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Jessica Nisén
Marika Jalovaara
Anna Rotkirch
Mika Gissler

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Title: Fertility recovery despite the COVID-19 pandemic in Finland?

Jessica Nisén[1,2*], Marika Jalovaara[1], Anna Rotkirch[3], Mika Gissler[1, 4, 5]

1 Invest Research Flagship and University of Turku, Finland

2 Max Planck Institute for Demographic Research, Germany

3 Population Research Institute, Väestöliitto, Finland

4 Finnish Institute for Health and Welfare, Finland

5 Karolinska Institutet, Sweden

*Corresponding author
Address: Jessica Nisén, Publicum (Room: 461), Assistentinkatu 7, 20500 Turku, Finland
E-mail: jessica.nisen(at)utu.fi

Abstract: Finland's increase in births, recorded in the months following the first two waves of the COVID-19 pandemic, was among the strongest. We assess whether the fertility increase in Finland occurred because of or despite the pandemic, or both, by investigating the country's fertility trends by women's region of residence, age group, and parity. While the country as a whole was modestly hit by the pandemic in 2020, the capital region Helsinki-Uusimaa faced more severe restrictions. We used aggregate register data until September 2021 to assess monthly fertility. In 2020 and 2021, the relative annual increases in fertility were strongest among women aged 30–34 and 35–49. In 2021, but not in 2020, fertility increased most in Helsinki-Uusimaa, and across all parities. Model-based estimates provided tentative support for an overall pandemic fertility boost for the time period until September 2019. We conclude that the unusual fertility increases in 2021 in Finland broadly follow from pre-existing trends where the country recovers from its all-time low fertility, but do not exclude the possibility of an additional boost from the pandemic itself. The study highlights the importance of carefully considering existing fertility trends when studying fertility responses to the pandemic.

Keywords: fertility, age-specific fertility, TFR, region, COVID-19, Finland

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Introduction

The decade-long strong fertility decline in Finland came to a halt in 2020, after the total fertility rate (TFR) had reached its all-time low of 1.35 children per woman in 2019 (Official Statisics of Finland 2021). The 28 per cent decline in TFR from 2010 to 2019 was remarkable and unexpected, and the recovery in 2020 to 1.37 negligible, yet notable in marking the end of the continuous decline since 2010. Given these prolonged low levels of period fertility, completed cohort fertility in Finland will also be subject to strong declines (Hellstrand, Nisén, and Myrskylä 2020). The fertility decline in Finland is not unique, since the 2010s were characterized by declines in period fertility across the Nordic countries (Hellstrand et al. 2020), as well as in several other high-income countries with traditionally relatively high fertility, such as the US, the UK, France, and the Netherlands (Human Fertility Database 2022b). The decline in the last decade was, however, the strongest in Finland, closely followed by Iceland and Norway. At the same time, Finland was also the country reporting among the strongest increases in births nine months following the onset of the COVID-19 pandemic in March, 2020 (Sobotka, Jasilioniene, Galarza, et al. 2021).[1] This background makes Finland a particularly interesting case study in which to observe fertility trends during the COVID-19 pandemic. Given the prolonged decline in fertility levels in the preceding decade, there are expectations for recuperation of fertility in the near future (Hellstrand et al. 2021; Nisén et al. 2020). At the same time, the pandemic is theorized to affect fertility rates as well (Aassve et al. 2020; Berrington et al. 2022; Ullah et al. 2020). Period fertility can be affected by both long-term trends (e.g., postponement of childbearing to older ages) and short-term events (onset of a global crisis and its immediate effects on health, economic security, and daily living), which furthermore may affect different demographic groups differently. We may therefore expect period fertility

[1] Among the countries studied by Sobotka, Jasilioniene, Zeman, *et al.* (2021), Finland recorded the strongest increase in births between December 2020 and September 2021. This study did not include Iceland. A study by Nordregio (2022) showed that when comparing the numbers of births from January to September 2021, relative to the same months in the previous year, Iceland (7.8%) shows a slightly higher increase than Finland (7.1%).

during the pandemic to result from multiple factors, some of which may be caused by the pandemic *itself*.

This study aims at providing a first assessment of whether fertility in Finland in late 2020 and early 2021 increased despite or because of the pandemic, or some combination of the two, by investigating the country's fertility trends by women's region of residence, age group, and parity. This has value also given that existing studies on fertility developments during the COVID-19 pandemic have mainly analyzed total numbers of births, thereby overlooking possible population heterogeneity. The current study is based on monthly data from 2015 until September 2021 provided by Statistics Finland, allowing us to cover the fertility response of the first two waves of the COVID-19 pandemic in Finland (THL 2022). We describe fertility developments in the recent years until September 2021, focusing on differences in fertility rates between groups of women of different region of residence, age group, and parity (birth order) and investigate how fertility trends evolved based on the time of conception (estimated from live births) before and after the onset of the pandemic. We discuss our findings in light of societal developments in Finland during the first waves of the pandemic.

Background

COVID-19 and fertility: plausible mechanisms and early evidence

Across countries, the COVID-19 crisis which began in early 2020 has already had a vast array of consequences, including those on demographic processes. The crisis may affect family formation and fertility levels, but potentially in different ways in different societal contexts (Aassve et al. 2020; Ullah et al. 2020). In the context of high-income countries, demographers generally expect fertility levels to be mainly affected through planned pregnancies, reflecting individuals' and couples' opportunities and intentions to have a(nother) child (Berrington et al. 2022; Ullah et al.

2020; Voicu and Bădoi 2021).[2] Therefore, the first effects on fertility can be observed around nine months after the outbreak of the pandemic. Some of the expected processes affecting fertility levels are less immediate and slower, such as those operating via partnership formation and stability, and any consequences of them for fertility can be observed only with a longer delay. It is important to note that any effects of the pandemic intertwine with other factors influencing fertility levels regardless of, but possibly together and in interaction with, the effects of the pandemic.

The evidence from previous health crises (e.g., The Great Famine in Finland in 1866–1868, Spanish Flu in 1918, Zika in 2014–2017) suggests a pattern in which fertility first drops but then recovers, so that the negative effect of an epidemic on fertility remains temporary (Ullah et al. 2020). However, this evidence is largely based on settings in which fertility was high and diseases targeted the young. For instance, the Great Famine in Finland in the late 19th century was accompanied by a temporary drop and a subsequent increase in fertility level, which remained close to five children per woman (Turpeinen 1979). More recently in Brazil – a country with readily low fertility levels – the Zika virus epidemic that started in 2014 resulted in an immediate decline in births (Castro et al. 2018), with potentially limited long-term impact on TFR (Marteleto et al. 2020), despite the severe direct risks of the virus associated with the development of the fetus. Hence, the effects of a pandemic targeting mostly the elderly in the context of wealthy and low-fertility societies remain largely unknown. Generally, the current global crisis is expected to affect fertility levels of high-income countries negatively, at least among young women who have more time to postpone childbearing (Berrington et al. 2022).

Pandemic-induced factors that may affect fertility negatively include economic and employment-related uncertainty, psychological stress, increased work-load for parents of young children, effects

[2] While effects of the COVID-19 virus infection also on male and female reproductive systems have been suggested, the evidence so far is inconclusive (Desai et al. 2022). In the present context, also effects through unplanned pregnancies are possible, but they are likely to play a small role given that unplanned pregnancies to a large extent occur to teenagers and teenage fertility in Finland is at a relatively low level (Vikat et al. 2002).

of the COVID-19 pandemic on own or family members' health and access to healthcare, and difficulties in housing transitions (Aassve, Cavalli, et al. 2021; Berrington et al. 2022; Ullah et al. 2020). Moreover, the effect of increased workload may be mediated by its different impact on women and men (Voicu and Bădoi 2021). Women have commonly faced larger challenges to balance work and family responsibilities during the pandemic than men (Del Boca et al. 2020; Eurofound 2020a), which in turn may weaken further childbearing intentions (Esping-Andersen and Billari 2015; Goldscheider, Bernhardt, and Lappegård 2015). Economic and employment-related uncertainty has also increased more strongly among women than men during the pandemic, given that increases in unemployment have been larger among women (Eurofound 2020a). Moreover, in the case of the COVID-19 pandemic, difficulties to access assisted reproduction may also have immediate negative effects on fertility of the older age groups.

A pioneer study from the US predicted fertility declines as a consequence of the pandemic based on Google searches for unemployment and proximate determinants of fertility (e.g., conception and pregnancy) (Wilde, Chen, and Lohmann 2020). There is partial support from surveys conducted in 2020 for the idea that, those who expected the pandemic to clearly worsen their own economic situation, were also the most likely to give up their childbearing intentions: this was the case in the UK, but not in Germany or Italy. In Germany the regional COVID-19 situation was associated with abandoning intentions to have a child, and in Italy younger women were more likely to do so (Luppi, Arpino, and Rosina 2020). In Poland, decreased financial security and worsened mental well-being during the pandemic were related to declines in childbearing intentions (Malicka, Mynarska, and Świderska 2021). Previous research on fertility responses to economic crises suggest that in economically uncertain times people tend to put their childbearing plans on hold (e.g. Andersson 2000; Goldstein et al. 2013; Sobotka, Skirbekk, and Philipov 2011), with the interesting exception of the economic recession of the 1990s in Finland, when more second and higher order children were born (Vikat 2002 and 2004).

It has also been suggested that the pandemic could have positive effects on fertility levels at least in groups not badly affected by the virus. Lockdowns allow more time at home, which might lead to a strengthened focus on family life and higher relationship quality among couples living together, as well as to a better work–life balance (Berrington et al. 2022). Berrington *et al.* (2022) suggest that the opportunity costs of having a(nother) child may have decreased during the pandemic, for instance due to fewer job opportunities, while on the other hand some couples may have accumulated more financial resources during the lockdowns and travel restrictions to account for the direct costs of having a(nother) child. High mortality could also trigger increased fertility through the so-called "replacement effect", although such an effect is unlikely to be widespread given that the COVID-19 excess mortality is focused in old-age groups (Ullah et al. 2020). The pandemic may also have promoted a psychological re-evaluation of life goals and a desire to 'give life' when faced with illness and death (see e.g. Mathews and Sear 2008), and death of parents and siblings is indeed associated with earlier age at first birth (Berg, Lawson, and Rotkirch 2020).

An early assessment of 22 high-income countries found declines in crude birth rates to be related to the COVID-19 pandemic in seven countries (in further six countries the pandemic effect coefficient was negative, but not statistically significant), indicating a drop in birth rate due to the pandemic beyond the predicted time trend between November 2020 and March 2021 (Aassve, Cavalli, et al. 2021). Many of the high-income countries worst hit by the pandemic (Italy, Spain, Portugal, the United States, France, and Russia) witnessed notable declines in their birth rates during the pandemic, while many other countries showed no significant changes. A more recent study found that while the current pandemic was associated with continued or accelerated declines in numbers of births in most high-income countries between November and February 2021, the negative trend reversed in March and April 2021 and births increased in many countries (Sobotka, Jasilioniene, Zeman, et al. 2021). Notably, in a few countries, the total numbers of births showed *increases* as compared to the previous year already in early 2021; these include the Netherlands, Denmark, Norway, Finland and Iceland (Human Fertility Database 2022a; Statistics Norway 2022). Indeed, the Nordic countries, with the partial exception of Sweden, seem to have experienced no declines in their birth rates based on conceptions during the first wave of the pandemic and observable until February 2021 (Aassve, Cavalli, et al. 2021). According to Sobotka, Jasilioniene, Zeman, *et al.* (2021), the number of births increased in Finland in the pandemic period until September 2021 by more than five per cent. Per cent increases in the numbers of births from January to September, 2021, compared to the same period in 2020 were 7.8 for Iceland, 7.1 for Finland, 5.7 for Norway, 3.1 for Denmark and 0.7 for Sweden (Nordregio 2022).

The current fertility context of Finland

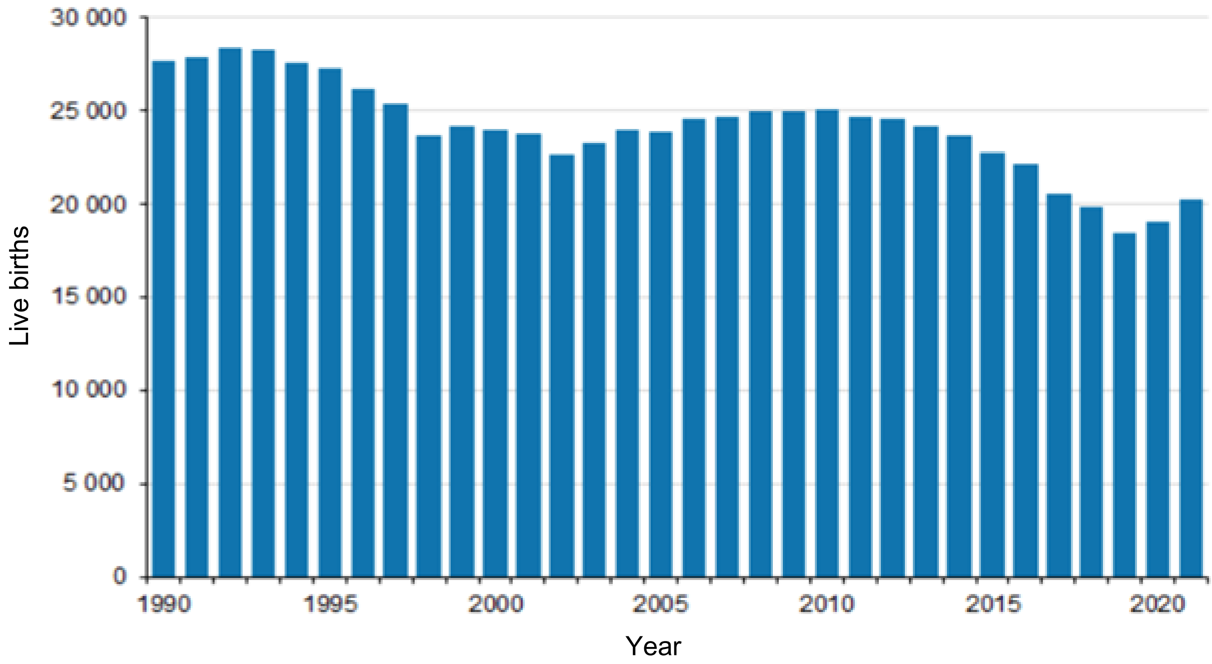
The fertility decline in Finland in the 2010s was rather pervasive in its character: it was observed in all age groups below the age of 40, and while it largely reflected declines in first births, declines were also observed across higher parities (Hellstrand et al. 2020). Declines were also observed across regions (Campisi et al. 2020), and were not limited to any socio-economic group, although declines in first births were slightly stronger among women with shorter education (Hellstrand, Nisén, and Myrskylä 2022). These declines were unexpected, since for decades fertility levels in the Nordic countries, including Finland, remained high by European levels, which has been attributed to their welfare states' support for families and to gender equality (Balbo, Billari, and Mills 2013), and there were no notable negative developments in these aspects in the 2010s (see Hellstrand et al. 2021). While fertility responses to economic recession varied between the Nordic countries in the 1990s – notably, with increases in higher order parities in Finland (Vikat 2002) – after the 2008–2009 recession the responses were largely homogeneous across the Nordic countries (Comolli et al. 2021).

The decline in fertility rate in Finland coincides with an increase in the share of young adults expressing to prefer to stay childless (Rotkirch 2021), and was strongly driven by couples who postpone or renounce having a first child (Hellstrand et al. 2022). The reasons behind this postponement remain poorly understood, but perceived uncertainty and lifestyle reasons are among the strongest candidates suggested to play a role (Savelieva, Jokela, and Rotkirch 2022). "Wanting to do other interesting things in life" was before the pandemic outbreak the most frequently mentioned single reason for postponing or renouncing births among both men and women and especially among young people in their 20s (Miettinen 2015). Focus group interviews indicate that such "more interesting things" included travelling, hobbies and a more carefree lifestyle, that was often seen as opposed to the responsibilities connected with parenting (Rotkirch et al. 2017; see Bergnehr and Bernhardt 2013 for similar results from Sweden;). Of course, with the first COVID-19 lockdown, the opportunities for most such "interesting other things" radically decreased, which may have paved the way for a more family-focused life and parenthood in some demographic groups.

Figure 1 shows the total number of live births in Finland between 1999 and 2021 between January and May. It illustrates that the decade-long continuous fertility decline in Finland ended just before the beginning of the COVID-19 pandemic in March 2020. (Numbers of births in May in 2020 were not yet subject to the pandemic, since most children born that month were conceived in September to October 2019.) As Figure 1 also shows, however, Finnish fertility in 2020 was still substantially below the levels of the early 2010s. Importantly, the recuperation of birth rates continued also in late 2020 and in the first half of 2021, when children who were conceived during the first two waves of the COVID-19 pandemic were born. Further evidence indicates that the overall increase in 2020 was limited to parities two and higher, while no increase was observed for first births (Official Statistics of Finland 2021). This crude evidence suggests no strong negative net effect of the pandemic on fertility in Finland, and especially not on second and higher parities.

During the first two waves of the pandemic in 2020, Finland as a whole was more modestly hit by the pandemic than many other European countries in terms of COVID-19 incidence and mortality (ECDC 2022; Pifarré i Arolas et al. 2021). Notably, incidence and excess mortality remained comparatively low also in the other Nordic countries, except Sweden (Nordregio 2022). Finland had the first lockdown relatively early, from March 18, 2020 (Valtioneuvosto 2020a). Most restrictions were lifted in May–June (Valtioneuvosto 2020b). Since March, state of emergency due to the coronavirus was mostly maintained for the rest of the year. Schools were in distance learning from mid-March to mid-May 2020, and were subject to local temporary physical closures in case of a local virus outbreak later on (Valtioneuvosto 2020b), but childcare centers for children under school age remained largely open despite the pandemic (Varanka et al. 2022). Yet, an overall less stringent and more flexible government response was characteristic of Finland as well as other Nordic countries in 2020 (Hale et al. 2020). Further, the declines in employment rates were not particularly large and the trust in the government remained comparatively high in Finland as well as the other Nordic countries (Eurofound 2020a, 2021). In Finland, more severe containment measures were in place in 2020 in the region Helsinki-Uusimaa, where also the incidence was higher than in other parts of the country (Kestilä et al. 2021).

The Finnish workforce and educational system adjusted rapidly to digital and remote forms of work; in 2020 Finland had the highest share (60%) of employees working remotely in Europe (Eurofound 2020b; Häkkilä et al. 2020). Apart from mortality and ill health, the adverse effects of the pandemic were in many ways concentrated to groups of reproductive age. Unemployment and psychological stress increased more strongly among the working-aged below 50 (Karvonen and Honkatukia 2021; Suvisaari et al. 2021). A survey among social workers in late 2020 suggested that issues related to mental health and housing were more common in large cities, while problems with daily coping and financial issues were more often faced in smaller cities and towns (Eronen et al. 2021). Generally, in late 2020 around a third of Finns expressed weakened optimisms about the future (Suvisaari et al. 2021) and stress levels in families with children had risen (Aalto-Setälä et al. 2021). Increases in unemployment and stress levels were also stronger among women than men (Kestilä et al. 2021).



Source: Population statistics (2021: Preliminary data), Statistics Finland

Figure 1 Live births between January and May in Finland, years 1990–2021.

Aims and expected findings

This study aims to primarily increase understanding of the recent fertility developments in Finland in general, and in particular following the first two waves of the COVID-19 pandemic. More broadly, we aim at providing evidence of fertility developments in times of a societal crisis. We describe fertility developments in the period between 2015 and September 2021 by women's region of residence, age group, and parity using register data covering the entire population of Finland. Our analysis is centered around the commonly used measure of total fertility rate, which is an estimate of the number of children that would be born to a woman over her lifetime, were she exposed to the age-specific fertility rates observed in a current year. Therefore, TFR is subject to changes in current conditions, which may reflect both postponement of childbearing as well as ultimate fertility. In times where childbearing postponement is common among women of different ages, TFR tends to underestimate the ultimate number of children born to women (Bongaarts and Feeney 1998). In turn, in a period in which postponement of childbearing lessens, TFR increases

(Bongaarts and Sobotka 2012). We discuss fertility trends in Finland in light of societal developments during the COVID-19 Pandemic in Finland, including in relation to the assumed spread (incidence) of the virus in different population sub-groups and the governmental responses to curtail the spread and mitigate the negative consequences of it (OECD 2021a).

Our first expectation is that the ongoing recuperation of fertility in Finland continues across most population subgroups – *despite* the pandemic. This general expectation is based on (i) the fact that the negative consequences of the pandemic have been less severe than in countries that were hit harder by the pandemic, as indicated by higher COVID-19 incidence and mortality, more extensive lockdowns, and stronger consequences for national economies, (ii) that the negative consequences have been less severe in welfare states with a highly-educated work force, high level of digitalization, and continued provision of child care and a well-functioning economic safety net in case of unemployment or illness during the pandemic, and (iii), that the boost to fertility is larger in countries where subjective reasons (e.g. perceived uncertainty and lifestyle factors) were prominent for postponing or renouncing childbearing before the pandemic.

Our second expectation is that possible negative effects of the pandemic on fertility were stronger among the younger age groups (i.e., below 30), the childless (and therefore 'at risk' of first birth), and those residing in the Helsinki-Uusimaa region. Fertility of the young age groups and those without children can be expected to be more severely hit by the pandemic due to economic uncertainty, given the generally weaker attachment of younger adults to the labor market on one hand, and due to the particularly important role of labor market attachment for entry into parenthood on the other (Andersson, Kreyenfeld, and Mika 2014; Miettinen and Jalovaara 2020; Vikat 2004). Moreover, young women have more time to postpone their childbearing without implications on their ultimate fertility. Moreover, we expect the COVID-19 pandemic to have affected more strongly negatively childbearing among those who live in regions with higher infection rates as well as stricter containment measures, such as Helsinki-Uusimaa in Finland during the first two waves.

Data and method

This study is based on aggregate data on preliminary numbers of births and women by woman's region of residence, age, and number of previously born children on a monthly basis received from Statistics Finland. We note that as the numbers are preliminary, they may slightly differ from the (final) official statistics, because some births to Finnish residents abroad or changes in residence are registered with a delay. However, the difference in the case of Finland is very small, for instance the TFR estimate for the year 2020 based on the preliminary numbers (1.38) differed from the official estimate (1.37) only slightly, and as far as we know there have been no significant changes in the registering practices in the period of our analysis.

We calculate age-specific, parity-specific, and total fertility rates, which are based on fertility rates (the ratio of the number of live births and the total number of women in the corresponding sub-group of population). These fertility rates were calculated on a monthly basis from March 2015 to September 2021 to describe the current fertility developments and evaluate potential effects of the pandemic on these developments. For fertility rates, we first calculate the monthly female mid-population as the average of the number of women on the last day of the current month and the previous month. Then we multiply this mid-population by the share of days of the current month of the days in the whole year, in order to adjust the length of the exposure in the fertility rates. We distinguish between four large regions (*suuralue,* NUTS2, see Eurostat 2022): the capital region of Helsinki-Uusimaa, Western Finland, Southern Finland, and Eastern and Northern Finland. Further, we distinguish between four age groups (15–24, 25–29, 30–34, 35–49) and three parity groups (one, two, and three or higher). The fifth NUTS2 region of Finland, Åland, was not included here given the small size of the region's population (31 000 in 2021) and the corresponding high fluctuation of its monthly fertility rates.

Model-based estimates of an effect of the pandemic were calculated following the strategy by Aassve *et al.* (2021). These models aim at capturing the effect of the pandemic itself, while taking into account time trends in fertility (existing irrespective of the pandemic), as well the seasonality of fertility. We estimated the following linear model:

$$TFR_t = \beta_0 + \beta_1 Pandemic_t + \sum_{i=1}^{3} \gamma_i \, Time_t^i + \alpha_m + \epsilon_t$$

This model was estimated by ordinary least squares for the country as a whole, as well as for each group of women based on their region of residence or their age group. We used the command *robust* (with the Huber-White-option) of Stata 17 to calculate p-values and confidence intervals adjusted for heteroscedasticity of the error terms of the monthly fertility rates. We estimated the effect β_1 of the variable "Pandemic", which is categorized as zero in months from March 2015 until October 2020 and as one in months from October 2020 to September 2021. The pandemic was assumed to affect the circumstances before and at the time of (potential) conception, i.e., fertility rates with a nine-month delay. Existing time trends in fertility were captured by including the linear, quadratic and, cubic time trends in the model. We also adjust for seasonal variation with month fixed effects α by including a dummy variable for each month in all models.

Results

Country-level trends

Figure 2 shows monthly TFR in 2015–2021 in Finland. September 2019 marked the beginning of a fertility rebound, in that it was the first month in which fertility did not decline further as compared to the same month in the previous year, after a continuous decline since 2010 (Hellstrand et al. 2020). Throughout 2020 the monthly rates were very similar to those in 2019, although higher in some months particularly in the first half of the year. Rates in November and December 2020 were very similar compared to the previous year, although then they were already subject to the COVID-19 pandemic. In turn, from January to September, the monthly fertility rate was higher in 2021 than in the corresponding month in 2020, thereby indicating a clear increase in the TFR in 2021. When comparing the average TFR across two following years (January to September) in Table 1, we again observe that fertility declined until 2019. The average monthly declines from January to September were as strong as 5.5 per cent in 2017, 5.0 per cent in 2018, and 4.5 per cent in 2019.

The year 2020 was the first in which fertility increased, modestly by 1.5 per cent; in 2021, the increase amounted already to 6.8 per cent (Table 1). The monthly increase in TFR in 2021 as compared to the year 2020 was between 1.8 to 11.0 per cent. This includes the largest increases since 2015 (February 10%, March 10%, June 11%), but in magnitude they are not substantially different from respective decreases until 2019, which amounted to 9.6 per cent. To add, in the whole period in which fertility was subject to the pandemic (November 2020 to September 2021), the monthly TFR increased by 5.5 per cent on average, which is similar to a previous estimate for Finland based on the number of births (Sobotka, Jasilioniene, Galarza, et al. 2021).

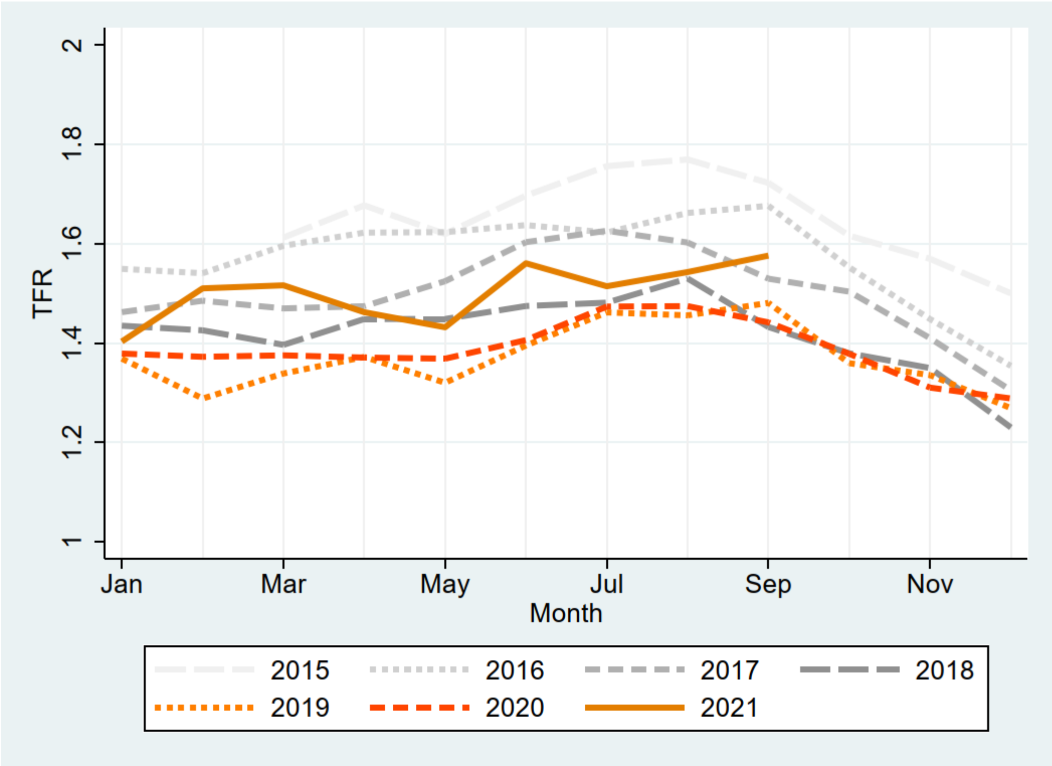


Figure 2 Monthly TFR in Finland, March 2015 – September 2021.

Table 1 Change in TFR relative to the same month in the previous year (in per cent) in Finland, March 2016 – September 2021.

Month	Δ 2016	Δ 2017	Δ 2018	Δ 2019	Δ 2020	Δ 2021
January		-5.6	-1.9	-4.6	0.7	**1.8**
February		-6.9	-4.0	-9.6	6.5	**10.0**
March	-1.0	-7.9	-5.0	-4.1	2.7	**10.2**
April	-3.3	-9.1	-1.8	-5.3	-0.1	**6.6**
May	0.2	-6.1	-5.0	-8.9	3.7	**4.6**
June	-3.5	-2.1	-8.0	-5.4	0.8	**11.0**
July	-7.6	0.2	-8.9	-1.3	0.8	**2.8**
August	-6.1	-3.6	-4.5	-4.8	1.3	**4.6**
September	-2.7	-8.8	-6.4	3.4	-2.7	**9.3**
October	-3.9	-3.1	-8.3	-1.4	1.4	
November	-7.7	-2.7	-4.3	-1.1	**-1.9**	
December	-9.7	-3.6	-5.7	3.2	**1.5**	
Average	-3.4	-5.5	-5.0	-4.5	1.5	6.8

Note: Average calculated for months from January to September. Months which are assumed to have had the chance to be affected by the Covid-19 pandemic are bolded.

Trends by region

Figure 3 shows the monthly TFR for the whole country, as well as for the four regions. As expected (see, e.g., Haandrikman and Van Wissen 2008; Norum, Heyd, and Svee 2014; Nuutila and Gissler 2011), the monthly TFR is subject to considerable seasonal variation. Over the study period, the average monthly TFR levels were lowest in Helsinki-Uusimaa (1.41) and highest in the North-East (1.60). Interestingly, the regional deviation from the country mean TFR decreased over the period, so that North-East and Helsinki-Uusimaa regions became more similar to the country average over the study period. We observe that increases in TFR in 2021 have occurred across all regions in Finland. When compared to the average of the three previous years, shown in Figure 4, changes in TFR were somewhat stronger in 2021 in Helsinki-Uusimaa (8.7%) than in the other regions of West (5.6%), South (5.8%) and, particularly, North-East Finland (3.5%). To note is too that respective declines in 2020 – predating any pandemic effects – were also already milder in Helsinki-Uusimaa (-1.3%) than in other regions (West -5.8%, South -3.2%, North-East -4.2%). In all regions except the North-East, the increase also seemed to strengthen in the period from February to March 2021, with births dating back to conceptions in May to June 2020. Obviously, monthly estimates are subject to large variation and conclusions based on specific months are thus uncertain.

To note here too is that a comparison to the previous year would provide a slightly different picture: while the comparison of the monthly TFR to a three-year-average gives the impression that TFR in 2020 was still on the decline, this was not the case when comparing to the previous year only (Table 1 and Figure 2). Moreover, based on an annual comparison (results not shown), Helsinki-Uusimaa (2.0%) was not the region with the strongest increase in TFR already in 2020 (West -1.3%, South 1.6%, North-East 3.9%). However, similarly as in the comparison to a three-year average, the annual comparison indicates that the increases in 2021 were larger in Helsinki-Uusimaa (9.0%) than in other regions (West 7.6%, South 6.6%, and North-East 3.2%). This illustrates how the choice of the reference period can be critical for the results.

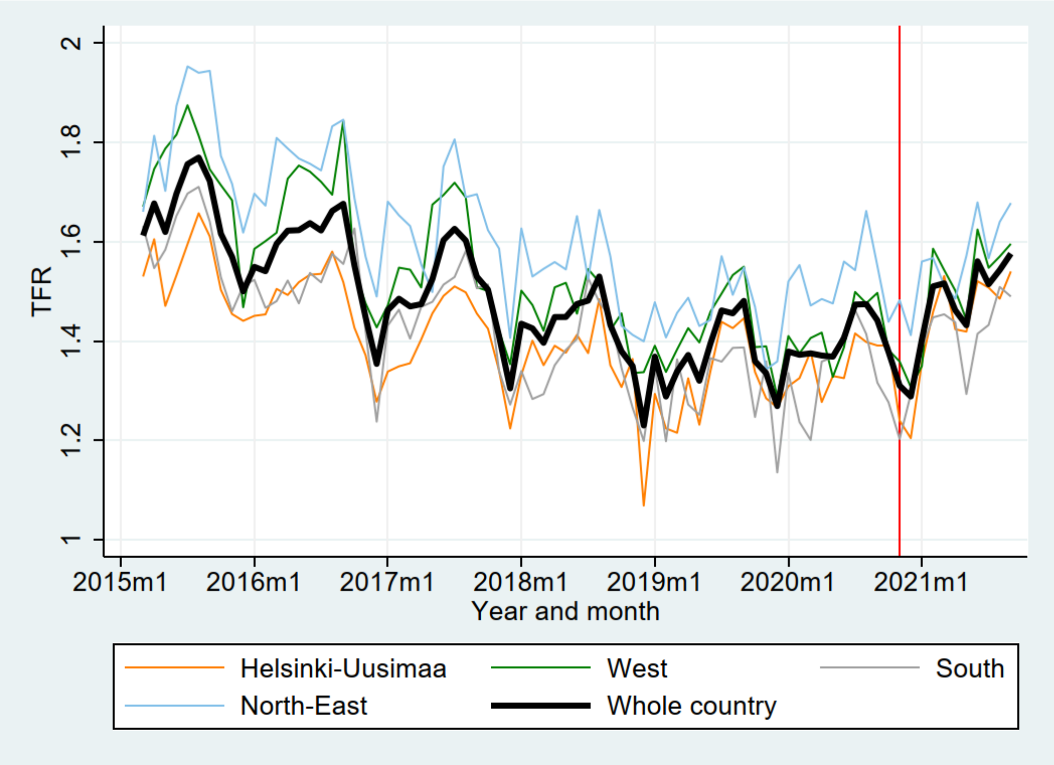


Figure 3 Monthly TFR by region in Finland, March 2015 – September 2021.

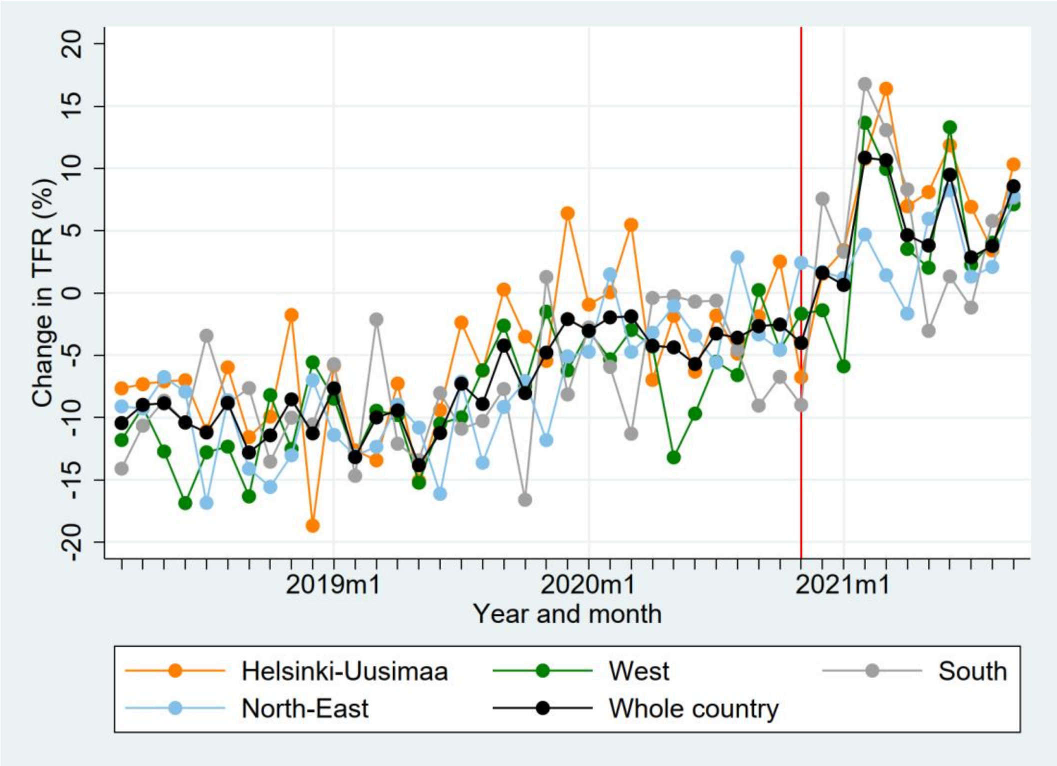


Figure 4 The change in monthly TFR as compared to a three-year average (in per cent) by region in Finland, January 2019 – September 2021.

Trends by age and parity

There was a remarkable fertility rebound in 2020 and 2021 among all but the youngest women (aged 15–24) (Figure 5). This ended the fertility decline of women aged 30–34 from 2010 to 2019 – a decade-long decline which had disrupted the long-term trend of fertility increase in this female age group since the 1970s (Nisén et al. 2020). The average change of the monthly rate relative to the previous year amounted in 2020 (January to September) to -5.3, 0.9, 4.2, and 2.8 per cent for women aged 15–24, 25–29, 30–34, 35–49, respectively; in 2021 the corresponding changes were 5.3, 5.1, 10.7, 9.8 (results not shown). The stable declining trend among the youngest women does not suggest a pandemic effect, but rather the continuation of a long-term trend of postponement of first births to higher ages. The apparent drop in November to December in 2020 and increase in early 2021 in the monthly rate among the 30-34-olds corresponds to hypotheses about a pandemic effect on fertility, however it also resembles the strong seasonal pattern of the previous years. Among the 35–49 year-olds there is a short-term drop in December 2020, which may reflect the fact that infertility clinics were (partially) closed in March-May 2020 (see Heino and Gissler 2021).

In terms of parity, there were increases in first, second, as well as third births to women (Figure 6). In absolute terms the increases were weaker in higher-order parities (second as well as third order children), but in relative terms increases in 2021 (January to September) as compared to 2020 were rather similar across parities, albeit slightly larger for first and third births (on average, TFR1 7.9, TFR2 5.8, and TFR3 7.8 per cent). These results suggest a general fertility rebound not limited to any specific parity. This is in contrast to 2020, where increases in TFR occurred mainly at second and higher parities (Official Statistics of Finland 2021). The increase of first births stands out in February and March 2021, where TFR1 amounted to much as 14.6 and 11.2 per cent compared to the same months in the previous year. In turn, the average fertility increase in June 2021 was particularly strong in for second and third or more children, with TFR2 and TFR3, amounting to 15.7 and 13.8 per cent, respectively.

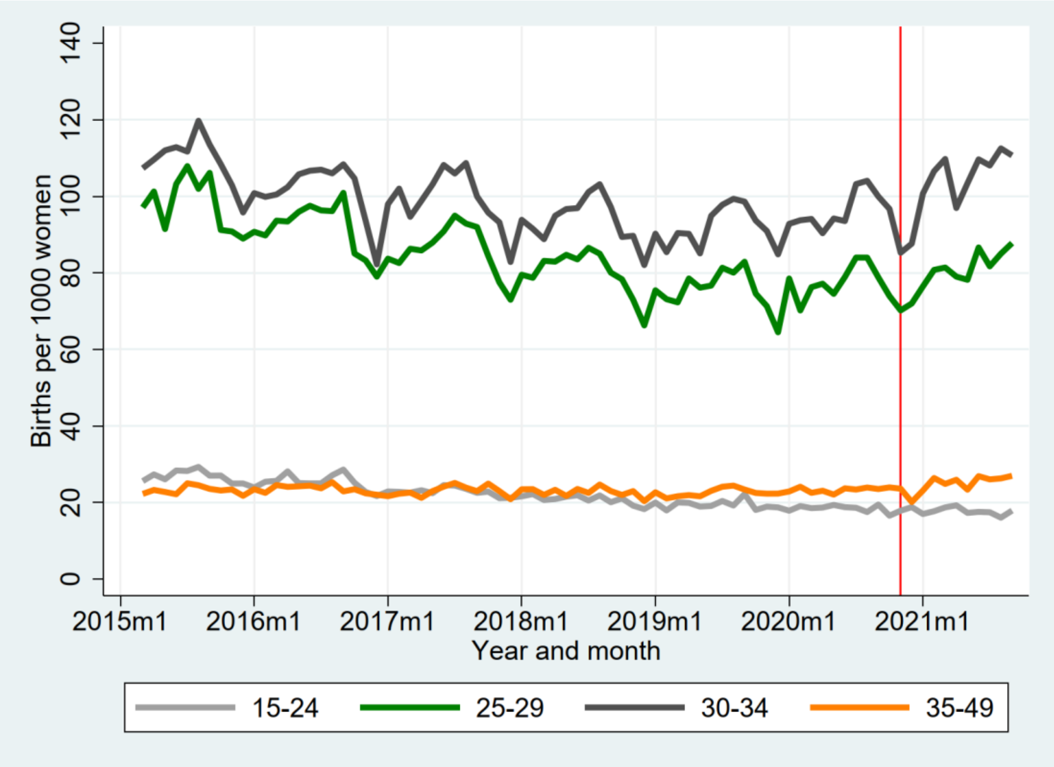


Figure 5 Monthly age-specific fertility rate in Finland, March 2015 – September 2021.

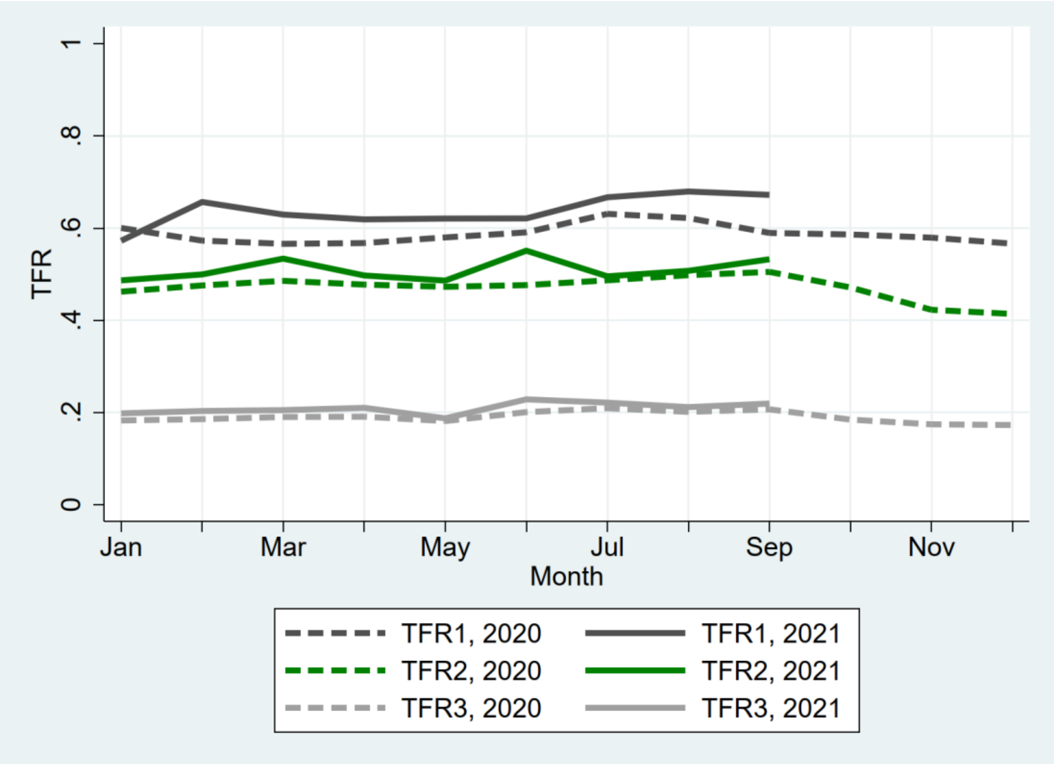


Figure 6 Monthly parity-specific TFR in Finland, January 2020 – September 2021.

Model-based results

Finally, we conducted model-based analyses in order to estimate pandemic effects on fertility. As illustrated in Table 2, the pandemic was estimated to increase the monthly TFR of the country by 2.5 per cent (0.043 children) on average in the period from November 2020 to September 2021 in Finland, but this estimated effect based on altogether 79 observations was not statistically significant (p-value 0.240). This estimate for Finland is similar to that found by Aassve *et al.* (2021) using the same approach but analyzing the crude birth rate instead of total fertility rate and analyzing data only until March 2021. We additionally estimated a model with regional TFR as the outcome, while controlling for average regional level in TFR. Here, the magnitude of the point estimate was very similar, at 3.1 per cent, but the estimate based on altogether 316 observations was now marginally statistically significant (p-value 0.063), and the corresponding 95% confidence interval (-0.002–0.063) would suggest the true effect of the pandemic on TFR to be either zero or positive (Appendix Table 2: Model 1 and Model 4).

Table 2 does not provide evidence of a statistically significant effect of the pandemic in any particular subgroup based on a woman's region of residence or age, based on 79 observations in each subgroup. The positive coefficient indicating a 6.4 per cent increase for the youngest women was marginally statistically significant (p-value 0.093). Results from models including all regions or age groups in the same model were neither able to provide statistically significant evidence of subgroup heterogeneity in the effect of the pandemic on births, while controlling for subgroup-specific time trends (Appendix Tables 2–3: Model 3). In all, the positive coefficients (except for the age group 35–49), with confidence intervals which to a large extent fall above zero, as shown in Table 2 and in the Appendix Tables 1–3, however, provide further indication for the lack of a negative effect of the pandemic on fertility in Finland by September 2021. Furthermore, we note that the effect estimated here aims at capturing an average effect of the pandemic on births in November 2020 to September 2021 as resulting from the two first waves of the COVID-19 pandemic in spring and autumn 2020. Hence, effects of the pandemic on fertility in specific months within the period of interest remain possible, such as a positive effect in February-March or June 2021, where fertility in Finland increased by 10 and 11 per cent, respectively, compared to the previous year (Table 1 above).

Table 2 Estimates of the pandemic effect on total fertility rate (TFR) in Finland in November 2020–September 2021

	β_1	p-value	95 % CI
TFR	0.043	0.163	-0.018, 0.105
TFR (ln)	0.025	0.240	-0.017, 0.068
TFR (ln)			
Helsinki-Uusimaa	0.011	0.740	-0.055, 0.077
West-Finland	0.042	0.180	-0.020, 0.104
South-Finland	0.058	0.183	-0.028, 0.144
East & North F.	0.011	0.635	-0.036, 0.059
ASFR (ln)			
15-24	0.064	0.093	-0.011, 0.140
25-29	0.030	0.278	-0.025, 0.084
30-34	0.024	0.515	-0.050, 0.099
35-49	-0.002	0.959	-0.072, 0.068

Note: All estimates shown are from separate models, which each control for linear, squared and quadratic time trend and month fixed effects. CI = Confidence interval. Number of observations in all models: N=79. Results from full models are shown in Appendix Table 1.

Discussion

Since late 2019, Finland has experienced a fertility rebound at the country level and across most population sub-groups. Here, we provide the first detailed evidence showing that the first phases of the COVID-19 pandemic seem not to have borne a negative effect on fertility in Finland. Prior to the pandemic, a recovery of the birth rate was both expected and predicted after a decade-long decline (Nisén et al., 2020; Rotkirch 2021). Based on the quite successful handling of the pandemic in Finland in 2020, we expected the recuperation of fertility to continue in 2021 in the whole country. Indeed, monthly fertility (from January to September) in Finland in 2020 increased 1.5 per cent on average, but in 2021 as much as 6.8 per cent. To put this in perspective, the respective fertility decline in 2017–2020 amounted to 5.5 per cent at most. Had there been concurrently an overall negative effect of the pandemic, as well as a rebound of the time trend in fertility (irrespective of the pandemic), the rebound would have needed to be extremely strong to counterbalance such an effect. In light of the current results, a general fertility rebound, potentially in combination with a moderate fertility-boosting effect of the pandemic, seems more likely. We found an overall increasing trend in 2021 across all age groups except the youngest women, and across all regions and parities. Moreover, model-based estimates provided tentative evidence of an overall positive effect of the pandemic, while controlling for the general time trend in fertility. A boosting effect of the pandemic on fertility may have been limited to specific months, however, such as February-March and June 2021 (corresponding to conceptions in May-June and September 2020). May-June 2020 was a time period where the first wave ended, with restrictions being lifted and life becoming more normal. September 2020 then again marked the beginning of the second wave, signaling perhaps for many the enduring nature of the pandemic.

We further expected that possible negative effects of the pandemic on fertility would have been stronger among the younger age groups, childless women, and those residing in Helsinki-Uusimaa. However, fertility increases in 2021 were not weaker for the first-parity births, which further strengthens the claim for a neutral or even positive effect of the pandemic. We expected a less positive effect of the pandemic on first children, given the importance of economic situation for the entry into parenthood and growing economic uncertainty caused by the pandemic. Instead, the trend in first births appears to have reversed from 2020 so that first-birth fertility began to increase in 2021. Fertility decline was observed only among the youngest age group of 15–24-year-old women. This is likely a continuation of the long-term decline of fertility in this age group since the late 1960s (Official Statistics of Finland 2021), rather than a pandemic effect. Women aged 25–29 had milder increases in fertility compared to those aged 30–34. This could signal a somewhat stronger negative pandemic effect among younger women. However, fertility increase was weaker in women below 30 years already in 2020, before being subject to the pandemic, which questions this argument.

It is remarkable that stronger increases in fertility in 2021 were witnessed in Helsinki-Uusimaa, which was also the region most severely hit in the early stages of the pandemic in Finland in 2020, in terms of both incidence and containment measures. Together with the model-based results this provides further support of the absence of a negative effect of the early phases of the pandemic on fertility in Finland. If the pandemic had a negative effect on fertility, we would have expected the higher incidence rates or containment measures to translate into lower fertility, or a less steep increase, in the regions that suffered more in terms of these measures. This is not what we see based on the description of regional fertility trends. Our model-based estimates also do not suggest a regionally strongly heterogenous response of the pandemic in Finland, but rather a neutral or modestly positive overall response. Given the widespread use of communication technology and public media in Finland, it is plausible that national pandemic developments strongly influence the individual perception of the pandemic.

Cross-country evidence shows that the fertility rates of the Nordic countries have generally been hit less negatively by the COVID-19 pandemic than fertility rates in many other European countries (Aassve, Cavalli, et al. 2021). While there was little change in numbers of births until January 2021, there were increases in births in the following months in Finland, Norway, Denmark and Iceland (Nordregio 2022; Sobotka, Jasilioniene, Zeman, et al. 2021). In our view, there are three possible explanations for this related to existing fertility trends on one hand, and the pandemic and institutional and cultural features of the countries on the other. First, the developments that we see in 2021 in these countries, as compared to other parts of Europe, can be influenced by the different general fertility trends before and during the pandemic. Fertility has declined across the Nordic countries in the past decade (Hellstrand et al. 2020). Finland witnessed a particularly strong fertility decline in the 2010s: it recorded in 2020 its lowest-ever TFR level at 1.35 children, and it has the currently lowest TFR of the five Nordic countries (Human Fertility Database 2022b). That Finland also witnessed one of the strongest increases in fertility between December 2020 and April 2021 (Aassve, Cavalli, et al. 2021; Sobotka, Jasilioniene, Zeman, et al. 2021) seems to be barely a coincidence, and is surely at least a partial explanation of the positive fertility trend in 2021. To add, Iceland is to our knowledge the only country having witnessed an even stronger fertility increase than Finland during the pandemic (Nordregio 2022), and Iceland, like Finland, also went through an exceptionally strong fertility decline in the 2010s (Human Fertility Database 2022b).

Second, the Nordic societies, excluding Sweden (OECD 2021), had a swift first lockdown and were less severely hit by the pandemic in 2020–2021 in terms of incidence (ECDC 2022), while the governmentally imposed restrictions were also less severe than in many other parts of the Europe (Hale et al. 2020, Nordregio 2022). Third, several institutional and cultural features of the Nordic societies may have buffered their fertility levels from falling in times of crises. For instance, the high general trust in governments may have helped people to accept the containment measures placed by the governments (Eurofound 2021), buffered increase in uncertainty of the future, and potentially through this mechanism also kept fertility from falling (Aassve, Billari, and Pessin 2016; Aassve, Le Moglie, and Mencarini 2021). These factors together may had prevented at least the early stages of the pandemic from affecting fertility negatively in Finland and other Nordic countries, and even potentially paved the way for an additional fertility boost after the fertility declines witnessed in the 2010s.

This study was limited in evaluating the role of other potentially relevant factors, such as differences in educational attainment between groups of women residing in different regions. Other sources show that fertility of tertiary-educated women increased in Finland in 2020, while the fertility of women educated to the upper secondary or basic level continued to decline (Official Statistics of Finland 2021). It seems therefore possible that the higher educational level of the women residing in the capital Helsinki-Uusimaa region explains the stronger increase reported here in 2020 and 2021. The highly educated suffered less from the pandemic, since they could more easily conduct distance work from home (Golden 2001; Sorsa and Rotkirch 2020) and had more often spacious apartments or summer cottages with access to green space. They also generally have more stable employment and partnership careers (Jalovaara and Fasang 2017; Thomson, Winkler-Dworak, and Kennedy 2013). Future studies on pandemic fertility should pay attention to heterogeneity by socioeconomic status, as the health crisis has had a disproportionate impact on groups which were already in a precarious situation before the pandemic (Eurofound 2021; Kestilä et al. 2021). Furthermore, in the longer term, research needs to consider the potential indirect effect of the pandemic on fertility through partnership formation, as the containment measures have made it difficult to meet new partners.

In sum, we provide the first detailed evidence pointing towards that the two first waves of the pandemic did not negatively affect childbearing in Finland. The strong fertility increases during 2021 were broadly due to a continuation of pre-pandemic fertility trends, where fertility recovers from its all-time low levels. We also found tentative evidence of a modest fertility-boosting effect of the pandemic itself, but this potential positive pandemic effect seems to be largely confined to specific months in 2021. To conclude, fertility in Finland in 2021 continued to recover *despite* the first two waves of the COVID-19 pandemic, with potentially an additional modest fertility increase in response to the pandemic. The latest preliminary statistics from Finland, however, already indicate that the number of births did not continue to increase in early 2022 as compared to early 2021 (Official Statistics of Finland 2022). The future will show how fertility trends continue to unfold in 2022 after the pandemic had entered its later phases and new crises appeared.

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Appendix Table 1

Outcome:	TFR (ln)			TFR (ln)		
	β	p-value	95 % CI	β	p-value	95 % CI
Time	**-0.005**	0.024	-0.008, -0.001	*-0.002*	0.082	-0.005, 0.000
$Time^2$	**0.000**	0.095	0.000, 0.000	**0.000**	0.025	0.000, 0.000
$Time^3$	**0.000**	0.007	0.000, 0.000	**0.000**	0.002	0.000, 0.000
Pandemic	0.043	0.163	-0.018, 0.105	0.025	0.240	-0.017, 0.068
January	**0.112**	0.000	0.076, 0.147	**0.082**	0.000	0.057, 0.107
February	**0.119**	0.000	0.065, 0.172	**0.086**	0.000	0.047, 0.124
March	**0.127**	0.000	0.084, 0.169	**0.092**	0.000	0.062, 0.122
April	**0.147**	0.000	0.115, 0.178	**0.105**	0.000	0.082, 0.127
May	**0.136**	0.000	0.097, 0.176	**0.098**	0.000	0.070, 0.126
June	**0.201**	0.000	0.165, 0.238	**0.141**	0.000	0.115, 0.166
July	**0.227**	0.000	0.187, 0.266	**0.157**	0.000	0.130, 0.184
August	**0.243**	0.000	0.209, 0.277	**0.168**	0.000	0.144, 0.192
September	**0.220**	0.000	0.179, 0.260	**0.152**	0.000	0.125, 0.180
October	**0.141**	0.000	0.107, 0.175	**0.101**	0.000	0.076, 0.125
November	**0.076**	0.000	0.038, 0.114	**0.056**	0.000	0.029, 0.083
Constant	**1.527**	0.000	1.488, 1.567	**0.408**	0.000	0.381, 0.435

Outcome: TFR (ln)	Helsinki-Uusimaa			West-Finland			South-Finland			East-North Finland		
	β	p-value	95 % CI	β	p-value	95 % CI	β	p-value	95 % CI	β	p-value	95 % CI
Time	-0.002	0.359	-0.006, 0.002	*-0.003*	0.078	-0.007, 0.000	*-0.004*	0.088	-0.008, 0.001	-0.001	0.604	-0.006, 0.003
$Time^2$	0.000	0.124	0.000, 0.000	0.000	0.190	0.000, 0.000	0.000	0.560	0.000, 0.000	**0.000**	0.046	0.000, 0.000
$Time^3$	**0.000**	0.023	0.000, 0.000	**0.000**	0.046	0.000, 0.000	0.000	0.293	0.000, 0.000	**0.000**	0.007	0.000, 0.000
Pandemic	0.011	0.740	-0.055, 0.077	0.042	0.180	-0.020, 0.104	0.058	0.183	-0.028, 0.144	0.011	0.635	-0.036, 0.059
January	**0.081**	0.006	0.024, 0.138	**0.065**	0.002	0.025, 0.104	**0.095**	0.000	0.048, 0.143	**0.099**	0.000	0.069, 0.128
February	**0.097**	0.005	0.030, 0.164	**0.090**	0.000	0.046, 0.135	*0.062*	0.053	-0.001, 0.126	**0.081**	0.000	0.041, 0.121
March	**0.110**	0.003	0.040, 0.181	**0.088**	0.000	0.055, 0.120	**0.084**	0.006	0.025, 0.142	**0.075**	0.000	0.044, 0.107
April	**0.117**	0.000	0.059, 0.175	**0.113**	0.000	0.084, 0.141	**0.101**	0.000	0.050, 0.153	**0.084**	0.000	0.053, 0.114
May	**0.106**	0.001	0.044, 0.169	**0.118**	0.000	0.076, 0.160	**0.090**	0.002	0.033, 0.147	**0.069**	0.000	0.033, 0.105
June	**0.142**	0.000	0.084, 0.201	**0.147**	0.000	0.109, 0.184	**0.140**	0.000	0.091, 0.190	**0.134**	0.000	0.100, 0.169
July	**0.165**	0.000	0.107, 0.223	**0.170**	0.000	0.140, 0.200	**0.164**	0.000	0.107, 0.220	**0.134**	0.000	0.093, 0.175
August	**0.179**	0.000	0.120, 0.239	**0.163**	0.000	0.134, 0.193	**0.178**	0.000	0.128, 0.227	**0.154**	0.000	0.121, 0.187
September	**0.159**	0.000	0.099, 0.218	**0.152**	0.000	0.100, 0.205	**0.150**	0.000	0.101, 0.199	**0.147**	0.000	0.121, 0.173
October	**0.117**	0.000	0.058, 0.176	**0.093**	0.000	0.065, 0.121	**0.113**	0.001	0.046, 0.181	**0.077**	0.000	0.047, 0.107
November	**0.075**	0.023	0.011, 0.140	**0.053**	0.005	0.017, 0.089	0.050	0.123	-0.014, 0.114	**0.044**	0.011	0.011, 0.078
Constant	**0.324**	0.000	0.259, 0.389	**0.457**	0.000	0.422, 0.493	**0.376**	0.000	0.321, 0.432	**0.502**	0.000	0.459, 0.545

Outcome: ASFR (ln)	15-24			25-29			30-34			35-49		
	β	p-value	95 % CI	β	p-value	95 % CI	β	p-value	95 % CI	β	p-value	95 % CI
Time	**-0.007**	0.010	-0.013, -0.002	-0.003	0.122	-0.006, 0.001	**-0.004**	0.045	-0.008, 0.000	*0.004*	0.059	0.000, 0.009
$Time^2$	0.000	0.814	0.000, 0.000	**0.000**	0.031	0.000, 0.000	0.000	0.409	0.000, 0.000	**0.000**	0.010	0.000, 0.000
$Time^3$	0.000	0.805	0.000, 0.000	**0.000**	0.004	0.000, 0.000	*0.000*	0.063	0.000, 0.000	**0.000**	0.004	0.000, 0.000
Pandemic	*0.064*	0.093	-0.011, 0.140	0.030	0.278	-0.025, 0.084	0.024	0.515	-0.050, 0.099	-0.002	0.959	-0.072, 0.068
January	0.002	0.942	-0.047, 0.051	**0.095**	0.000	0.052, 0.138	**0.114**	0.000	0.078, 0.149	**0.073**	0.008	0.020, 0.127
February	0.022	0.469	-0.039, 0.083	**0.077**	0.001	0.034, 0.120	**0.117**	0.000	0.064, 0.170	**0.088**	0.010	0.022, 0.155
March	0.029	0.279	-0.024, 0.083	**0.115**	0.000	0.074, 0.156	**0.114**	0.000	0.065, 0.164	**0.073**	0.005	0.023, 0.123
April	**0.069**	0.021	0.010, 0.127	**0.132**	0.000	0.096, 0.167	**0.113**	0.000	0.076, 0.150	**0.086**	0.003	0.029, 0.143
May	0.035	0.188	-0.017, 0.087	**0.119**	0.000	0.075, 0.164	**0.137**	0.000	0.089, 0.184	**0.059**	0.020	0.010, 0.109
June	**0.067**	0.009	0.018, 0.117	**0.168**	0.000	0.130, 0.205	**0.170**	0.000	0.127, 0.212	**0.113**	0.000	0.063, 0.162
July	**0.071**	0.007	0.020, 0.122	**0.195**	0.000	0.153, 0.237	**0.188**	0.000	0.149, 0.228	**0.123**	0.000	0.071, 0.175
August	**0.070**	0.026	0.009, 0.132	**0.187**	0.000	0.150, 0.224	**0.213**	0.000	0.172, 0.254	**0.139**	0.000	0.092, 0.186
September	**0.106**	0.008	0.029, 0.183	**0.192**	0.000	0.148, 0.236	**0.179**	0.000	0.142, 0.216	**0.096**	0.000	0.052, 0.141
October	0.044	0.108	-0.010, 0.097	**0.096**	0.000	0.056, 0.135	**0.134**	0.000	0.092, 0.175	**0.095**	0.001	0.042, 0.148
November	0.001	0.964	-0.047, 0.049	**0.048**	0.010	0.012, 0.083	**0.074**	0.006	0.022, 0.126	**0.079**	0.002	0.031, 0.126
Constant	**3.286**	0.000	3.224, 3.349	**4.474**	0.000	4.425, 4.522	**4.577**	0.000	4.540, 4.615	**3.040**	0.000	2.981, 3.099

Note: Results shown from separate models for country TFR and country TFR (ln), as well as for TFR (ln) of each region and ASFR (ln) of each age group. ASFR= age-specific fertility rate. CI = Confidence interval. Number of observations in all models: N=79.

Appendix Table 2

Outcome: TFR (ln)

	Model 1			Model 2			Model 3			Model 4		
	β	p	95 % CI	β	p	95 % CI	β	p	95 % CI	β	p	95 % CI
Time	**-0.002**	0.020	-0.004, 0.000	**-0.002**	0.019	-0.004, 0.000	-0.002	0.266	-0.006, 0.002	-0.003	0.113	-0.006, 0.001
Time^2	**0.000**	0.007	0.000, 0.000	**0.000**	0.007	0.000, 0.000	0.000	0.124	0.000, 0.000	0.000	0.161	0.000, 0.000
Time^3	**0.000**	0.000	0.000, 0.000	**0.000**	0.000	0.000, 0.000	**0.000**	0.019	0.000, 0.000	**0.000**	0.013	0.000, 0.000
Pandemic	*0.031*	0.063	-0.002, 0.063	**0.060**	0.006	0.017, 0.103	0.012	0.711	-0.051, 0.074	*0.031*	0.062	-0.002, 0.063
Helsinki-Uusimaa (ref.)												
West	**0.082**	0.000	0.070, 0.094	**0.087**	0.000	0.075, 0.100	**0.126**	0.000	0.085, 0.167	**0.122**	0.000	0.084, 0.161
South	0.008	0.232	-0.005, 0.020	*0.012*	0.065	-0.001, 0.025	*0.038*	0.063	-0.002, 0.079	*0.033*	0.088	-0.005, 0.071
North-East	**0.129**	0.000	0.117, 0.141	**0.135**	0.000	0.123, 0.147	**0.151**	0.000	0.102, 0.201	**0.150**	0.000	0.102, 0.198
January	**0.085**	0.000	0.063, 0.107	**0.085**	0.000	0.063, 0.107	**0.085**	0.000	0.063, 0.107	**0.085**	0.000	0.063, 0.107
February	**0.083**	0.000	0.057, 0.108	**0.083**	0.000	0.057, 0.109	**0.083**	0.000	0.057, 0.109	**0.083**	0.000	0.056, 0.109
March	**0.089**	0.000	0.065, 0.113	**0.089**	0.000	0.065, 0.113	**0.089**	0.000	0.065, 0.113	**0.089**	0.000	0.065, 0.114
April	**0.104**	0.000	0.084, 0.124	**0.104**	0.000	0.083, 0.124	**0.104**	0.000	0.083, 0.124	**0.104**	0.000	0.083, 0.124
May	**0.096**	0.000	0.072, 0.120	**0.096**	0.000	0.072, 0.120	**0.096**	0.000	0.072, 0.120	**0.096**	0.000	0.072, 0.120
June	**0.141**	0.000	0.119, 0.162	**0.141**	0.000	0.119, 0.163	**0.141**	0.000	0.119, 0.162	**0.141**	0.000	0.119, 0.163
July	**0.158**	0.000	0.135, 0.181	**0.158**	0.000	0.135, 0.181	**0.158**	0.000	0.135, 0.181	**0.158**	0.000	0.135, 0.181
August	**0.169**	0.000	0.148, 0.189	**0.169**	0.000	0.148, 0.189	**0.169**	0.000	0.148, 0.190	**0.169**	0.000	0.147, 0.190
September	**0.152**	0.000	0.129, 0.175	**0.152**	0.000	0.129, 0.175	**0.152**	0.000	0.129, 0.175	**0.152**	0.000	0.129, 0.175
October	**0.100**	0.000	0.077, 0.124	**0.100**	0.000	0.076, 0.124	**0.100**	0.000	0.077, 0.124	**0.100**	0.000	0.077, 0.124
November	**0.056**	0.000	0.032, 0.079	**0.056**	0.000	0.031, 0.080	**0.056**	0.000	0.031, 0.080	**0.056**	0.000	0.031, 0.080
Pandemic x 1.region (ref.)												
Pandemic x 2.region				**-0.041**	0.047	-0.081, -0.001	0.028	0.520	-0.057, 0.113			
Pandemic x 3.region				-0.032	0.137	-0.075, 0.010	0.037	0.457	-0.061, 0.135			
Pandemic x 4.region				**-0.044**	0.017	-0.080, -0.008	0.010	0.793	-0.066, 0.087			
Time x Helsinki-Uusimaa (ref.)												
Time x West							-0.001	0.615	-0.006, 0.004	-0.001	0.817	-0.005, 0.004
Time x South							-0.001	0.627	-0.007, 0.004	0.000	0.917	-0.005, 0.004
Time x North-East							0.001	0.757	-0.005, 0.007	0.001	0.649	-0.004, 0.006
Time^2 x Helsinki-Uusimaa (ref.)												
Time^2 x West							0.000	0.832	0.000, 0.000	0.000	0.817	0.000, 0.000
Time^2 x South							0.000	0.675	0.000, 0.000	0.000	0.920	0.000, 0.000
Time^2 x North-East							0.000	0.650	0.000, 0.000	0.000	0.476	0.000, 0.000
Time^3 x Helsinki-Uusimaa (ref.)												
Time^3 x West							0.000	0.737	0.000, 0.000	0.000	0.846	0.000, 0.000
Time^3 x South							0.000	0.555	0.000, 0.000	0.000	0.991	0.000, 0.000
Time^3 x North-East							0.000	0.791	0.000, 0.000	0.000	0.564	0.000, 0.000
Constant	**0.360**	0.000	0.334, 0.387	0.000		0.329, 0.383	**0.336**	0.000	0.301, 0.371	**0.338**	0.000	0.304, 0.373

Note: Results shown from models, with the regional TFR (ln) as the outcome. Number of observations: N=316. Statistical significance: bolded if p-value <0.05 and italicized if p-value <0.10. CI = confidence interval.
Model 1: Time, Time^2, Time^3, Pandemic, Month dummies
Model 2: Time, Time^2, Time^3, Pandemic, Month dummies, Pandemic x Region
Model 3: Time, Time^2, Time^3, Pandemic, Month dummies, Pandemic x Region, Time x Region, Time^2 x Region, Time^3 x Region
Model 4: Time, Time^2, Time^3, Pandemic, Month dummies, Time x Region, Time^2 x Region, Time^3 x Region

Appendix Table 3

Outcome: ASFR (ln)

	Model 1			Model 2			Model 3			Model 4		
	β	p	95 % CI	β	p	95 % CI	β	p	95 % CI	β	p	95 % CI
Time	-0.002	0.336	-0.007, 0.003	-0.002	0.230	-0.006, 0.002	**-0.008**	0.005	-0.013, -0.002	**-0.007**	0.007	-0.011, -0.002
Time^2	0.000	0.270	0.000, 0.000	0.000	0.153	0.000, 0.000	0.000	0.622	0.000, 0.000	0.000	0.847	0.000, 0.000
Time^3	0.000	0.124	0.000, 0.000	**0.000**	0.045	0.000, 0.000	0.000	0.586	0.000, 0.000	0.000	0.782	0.000, 0.000
Pandemic	0.029	0.367	-0.034, 0.093	**-0.149**	0.000	-0.230, -0.067	*0.080*	0.069	-0.006, 0.167	0.029	0.145	-0.010, 0.069
15–24 (ref.)												
25–29	**1.362**	0.000	1.338, 1.387	**1.340**	0.000	1.319, 1.361	**1.262**	0.000	1.207, 1.317	**1.273**	0.000	1.222, 1.324
30–34	**1.529**	0.000	1.504, 1.555	**1.493**	0.000	1.472, 1.515	**1.371**	0.000	1.321, 1.421	**1.382**	0.000	1.337, 1.426
35–49	**0.084**	0.000	0.055, 0.114	**0.044**	0.001	0.018, 0.070	**-0.206**	0.000	-0.260, -0.151	**-0.198**	0.000	-0.248, -0.149
January	**0.071**	0.000	0.034, 0.108	**0.071**	0.000	0.035, 0.107	**0.071**	0.000	0.045, 0.097	**0.071**	0.000	0.044, 0.097
February	**0.076**	0.001	0.033, 0.120	**0.076**	0.000	0.036, 0.117	**0.076**	0.000	0.046, 0.107	**0.076**	0.000	0.045, 0.107
March	**0.083**	0.000	0.045, 0.121	**0.083**	0.000	0.046, 0.120	**0.083**	0.000	0.056, 0.110	**0.083**	0.000	0.056, 0.110
April	**0.100**	0.000	0.061, 0.138	**0.100**	0.000	0.062, 0.138	**0.100**	0.000	0.073, 0.127	**0.100**	0.000	0.072, 0.128
May	**0.087**	0.000	0.051, 0.124	**0.087**	0.000	0.052, 0.123	**0.087**	0.000	0.060, 0.115	**0.087**	0.000	0.060, 0.115
June	**0.129**	0.000	0.088, 0.171	**0.129**	0.000	0.091, 0.168	**0.129**	0.000	0.104, 0.155	**0.129**	0.000	0.103, 0.155
July	**0.144**	0.000	0.104, 0.184	**0.144**	0.000	0.107, 0.182	**0.144**	0.000	0.118, 0.171	**0.144**	0.000	0.117, 0.172
August	**0.152**	0.000	0.108, 0.196	**0.152**	0.000	0.111, 0.193	**0.152**	0.000	0.125, 0.179	**0.152**	0.000	0.125, 0.180
September	**0.143**	0.000	0.101, 0.186	**0.143**	0.000	0.103, 0.183	**0.143**	0.000	0.113, 0.173	**0.143**	0.000	0.113, 0.173
October	**0.092**	0.000	0.051, 0.133	**0.092**	0.000	0.051, 0.133	**0.092**	0.000	0.065, 0.119	**0.092**	0.000	0.065, 0.119
November	**0.050**	0.006	0.015, 0.086	**0.050**	0.009	0.013, 0.088	**0.050**	0.000	0.023, 0.077	**0.050**	0.001	0.022, 0.079
Pandemic x 15–24 (ref.)												
Pandemic x 25–29				**0.162**	0.000	0.100, 0.224	-0.075	0.145	-0.176, 0.026			
Pandemic x 30–34				**0.259**	0.000	0.191, 0.327	-0.076	0.193	-0.191, 0.039			
Pandemic x 35–49				**0.289**	0.000	0.222, 0.357	-0.053	0.351	-0.164, 0.059			
Time x 15–24 (ref.)												
Time x 25–29							*0.006*	0.094	-0.001, 0.012	0.004	0.225	-0.002, 0.009
Time x 30–34							0.005	0.156	-0.002, 0.012	0.003	0.335	-0.003, 0.008
Time x 35–49							**0.012**	0.001	0.005, 0.019	**0.010**	0.001	0.004, 0.016
Time^2 x 15–24 (ref.)												
Time^2 x 25–29							*0.000*	0.074	0.000, 0.000	0.000	0.221	0.000, 0.000
Time^2 x 30–34							0.000	0.249	0.000, 0.000	0.000	0.625	0.000, 0.000
Time^2 x 35–49							*0.000*	0.086	0.000, 0.000	0.000	0.133	0.000, 0.000
Time^3 x 15–24 (ref.)												
Time^3 x 25–29							**0.000**	0.022	0.000, 0.000	*0.000*	0.065	0.000, 0.000
Time^3 x 30–34							*0.000*	0.067	0.000, 0.000	0.000	0.176	0.000, 0.000
Time^3 x 35–49							*0.000*	0.064	0.000, 0.000	*0.000*	0.087	0.000, 0.000
Constant	**3.101**	0.000	3.047, 3.154	**3.125**	0.000	3.074, 3.176	**3.238**	0.000	3.187, 3.288	**3.230**	0.000	3.184, 3.277

Note: Results shown from models, with the ASFR (ln) as the outcome. ASFR = age-specific fertility rate. Number of observations: N=316. Statistical significance: bolded if p-value <0.05 and italicized if p-value <0.10. CI = confidence interval.

Model 1: Time, Time^2, Time^3, Age, Pandemic, Month dummies

Model 2: Time, Time^2, Time^3, Pandemic, Age, Month dummies, Pandemic x Age

Model 3: Time, Time^2, Time^3, Pandemic, Age, Month dummies, Pandemic x Age, Time x Age, Time^2 x Age, Time^3 x Age

Model 3: Time, Time^2, Time^3, Pandemic, Age, Month dummies, Time x Age, Time^2 x Age, Time^3 x Age