.0 in December 2022 (Cozzani et al., 2022), the sharpest drop observed in Europe (Sobotka et al., 2021). Fertility declines during the transition from 2020 to 2021 were also observed for Japan (Ghaznavi et al., 2022), the United States (Gromski et al., 2020; Hamilton, Martin, and Osterman, 2021) and the United Kingdom (Berrington et al., 2022a).

However, in Scandinavian and German-speaking countries the fertility patterns were somewhat different. In Sweden (Neyer et al., 2022), Norway (Lappegård et al., 2022), Finland (Nisén et al., 2022), and Germany (Pötzsch, 2021), there was no visible fertility decline in late 2020 or early 2021. In contrast, these countries even experienced minor increases in their monthly fertility rates in early 2021 as well as during the autumn of the same year. Explanations to the positive fertility trends during the course of the COVID-19 pandemic range from the less severe mortality impacts than in many other contexts to the buffering role of protective social policies and swiftly introduced economic-support programmes during the early phases of the pandemic. The role of uncertainty regarding job markets and household finances for fertility considerations (Tavares, Azevedo, and Arpino, 2022) became less pressing than anticipated at the very onset of the pandemic.

However, in the immediate aftermath of the pandemic, monthly fertility data from Sweden and Germany show a strong fertility decline in early 2022, with about 10 to 15 % less births, respectively, than what was observed during the same period the previous year. This poses questions on the role of previously suggested mechanisms for pandemic-related fertility change, such as the role of health-related or economic-centred factors in recent fertility change. It also brings factors related to the perceived cessation of the pandemic to our attention, as reflected in the onset of broad-based vaccination programmes directed at the population at reproductive and economically active ages. The first vaccines were made available already at the very end of 2020 and were initially aimed at specific groups of employees in the healthcare system, at older people, and those with an underlying health condition. The vaccination programmes were later expanded to cover the general population and in most European countries vaccination intensities reached its peak during the spring and

summer of 2021 (Antonini et al., 2022). If there is an impact of these interventions on childbearing behaviour, it should be observed from the turn of 2021 to 2022 and onwards.

The current study aims to describe the fertility-trend change that occurred in Germany and Sweden during early 2022 by presenting statistics on monthly live births and seasonally adjusted monthly TFR prior to and during the course of the pandemic. Further, we compare our monthly fertility indicators with contextually relevant developments for a few pandemic-related factors, including the onset of broad-based vaccination programmes in the two countries we study. We expect our contribution to be helpful for future research when developing new hypotheses on the different factors that may contribute to family-related change as societies exit from their pandemic-driven circumstances.

2. Four relevant influences of the COVID-19 pandemic on childbearing behaviour

The most obvious influence of the COVID-19 pandemic on fertility trends is through different factors that relate to the **health crisis** as such. For example, evidence from previous global pandemics indicate that fertility declined after the H1N1 'Spanish Flu' of 1918-19 in Britain (Reid, 2005), Japan (Chandra and Yu, 2015), and the United States (Chandra et al., 2018). The fertility decline in US cities was about 20 % nine months after the peak of that pandemic but recovered where public health interventions were implemented (Wagner et al., 2020). However, these historical experiences cannot be transferred directly to the contemporary situation as healthcare and economic welfare systems are now much more developed than a century ago. Also, the Spanish Flu mainly had an impact on persons at childbearing and economically active ages (Reid, 2005) while COVID-19 mortality and morbidity have had the strongest impact on people at more advanced ages (Bonanad et al., 2020; Kolk et al., 2022). However, the healthcare system was partly overstrained also during the COVID-19 pandemic, resulting in reduced support in patient fertility care for assisted reproductive procedures and for birth clinics in general (DSouza et al., 2022).

The impact of **economic crises** as triggered by the global pandemic, and the perception of economic uncertainty during the course of the pandemic, is another mechanism that could relate to reduced fertility intentions and childbearing behaviour. A negative relation between employment instability, aggregate unemployment, and fertility is well-known (Adsera, 2011; Albeitawi et al., 2022). The Great Recession in Europe during 2007-2008 was negatively related to subsequent fertility trends; however, with considerable differences by age, birth parity, and regions in Europe (Goldstein et al., 2013). Higher levels of unemployment at the regional level seem to be negatively related to fertility trends (Matysiak, Sobotka, and Vignoli, 2021) and cohort fertility (Bujard and Scheller, 2017). However, subjective indicators such as individuals' perceptions of economic uncertainty may often matter more for couples' fertility decisions than their actual economic situation (Comolli et al., 2021; Kreyenfeld, 2016; Vignoli et al., 2020).

While the health crisis and different aspects of pandemic-induced economic uncertainty are expected to bring negative influences on fertility, there could also be a positive influence from the life circumstances during the pandemic that could be labelled a **cocooning effect**. There was huge heterogeneity in families' experiences and life circumstances while social distancing policies and other interventions were in effect in people's lives during the pandemic, but sometimes these may have led to a more family-oriented life situation (Ahmed, Buheji, and Fardan, 2020). Increased time by parents to care for their children and, in the case of Germany, for home-schooling were often challenging but sometimes also provided opportunities for more value-based behaviour (Szabo et al., 2020). Partners may have had more time to talk about their fertility plans and perhaps more opportunity for sexual intercourse (Berrington et al., 2022a). An increased attention to the value of children (Hoffman and Hoffman, 1973) and more time for couple interaction may for some have resulted in stronger childbearing intentions.

The mechanisms behind the onset of large-scale **vaccination programmes** on fertility have not yet been analysed. These programmes mark the ending of the pervasiveness of the global pandemic on people's lives and the life situation that had prevailed during the pandemic. They signalled a return to the less family- and home-centred life situation that prevailed before the onset of the pandemic. Another factor could be that any perceived fear that the COVID-19 vaccine had a negative impact on women and men's fecundity, which in some cases was labelled a "major cause of vaccine hesitancy" (Diaz et al., 2022), affected childbearing considerations. Further, the official recommendation to get vaccinated during pregnancy was initially hesitant but later changed during the course of vaccination programmes. Since the vaccination uptake for pregnant women was lower than for the general population (Januszek et al., 2021), unvaccinated women possibly could have postponed their fertility plans to after getting vaccinated.

3. Data and methods

Monthly data on live births in Germany during 2000 to 2021 were drawn from the German birth register (Statistisches Bundesamt, 2022b). For 2022, we use preliminary data on live births, by birth month, which differ somewhat from statistically recorded notifications of births (Statistisches Bundesamt, 2022a). We estimated monthly Total Fertility Rates (TFR) based on annual TFRs, monthly fertility data and population exposures (Jdanov et al., 2022). Since monthly changes in the population exposure are rather small and estimations for monthly TFR are strongly influenced by seasonal patterns of fertility fluctuation, we adjusted for seasonal effects.

Swedish data on live births stem from the country's population register and are available at Statistics Sweden (Statistics Sweden, 2022a). Statistics Sweden also produces time series of monthly TFR, including seasonally adjusted series of such fertility rates. The procedures for

this are the same as in Germany, but the seasonality patterns looks slightly different in Sweden than in Germany (Dahlberg and Andersson, 2018).

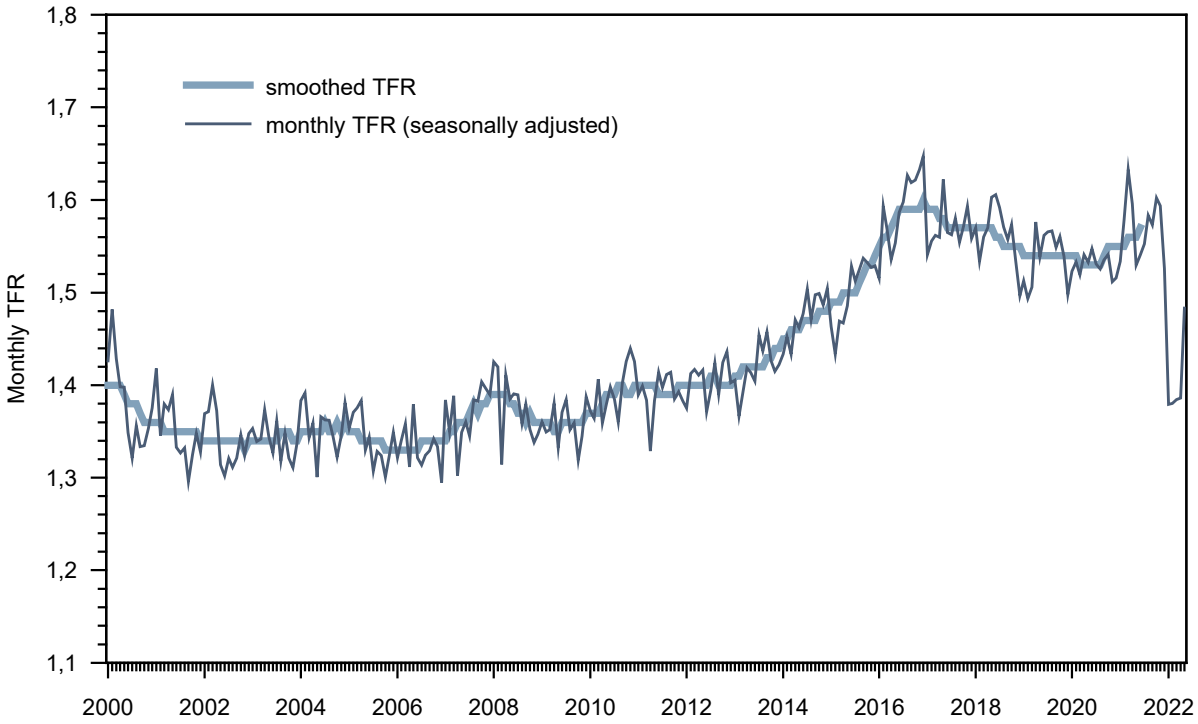
In our presentation, we also relate the developments in birth statistics with monthly data on a few relevant contextual indicators which we observe nine months before the childbirths we cover. With regard to the health crisis we consider the number of COVID-19 related deaths in Germany and Sweden and the seven-day infection incidence in Germany (Robert Koch-Institute, 2022a). Regarding economic factors we consider the monthly unemployment rates in Germany and Sweden and, for Germany, the number of employees taking short-work benefits ("Kurzarbeit"). The latter programme helped employees not become unemployed and can be seen as an indicator of the degree of job insecurity during the course of the pandemic (Bundesagentur für Arbeit, 2022). As a third contextual factor we consider the vaccination programmes and its interventions with a first, second, and third vaccination event in Germany (Robert Koch-Institute, 2022b) and any vaccination in Sweden (Public Health Authority Sweden, 2022).

4. Results

4.1. Fertility developments in relation to previous trends: Monthly TFRs in Germany and Sweden in the 21st century

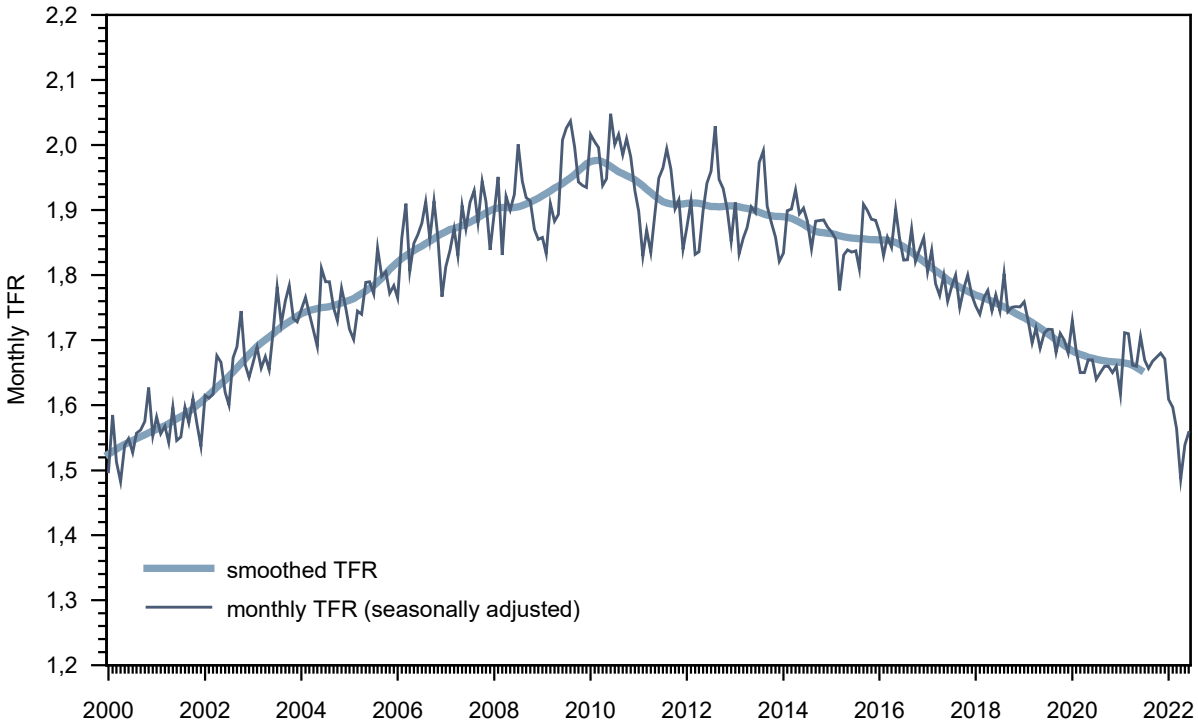
Between the years 2000 and 2014 Germany's seasonally adjusted TFR was constantly hovering at a level between 1.3 and 1.5 children per woman (Figure 1). From 2015 to 2021 it was on an upward trend from a (seasonally adjusted) TFR level of about 1.5 to that of about 1.7, and peaked in December 2016 at a level of 1.65. Another peak occurred during the COVID-19 pandemic in March and October 2021 with a TFR level of above 1.60. However, in the first months of 2022 there was an abrupt decline in birth rates so that the seasonally adjusted TFR reached a level of 1.38 in February 2022, 1.38 in March 2022, 1.39 in April 2022, and 1.48 in May 2022 (without seasonally adjustment: 1.26, 1.35, 1.31, and 1.49).

Figure 1: Estimated monthly Total Fertility Rate (TFR) for Germany, 2000-2022



Note: The TFR is seasonally adjusted.
Source: Own calculations based on Germany's birth statistics.

Figure 2: Monthly Total Fertility Rate (TFR) for Sweden, 2000-2022



Note: The TFR is seasonally adjusted.
Source: Own smoothing of monthly TFR data produced by Statistics Sweden.

The TFR trends in Sweden during the first two decades of the new century were markedly different from those in Germany: Sweden's TFRs first increased during the first decade of the 21st century, then declined during its second decade. The initial increase amounted to a recuperation of the depressed fertility and postponed childbearing that occurred during the 1990s. The latter decline coincided with fertility declines in other countries in Northern and Western Europe as well as in the Anglo-Saxon countries. It was driven by declines in first-birth rates of women and men in couples (Ohlsson-Wijk and Andersson, 2022). However, the fertility patterns during the COVID-19 pandemic were largely similar to those in Germany. During the pandemic, the previous fertility decline came to a halt and Sweden's TFR hovered at a seasonally adjusted level of 1.65-1.71. As in Germany, it subsequently showed a drastic decline in its monthly TFR when the pandemic came to a halt: During the first months of 2022 the Swedish TFR fell to a markedly depressed level of around 1.5-1.6.

4.2. Changes in the number of live births per month during the course of the COVID-19 pandemic

In contrast to many other European countries, Germany experienced no birth decline in the first months of 2021. There was even a small increase of about 2.9 % in the total number of births in 2021 as compared to the previous year; the increase was particularly pronounced during February and March and during October to December 2021. In contrast, the subsequent decline in the number of births during February and March 2022 was 14.3 % and 13.7 % as compared to the same months in 2021; when compared to the five-year average of 2016-2020, the corresponding decline was between 8.2 and 11.1 % in the first four months of 2022 (Table 1).

Table 1: Trends in the number of births in Germany, by month in 2021-22

	Live births 2021	Live births 2022	Change 2021 / 2020	Change 2022 / 2021	Change 2021 / mean 2016-20	Change 2022 / mean 2016-20
Jan	59,799	57,853	-6.14%	-3.25%	-6.16%	-8.24%
Feb	61,841	53,003	5.35%	-14.29%	5.38%	-10.25%
Mar	65,903	56,860	5.90%	-13.72%	4.90%	-10.26%
Apr	62,538	55,243	2.12%	-11.66%	1.69%	-11.10%
May	64,848	62,794	0.22%	-3.17%	-1.57%	-4.09%
Jun	65,690		-0.64%		-1.68%	
Jul	72,030		1.36%		-0.55%	
Aug	71,485		2.57%		0.02%	
Sep	71,084		2.34%		1.14%	
Oct	68,990		4.50%		2.96%	
Nov	63,382		6.52%		3.72%	
Dec	67,927		11.88%		10.58%	

Source: Own calculations based on Germany's birth statistic, 2018-21: Statistisches Bundesamt (2022b), 2022: Statistisches Bundesamt (2022a).

The patterns of monthly increases and subsequent declines in the number of births in Sweden in 2021 and 2022 were very similar to those observed for Germany. The declines in the number of live births in early 2022 were also impressive, but somewhat weaker than the relative declines observed for Germany.

Table 2: Trends in the number of births in Sweden, by month in 2021-22

	Live births 2021	Live births 2022	Change 2021 / 2020	Change 2022 / 2021	Change 2021 / mean 2016-20	Change 2022 / mean 2016-20
Jan	9,071	8,919	-6.26%	-1.68%	-5.20%	-6.79%
Feb	8,989	8,545	0.39%	-4.94%	-0.02%	-4.96%
Mar	10,067	9,194	4.36%	-8.67%	1.12%	-7.65%
Apr	9,823	8,809	1.13%	-10.32%	-1.92%	-12.05%
May	10,322	9,572	-0.83%	-7.27%	-1.72%	-8.86%
Jun	10,216		3.43%		1.75%	
Jul	10,325		2.04%		-0.69%	
Aug	10,082		1.24%		-0.94%	
Sep	9,419		1.03%		-1.60%	
Oct	9,316		1.55%		-0.20%	
Nov	8,492		3.64%		0.40%	
Dec	8,141		1.34%		-1.22%	

Source: Calculations based on data from Statistics Sweden (2022a).

4.3. Fertility change in the context of health crises, economic hardship, and vaccination programmes

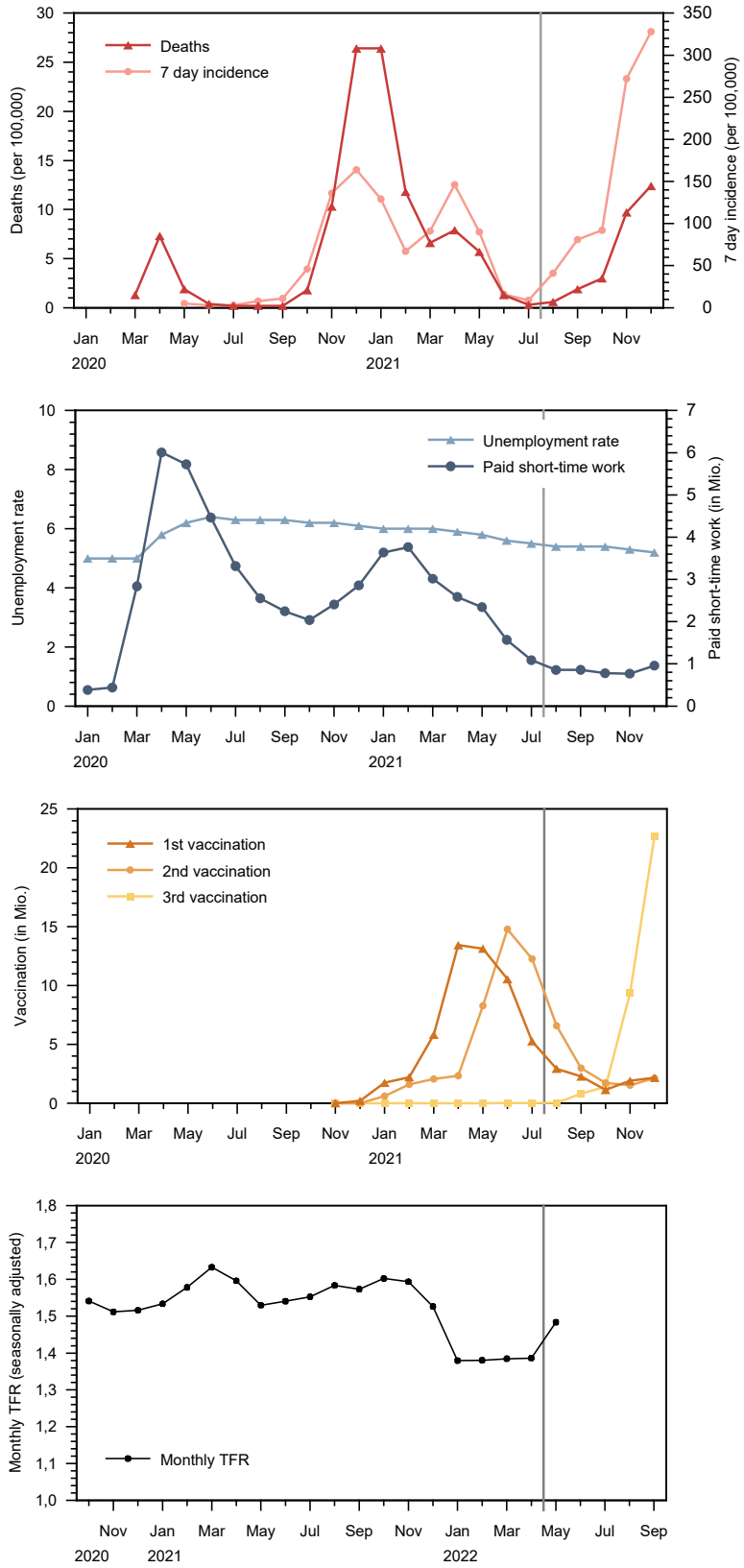
In this section, we relate the monthly fertility patterns in Germany and Sweden during and in the immediate aftermath of the pandemic to a few crucial contextual developments which we lag with nine months in relation to our birth data (cf. Figure 3 for Germany; Figure 4 for Sweden). In Germany, the peaks of COVID-19 related mortality occurred during April 2020 and December 2020 to January 2021. There was also a third wave of COVID-19 deaths towards the end of 2021. In Sweden the first two peaks occurred at rather similar times: during April-May 2020 and November-December 2020 to January 2021, but with a much stronger first wave of COVID-19 mortality than in Germany. In contrast, towards the end of 2021 Sweden had very low COVID-19 mortality. Nine months after the first two peaks of COVID-19 mortality, we observe no fertility declines. Actually, nine months before the fertility decline in early 2022, i.e., during April to July 2021, the number of COVID-19 deaths and the incidences of COVID-19 infections were fairly low in both countries.

In addition, in Germany the unemployment rate was increasing slightly in April and May 2020, and in these months the number of paid short time workers in Germany also reached its peak with more than 6 million employees in *Kurzarbeit*. Nine months after this peak in labour market volatility there was no fertility decline. A similar lack of a clear relationship between unemployment rates and subsequent fertility is observed for Sweden. Swedish unemployment peaked towards the end of the pandemic with elevated unemployment levels in January to

June 2021, which corresponds to periods nine months later that coincides with the time both before and after the fertility decline of interest. It also corresponds to periods both before and during the process of mass vaccinations in Sweden. Later on, unemployment levels declined as Swedish society opened up with a labour force of vaccinated workers.

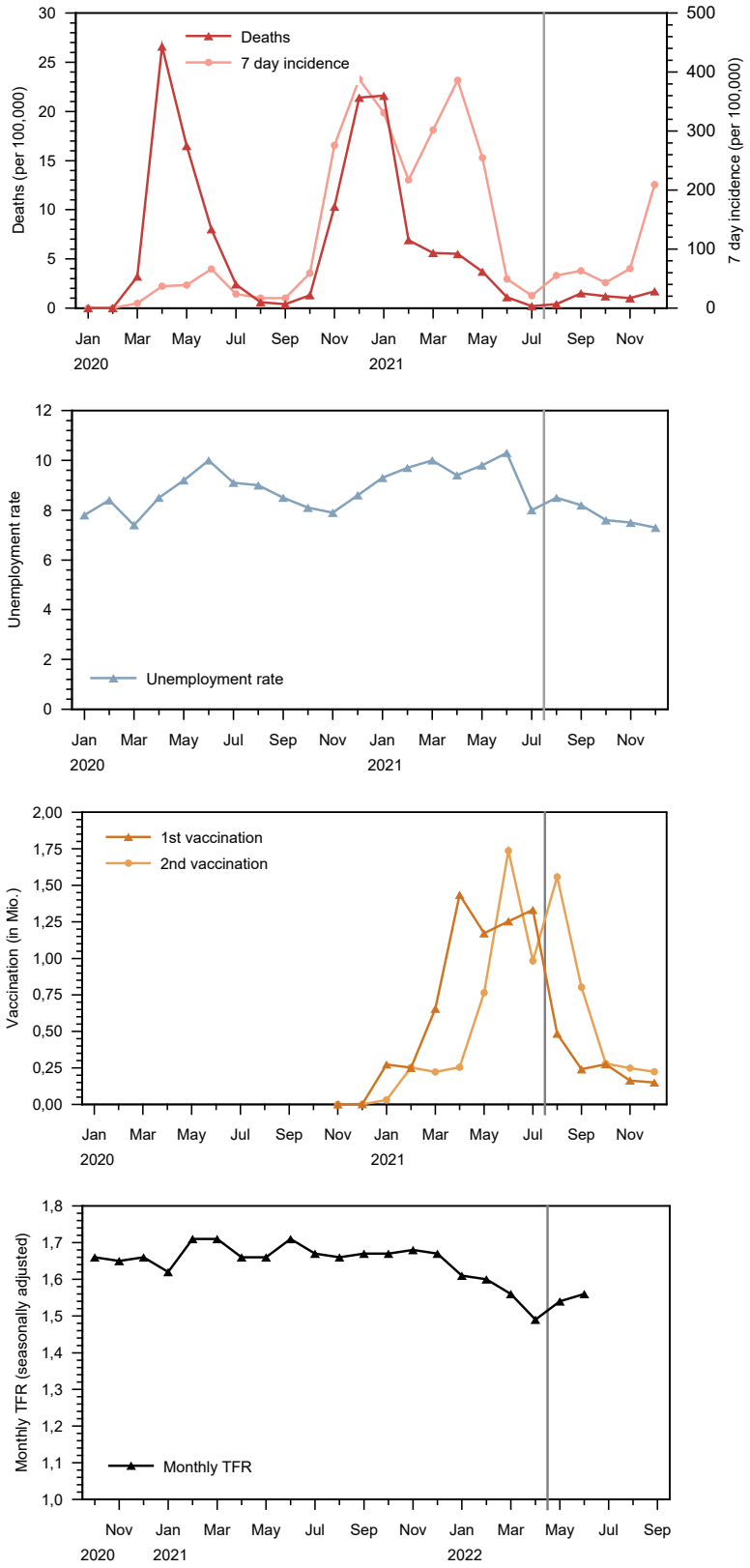
In contrast, there is a clear correlation between the onset of vaccination programmes and fertility declines that occurred nine months later. In Germany as well as in Sweden, the vaccination campaigns with mass enrolments for a first vaccination reached its peak in April, May, and June 2021, followed by a wave of second vaccinations with its peak between May and August the same year. (Two vaccinations were considered being fully vaccinated.) The implementations of these programmes in both Germany and Sweden coincide very well with a distinct change in fertility levels exactly nine months later. The fertility rates remained at a reduced level during the entire first half of 2022.

Figure 3: COVID-19 measures, employment, and vaccinations in 2020-21 in Germany and lagged TFRs for 2020-2022



Source: Own diagram, data on deaths and incidences based on Robert Koch-Institute (2022a), data on paid short-time work and unemployment based on Bundesagentur für Arbeit (2022), data on vaccinations based on Robert Koch-Institute (2022b).

Figure 4: COVID-19 measures, unemployment, and vaccinations in 2020-21 in Sweden and lagged TFRs for 2020-2022



Source: Own diagram, 7 day incidence and vaccinations is calculated based on data available at Ritchie et al. (2022), data on deaths from the Swedish National Board of Health and Welfare (2022), data on unemployment from Statistics Sweden's Labour-force Surveys (Statistics Sweden, 2022b).

Analyses based on Swedish data reveal that the decline in fertility during early 2022 was confined to several birth orders, including those of second and third births (Lundkvist, 2022). The latter trend change makes a reversal of the situation during the pandemic itself when parents of one and two children sometimes took the opportunity to speed up their childbearing with the arrival of a next, already planned child (Neyer et al., 2022). To speed up continued childbearing during a situation when many parents were confined to their homes could sometimes be a rational use of parenting time. This would amount to a version of the cocooning effect in childbearing behaviour that we discussed in Section 2. When societies during 2021 opened up again, this cocooning effect was no longer at play. Taken together, the observations of parity-specific fertility changes during 2021-2022 suggest that a large part of the post-pandemic fertility change can be ascribed to behavioural changes in reaction to societies opening up to less home-centred life circumstances than those prevailing during the pandemic.

However, there could initially also have been a more direct role of the vaccination programmes as such on childbearing considerations. During the course of vaccination programmes, recommendations for pregnant women changed in the light of increasing evidence of the security of vaccines for pregnant women. In January 2021, there was no official recommendation for the vaccination of pregnant women by the permanent vaccination commission of Germany (Robert Koch Institute, 2021a). It lasted until September 23rd the same year when this commission gave an explicit recommendation for pregnant women to get vaccinated against COVID-19 and labelled them as an "explicit target group" (Robert Koch Institute, 2021b). The lack of initial recommendations could have propelled some prospective mothers to postpone childbearing until after getting a vaccination for themselves.

5. Discussion

This study has demonstrated a remarkably strong and very sudden drop in fertility in Germany and Sweden in the first months of 2022. The number of live births dropped by some 15 % in Germany and close to 10 % in Sweden, as compared to the fertility levels in previous years. The fertility decline was very different from the slower pace of change that usually characterize fertility developments. It happened as societies were to open up after two years of COVID-19 related restrictions on people's lives. More precisely, the fertility decline occurred some nine months after the implementation of broad-based vaccination programmes for the general population in Germany and Sweden. In the wake of these interventions, the seasonally adjusted monthly TFR of Germany dropped from a level during 2016-2021 of 1.5-1.6 children per woman to a lowest-low fertility level of 1.3-1.4. In Sweden the decline occurred from a slightly higher level of departure but with a similar direction and magnitude. These declines are remarkable for two reasons: First, Germany and Sweden are countries that experienced no fertility decline during the course of the pandemic itself, in 2020 and 2021. Second, both countries reached fertility levels that were lower than what had been experienced for many years.

Other well-known explanations of fertility change during the course of the pandemic, such as the impact of health-related and economic factors seem not to be associated with the timing of fertility decline in 2022. Based on the descriptive associations presented in this study, we interpret the post-pandemic change in childbearing behaviour as a reaction to the changes in life circumstances that were anticipated as societies were to open up to non-pandemic conditions. In some cases, there may have been a more direct effect of the vaccination programme as such, as some prospective parents may have postponed a decision to have another child until after securing a vaccination for themselves.

There are several limitations of our study. The data for Germany are still preliminary and may be corrected later. However, such corrections will not change the extent of fertility decline in any substantial manner. The estimation of monthly TFRs and the seasonal adjustments that we apply also depend on assumptions of seasonal patterns that may be challenged. The biggest limitation is that our interpretations are based on descriptive associations that do not account for the many individual-level characteristics and other contextual factors that may also be at play. Further research based on individual-level data will provide better insight into the nature of the observed fertility decline, when such data are available. It will, for example, be crucial to find out whether the fertility decline occurred with equal force for parents and non-parents alike, and whether different socio-economic groups contributed to the same extent to changes in behaviour that we have observed in this study.

This study still provides valuable data and insight on a new and entirely unanticipated fertility development in the context of the COVID-19 pandemic. It remains to be seen whether these developments are of a short-term nature and how fast fertility trends in Germany and Sweden will return to their pre-pandemic patterns, which for Germany was running in an upward direction and for Sweden with a downward trend.

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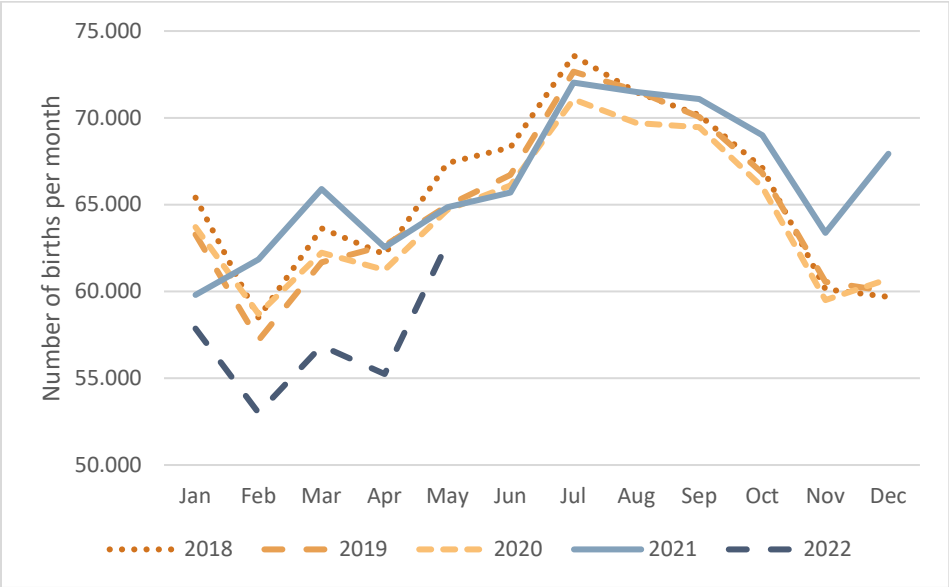
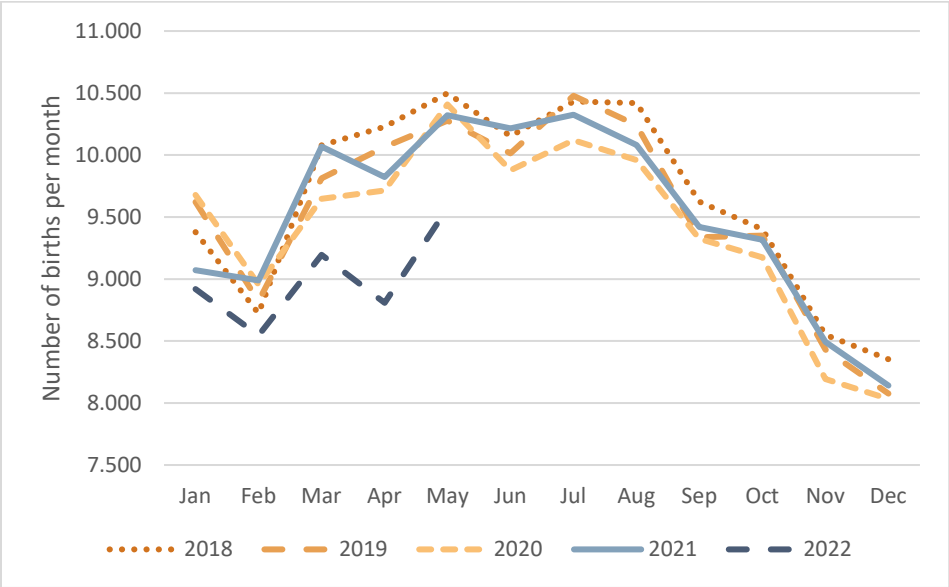
Appendix

Figure A1: Trends in the number of births in Germany, by month in 2018-2022



Source: Own calculations based on Germany's birth statistic, 2018-21: Statistisches Bundesamt (2022b), 2022: Statistisches Bundesamt (2022a).

Figure A2: Trends in the number of births in Sweden, by month in 2018-2022



Source: Statistics Sweden (2022a), Statistikdatabasen.