Scenario-based Fertility Projections Incorporating Impacts of COVID-19

Abstract

This paper examines the recent declines in period fertility in the constituent countries of the UK during the past decade and speculates mechanisms through which the COVID-19 pandemic could influence childbearing in the UK. The effects are likely to differ by age and presence of children. Considering potential forces acting on individuals at different ages and family sizes, we expect that the COVID-19 pandemic will depress fertility, particularly among younger people. Because fertility at all ages was declining before the onset of the pandemic, this could mean a further decline in period fertility to historically low UK levels. We put forward a number of scenarios to examine the possible impact of the pandemic on numbers of live births. Our projections show that for three scenarios out of four fertility is expected to decline over the next three years, leading to significantly fewer births annually compared to the pre-pandemic period.

Keywords

COVID-19; pandemic; fertility; baby boom; baby bust.

1. Introduction

Predicting future numbers of births is important for planning, e.g. for maternity services, schools, and financial commitments through the welfare system. It is useful therefore to examine recent trends in birth rates and to consider the potential ways the COVID-19 pandemic could affect these, at least in the short term. Many factors affect childbearing decisions: economic influences (Becker, 1981), attitudes and beliefs (Lesthaeghe, 1995), and levels of gender equality outside and inside the home (McDonald, 2000; Goldscheider et al., 2015). Individuals and couples can generally decide how many children they want and when to have them, although some births are unplanned (Wellings et al., 2013). Given the complexity of the factors affecting childbearing, it is perhaps not surprising that previous predictions of future fertility in the UK have often been wrong (Hobcraft, 1996; ONS, 2015). Nevertheless, it is important to review potential mechanisms through which the pandemic may have affected childbearing in high-income settings such as the UK.

The aims of the paper are three-fold. First, we will examine fertility trends up to 2019 in the UK's constituent countries, to understand what was already happening prior to the pandemic. Readers should note that this paper was written in March 2021 and fertility rates for 2020 for all of the countries were not available. Second, we will discuss the possible impact of COVID-19 on childbearing behaviour and outline a number of possible future scenarios for fertility rates. Third, we will use these scenarios to project the Total Fertility Rate (TFR) and the annual number of births for the period of 2021-23. Our findings inform those charged with making assumptions about future fertility levels as part of population projections at national (Robards, 2021) and regional level (Greater London Authority, 2021) and inform public debates as to whether the pandemic is likely to result in a baby boom or bust (Luppi et al., 2020; Lynch, 2021).

The period TFR indicates the number of children a hypothetical woman would have if she experienced age-specific fertility rates (ASFRs) observed in that year throughout her reproductive career. The period TFR is influenced by both the level and the timing of births. Year-on-year fluctuations in births can be caused by people postponing or accelerating having a child and hence

are influenced by current events, such as economic recession, or a pandemic. Figure 1 shows the trend in total fertility for the constituent countries of the UK and other Northern and Western European countries (Human Fertility Database, 2021). We choose to focus on this region because over the past few decades it has tended to have higher levels of fertility than either Southern or Eastern Europe (Neyer and Andersson, 2008; Goldscheider et al., 2015), and thus levels more similar to the UK. During the 1990s, fertility rates in Northern and Western Europe showed some small declines (Figure 1). However, during the early and mid-2000s, all countries experienced an increase in birth rates. This upswing came to a halt in many countries following the 2008 economic recession, birth rates in many Northern and Western European countries declining from around 2009-10. Some Nordic countries, most notably Finland, and to a lesser extent, Norway have seen very substantial declines (Hellstrand et al., 2020). Previously, Nordic countries were seen as examples of high fertility, made possible by family-friendly policies and high gender equality (Neyer and Andersson, 2008). Demographers have suggested that the recent declines in Nordic countries relate to real and perceived financial and labour market insecurities, together with declines in welfare support which were enacted after the global recession of the late 2000s (Comolli et al., 2021; Matysiak et al., 2021). Economic precarity and welfare retrenchment may have had a similar effect on the postponement of transitions to adulthood in the UK (Furlong et al., 2017).

2. Fertility differences between the constituent countries of the UK

During the 1990s, fertility rates in Northern Ireland fell significantly to align more closely with trends in England and Wales[1], albeit at a higher level. In 2013, the TFR in Northern Ireland was around 2 births per woman, as compared to 1.8 in England and Wales. Fertility rates in Scotland started to diverge from England and Wales in the 1980s and by 2000, the TFR in Scotland was just under 1.5 births per woman (as compared to 1.7 for England and Wales). Scotland, like all the UK countries,

[1] Fertility rates are published separately for Scotland and Northern Ireland, but those for England and Wales are published together (ONS, 2020a).

experienced an increase in birth rates from 2000 to 2008, followed by an earlier and steeper decline, such that by 2019 the TFR was just below 1.5. Thus, prior to the COVID-19 pandemic, fertility rates were already declining in all countries of the UK and by 2019 were already at some of the lowest levels ever seen in the UK.

Figure 2 shows the ASFRs from 2000 to 2019 in the constituent countries of the UK (ONS, 2020a; NRS, 2020; NISRA, 2021a). Childbearing rates are highest among women in their late twenties and early thirties and lowest among those aged 40-44 and teenagers. The trends in ASFRs over the past two decades are similar across the UK, apart from an earlier decline in fertility at ages 25 and over in Scotland. During the first decade of the 21st century, childbearing rates increased among all age groups, apart from those under 20 who saw a dramatic decline (Heap et al., 2020). However, by 2010, fertility rates among those in their early twenties had started to decline, and by 2012, fertility among those in their late twenties had also started to fall.

Fertility rates among those in their thirties continued to slowly increase until around 2015 (2011 in Scotland). This increase in fertility among women in their thirties may have resulted from the recuperation of births that had been postponed (Berrington et al., 2015a), or could be the result of some women having a higher total number of births. In the last few years, fertility rates at ages 35 and over have started to decline. These trends may be due to fewer women having higher order births or could (also) reflect the end of the postponement of births from the twenties to thirties. Any potential impact of the COVID-19 pandemic on fertility (discussed in the next section) needs to be seen in the context of declining ASFRs. If the impact of COVID-19 is confined to teenagers and/or women aged over 40 then the overall effect on the TFR and number of births will be small. A more significant impact on the TFR will be seen if it is women in the peak childbearing years, e.g. those aged 25-34, who are affected.

The pandemic is affecting the registration of births and publication of statistics and time series of births by date of registration are severely disrupted (NISRA, 2021b). Provisional birth statistics in England and Wales (ONS, 2020b) relied on NHS births notification data.

3. Potential mechanisms through which the Covid-19 pandemic could impact fertility in the UK

Previous research suggests that the impact of COVID-19 on fertility rates is likely to be negative in high-income countries, largely due to increased social and economic uncertainty, and practical concerns such as access to hospitals and other social support during pregnancy and parenthood (Aassve et al., 2020; Lappegård et al., 2020; Charles-Edwards et al., 2021). Information about fertility intentions from surveys carried out in 2020 provides some support to this argument for (Lindberg, 2021; Luppi et al., 2020). In the UK, it was reported that fertility plans were most frequently abandoned by those individuals that expected the worst impact of the crisis on their future income (Luppi et al., 2020). Other evidence from social media also points to a possible fertility decline: Wilde et al. (2020) found a reduction in Google searches in the US for keywords relating to pregnancy, suggesting a possible decline in fertility.

At the time of writing (March 2021) few data, e.g. from antenatal booking services, or births have been published at the national level to indicate the impact of the pandemic on UK fertility rates. Thus, we can only hypothesise *what might happen*. Although the timing and extent of the COVID-19 pandemic and lockdown rules differed slightly between the nations of the UK, the application of rules and impacts on daily life were similar and we assume a similar response in the devolved nations.

Because decisions about childbearing are often made sequentially, it is justified to consider separately the potential impact of COVID-19 on childless women in addition to mothers. Moreover, given that virtually all maternities occur between ages 15 and 50, younger women have more opportunity to delay their childbearing in response to uncertainties than older women. Parents of children have faced particular challenges during the pandemic, especially when they have had to take on childcare duties due to their children not being able to attend nurseries and schools. Women have borne the brunt of additional childcare and home-schooling (Anders et al., 2020). Given that women

have greater control over their childbearing, this is likely to have an impact on fertility. In Table 1 we put forward hypotheses about the possible ways in which the COVID-19 pandemic might affect fertility according to age and parity. Green upward arrows refer to fertility-enhancing effects, whilst red downward arrows indicate a likely downward pressure on fertility. The number of arrows indicates the strength of the force. If no arrow is present, then we do not expect any impact on fertility. Next, we briefly explain each mechanism.

3.1. Downward pressures on childbearing

The first UK national lockdown in March 2020 encouraged individuals to remain at home. Restaurants, pubs, bars and nightclubs closed with less opportunity for people to socialise and meet new partners, or to have sexual relations with existing non-resident partners. Dating moved online, with less physical contact. Those already in a non-resident couple were forced to only meet outdoors since overnight stays were banned. Subsequently, in June 2020 rules were amended to allow support bubbles for those living alone. Couples who lived apart could stay overnight with each other. However, the rules only covered the situation where at least one of them lived alone. Therefore, for partnerships where both partners lived in shared, multi-person households, there remained difficult decisions to make as to which of the partners was allowed to stay over (Mason, 2020). From July 2020, the UK lockdown eased. Whilst nightclubs remained closed, other venues reopened, opportunities for socialising and meeting dates increased. In September, students returned to further and higher education, but by December 2020 the second lockdown had started and students were encouraged to return to their family home. Lockdowns would have the greatest impact on young people's sexual activity as they are the most likely not to be already living with their partner. For the same reason, they are also likely to have a greater effect on childless individuals as compared to those who already had a child.

Returning to live within parents is also common for young people not in education who experience job loss and economic insecurity (Stone et al., 2014) and appears to have increased in

response to the pandemic (Evandrou et al., 2021). Young adults moving back home experienced reduced levels of social contact with peers and the opportunities for having sexual intercourse were greatly diminished. For parents, the "stay at home" order meant that there would have been less privacy and time alone in the home. Thus, we might also expect reductions in sexual activity among older couples.

There is a reciprocal relationship between housing and fertility. Couples may change their housing situation in anticipation of or resulting from having children, or they may decide to start or expand their family after securing appropriate housing (Kulu and Washbrook, 2014). Couples who currently live apart often wait until they can set up a joint home before becoming parents. Couples who are already living together and who intend to have children might prefer to move to a suitable 'family home' before parenthood. Living with parents, or insecure housing situations, e.g. privately rented accommodation, are generally associated with lower levels of childbearing (Tocchioni et al., 2019). Thus, factors affecting the ability of couples to set up home together would likely relate to a decrease in fertility. Whilst it has been legal to move home during the pandemic, the process of searching for and moving into a new home has been made more difficult. The UK Government announced in summer 2020 financial support to the housing market through the stamp duty holiday whereby the threshold at which stamp duty was payable was raised to £500,000 in England and Northern Ireland, and £250,000 in Scotland and Wales. However, access to the housing market remained difficult with average house prices in the UK increasing by 8.5% in the year to December 2020 (ONS, 2021a). In April and May 2020, the number of residential house sales fell by half as compared to the previous year (ONS, 2021a), although residential transactions increased during subsequent months due to pent-up demand. Thus, we hypothesize that difficulties in housing transitions will be associated with a decrease in fertility.

The Government-supported UK Weddings Taskforce (2021) estimates that over 200,000 weddings were postponed during 2020. Whilst almost half of all births take place in the UK outside of marriage, there remains a strong inter-connection between marriage and entry into parenthood,

particularly for those from socio-economically advantaged backgrounds (Berrington et al., 2015b). Couples often postpone marriage until they can afford a "proper wedding" and the importance of marriage as a public statement of commitment continues (Berrington et al., 2015b). During the COVID-19 pandemic, large weddings have not been permitted and many couples have postponed their wedding plans at least once. We hypothesise that the ban on large weddings will have a downward effect on fertility.

Couples may decide to postpone having a baby due to concerns about the potential impacts of COVID-19 on the pregnancy. Although there was little concrete evidence on the possible risks at the start of the pandemic, couples may well have been concerned. Later, as evidence began to emerge, it was suggested by the Royal College of Obstetricians and Gynaecologists (RCOG) that pregnant women who catch COVID-19 may be at increased risk of becoming severely unwell compared to non-pregnant women (RCOG, 2021). Couples may have been put off trying for a baby due to the fear of an "overwhelmed" healthcare system (Lockett, 2020), or the possible exposure to COVID-19 that they themselves would have as a result of routine check-ups during pregnancy, and hospital stays during the birth of their child. In the UK, during the first lockdown, many fathers were unable to be present during important antenatal appointments including scans and were not able to witness the birth of their child (Schraer, 2020). For all of these reasons it would seem likely that women/couples of all ages and parities might postpone a planned pregnancy. Given that births to teenagers are less likely to be planned (Wellings et al., 2013), the effect on this age group may be smaller.

Lobby groups including the NSPCC (2020) highlight a lack of support for new parents during the pandemic. Prospective parents may be concerned about the lack of access to healthcare, including perinatal services and home visitors during COVID-19. They may also be concerned about the lack of social support from family and friends due to lockdown rules and travel restrictions for migrants with family overseas. New parents often rely on the help of other family members whilst they care for a newborn, and more generally the pandemic has meant that less informal childcare is available. Whilst online support, such as trained peer supporters has been available, there is also an awareness

that much of the community support for new parents (antenatal peer groups, public parent and baby groups, opportunities for informal meetups) are not possible at this time. For all of these reasons we would expect there to be a downward pressure on fertility rates. The COVID-19 pandemic increased death rates at the oldest ages. Many individuals have experienced the loss of an elderly family member. The impact of such tragic events on childbearing patterns is difficult to predict. The relationship is likely to be complex, possibly mediated via its effect on individuals' mood and anxiety, financial and housing implications of the death.

Micro-economic theories suggest that reductions in income would result in reduced demand for children due to their direct costs, e.g. for clothes, food, equipment (Becker, 1981). The economic consequences of the COVID-19 pandemic have been severe, particularly for those already vulnerable. Lower-paid workers are more likely than those on higher pay to have been furloughed or lost their jobs (Handscomb and Judge, 2020). A significant minority of those on the lowest incomes are likely to have had to borrow money in order to meet basic needs such as food and heating. Young people were particularly likely to lose their jobs during the first lockdown, as industries that traditionally employ younger staff such as pubs, restaurants, hotels and leisure centres closed their doors. According to Gustafsson (2020), one third of 18-24-year-old employees (excluding students) lost jobs or were furloughed, compared to one in six prime-age adults. In addition to these immediate financial implications of COVID-19, the pandemic has also increased economic uncertainties as to what the future might hold in terms of a financial recovery and job prospects. Concerns about finding and keeping a well-paid job are likely to have been magnified by the pandemic and associated with a delayed entry into parenthood, or a delay in having an additional child due to worries about the costs. Evidence from previous economic recessions highlights the fertility postponing effects, particularly for young childless adults (Goldstein et al., 2013).

Less commuting, more home working, and being furloughed may have improved some individuals' work-life balance in the UK (Williams et al., 2021). However, the pressure to combine both domestic and paid work often increased. Survey evidence suggests that it is women that have

taken on the majority of the burden of childcare and home-schooling (Anders et al., 2020). Previous academic research found that increased gender equality within the home, for example in terms of share of domestic chores, or fathers' involvement in parental leave, is associated with a greater likelihood of childbearing (Goldscheider et al., 2013; Duvander et al., 2019). Existing parents (especially women) may be discouraged from having an additional child due to the burdens of caring for existing children under lockdown and the persistently unequal division of labour between sexes brought to light by pandemic-related circumstances.

At the time of the first lockdown in March 2020, all IVF treatments were suspended. Subsequently, some treatment has resumed at a lower level but several months of closure resulted in a sizeable backlog of untreated couples. In July 2020, new Human Fertilisation and Embryology (HFEA) Regulations came into effect which extended the storage limit of frozen eggs, sperm and embryos by two years so that those undergoing fertility treatment during the coronavirus outbreak have more time to continue treatment (HFEA, 2021). However, delays of even just six months to treatment, especially of older women, reduces IVF success rates. The HFEA database (HFEA, 2020) shows that the number of live births resulting from IVF in the UK in 2018 was 19,728, suggesting that approximately three percent of live births resulted from IVF that year. There may be additional downward pressures on fertility due to couples not being able to access primary healthcare to investigate unexplained fertility, or to access fertility enhancing drugs. Thus, for those at ages over 35 we would expect a small downward pressure on fertility rates due to restrictions on IVF. There will be little effect at younger ages however.

3.2. Upward pressures on childbearing

The COVID-19 pandemic has made access to contraceptives, or at least the perceived access, more difficult (APPGSRH, 2020). Individuals may have been reluctant to contact their healthcare provider at times when the NHS was thought to be "overwhelmed" (Lockett, 2020). Many reproductive health appointments were switched from face-to-face to online or telephone

appointments. Thus, difficulties in accessing contraception have been especially the case for methods which involve intervention by a health practitioner (e.g. Long-Acting Reversible Contraceptives such as Intra-Uterine Devices and Contraceptive Implants). It is unclear how the pandemic has affected the use of emergency contraception and abortion rates, although COVID-19 has driven a shift from surgical to medical abortion. Abortion regulations in England, Wales and Scotland were amended to allow home administration of mifepristone and misoprostol (Bateson et al., 2020). However, teenagers especially may have been reluctant to contact health services during the pandemic upon realising that they are (at risk of becoming, or currently) pregnant (Lewis et al., 2021). As a result of these changes, we would expect an upward trend in birth rates, particularly among teenagers who may be less confident about accessing services.

Some couples decided to move in together at the start of the lockdown in March 2020 as a way of being able to continue their relationship. Indeed, Government advisors even suggested that couples move in together (Walker, 2020). The extent to which this phenomenon took place, and the extra co-residential partnerships that occurred over and above that which would have happened anyway is unknown. Moreover, other anecdotal evidence suggests that some young adults who were living in the parental home moved in with their boyfriend/girlfriend but continued to live with one set of parents (often alternating between the two sets). It is likely that for many young people, there was a swifter transition from girlfriend/boyfriend to co-residential partner than would otherwise be the case, exerting an upward pressure on fertility rates.

Micro-economic theories of childbearing also highlight the indirect economic costs of childbearing – for example the lost income and promotion opportunities that (for women especially) occur when time is taken away from paid work in order to care for children (Becker, 1981). There are other indirect costs of parenthood which are less quantifiable in nature, such as parents' reduced ability to socialise outside of the home, act spontaneously or travel abroad as easily. The COVID-19 pandemic could have reduced the opportunity costs of having a(nother) child. The chances of finding a new job during lockdown were reduced. The Institute for Fiscal Studies found that new job vacancy

postings on the Department for Work and Pensions "Find a Job" website on 25 March 2020 (just as the first lockdown was announced) were just 8% of the equivalent day in 2019. Thus, for those who were already out of the paid labour force, for example because they were unemployed or undertaking family care, there was less chance that they would be able to find a job. Hence, the economic opportunity costs of having a(nother) child would be reduced. Previous evidence from Germany highlighted heterogeneity in the response to employment uncertainty (Kreyenfeld, 2010). While more highly educated women tended to postpone parenthood when subject to employment uncertainties, those with low levels of education often responded by becoming mothers. For those intending to have another child in the future, the reduced economic opportunity costs of childbearing may have accelerated their transition to having an additional child.

The pandemic forced many co-resident couples, especially those who have been working from home, to spend more time in each other's company. It is possible that the new opportunities to spend time together could increase the frequency of sexual activity and thus increase fertility rates. The pandemic has encouraged a new focus on home life. Becoming a parent and having a young child can hinder social activities outside of the home. Such activities have not been possible (or have only been possible for part of the time) during the pandemic. Thus, couples might view the pandemic as a good time to try for a baby. However, we acknowledge that at the start of the COVID-19 pandemic in the UK, few would have predicted the subsequent waves of the pandemic during late 2020, early 2021, and the summer of 2021. Some people have welcomed the slower pace of life and the time to spend within the home that the lockdown has brought (Soper, 2020; Van Kessel et al., 2021). For some, particularly the better off, relationships are reported to have improved during the pandemic (Perelli-Harris et al., 2020). It is possible that couples who previously focused on paid work and may have worked long hours, with long commutes, may re-evaluate their life priorities and consider starting a family. This could be particularly the case for those in their twenties and early thirties who had previously been postponing parenthood. Thus, we hypothesise an upward pressure on fertility due to

better work-life balance, noting again however, that at the early stages of the pandemic individuals had no knowledge of the future extent of social restrictions during subsequent waves of the pandemic.

The economic impacts of COVID-19 on family finances have been very variable. Whilst income declines have been greatest for those already on low incomes, a significant minority of better off families have been able to increase their savings (Davenport et al., 2020). A recent survey suggested that 44% of high income, employed households saved more during the pandemic (Bank of England, 2020). Savings have occurred for example due to fewer opportunities to take holidays, especially overseas. For parents with school-age children, there have been fewer outgoings due to cancelled school trips (both in the UK and overseas), and less costs associated with extra-curricular activities and clubs which were cancelled. We hypothesise that, especially for couples in their thirties who have postponed childbearing to later ages, increased savings might encourage higher fertility.

3.3. Overall impact of the pandemic on fertility

In summary, the COVID-19 pandemic is likely to have a depressing effect on fertility rates, particularly among those aged under 30, and especially young adults who are currently childless and in paid work. Among older women the effect is likely to be near zero, or even slightly positive, especially for existing parents.

4. Quantifying the short-term impact of the pandemic on fertility: four scenarios

We put forward a number of possible future scenarios for fertility rates in the constituent countries of the UK. Our aim is not to make predictions of what the future fertility rates will be, but to explore what the implications of different scenarios regarding changes to ASFRs would mean in terms of the overall TFR and number of annual births.

4.1. The four scenarios

The scenarios reflect assumptions about both the baseline underlying trend in fertility which would have occurred in the absence of the pandemic (See Section 4.2 for details), plus assumptions regarding the effect of COVID (See Section 4.3). In order to examine the potential impact of the pandemic on fertility we need to establish the level of fertility pre-pandemic. At the time of writing (March 2021) 2020 ASFRs for Scotland and Northern Ireland are not available, but provisional estimates for England and Wales based on NHS registrations for the period January-September 2020 have been published (ONS, 2020b). In comparison with 2019 ASFRs from the same NHS source, the ASFRs for January-September 2020 are slightly lower, suggesting a continuation of the existing decline in fertility prior to the impact of COVID-19 (March conceptions being born in December). In order to obtain estimates of the 2020 ASFRs for Scotland and Northern Ireland, we make the assumption that the change in ASFRs between 2019 and 2020 followed the same pattern (i.e. declined in the same ratio) as for England and Wales.

Our first two scenarios assume that recent changes in ASFRs would cease and thus in the absence of COVID-19 the ASFRs would remain at the levels experienced during January-September 2020 - we call this the stable baseline. Scenario 1 then adjusts the 2020 rates by hypothesized COVID-19 baby boom adjustment factors, whilst Scenario 2 adjusts fertility by COVID-19 baby bust factors (Section 4.3 discusses the adjustment factors in more detail). The second two scenarios assume that past trends (averaged over the past five years) for each age group will continue over the subsequent three years (see Section 4.2 for the method for projecting the baseline trend). Given that fertility rates have been declining in all countries of the UK recently, assuming a continuation of recent declining trends results in lower projected fertility rates. We therefore refer to this as the declining baseline.

4.2. Projecting the underlying baseline trend for UK countries in absence of COVID-19

Scenarios 1 and 2 assume that in the absence of the pandemic, the fertility rates observed in 2020 would continue for the subsequent three years. Scenarios 3 and 4 assume that in the absence of the COVID-19 pandemic the recent trend (mostly downward) in ASFR would continue into the near future. This sort of extrapolation, whereby projections are based on recent trends has previously been implemented successfully in fertility forecasting (Bohk-Ewald et al., 2018). Such trends are commonly estimated using the rates observed over the past five years (Ellison et al., 2020; Myrskylä et al., 2013; Schmertmann et al., 2014). This motivates the approach that we take in Scenarios 3 and 4, where our baseline trend is an extrapolation of the most recent five-year trend in ASFRs (Figure 2). Additive change on the log scale is equivalent to multiplicative change on the original scale. Therefore, for a given country and five-year age group, we estimate the average trend of the log-rates observed between 2015 and 2020 inclusive. This is the straight line joining the 2015 and 2020 log-rates. We generally find a declining trend in ASFRs for all five-year age groups across the UK countries, except for the 40-44 age group where an increase is observed. We extrapolate the trend for the next three years (2021-2023) by recursively adding the slope of the line. Exponentiating to return to the original scale, we calculate the corresponding annual multiplicative factor which is equal to the exponential of this slope. This straightforward projection of pre-COVID trends suggests a significant further reduction in period fertility.

4.3. COVID-19 baby boom and baby bust adjustment factors

Qualitative baby boom and baby bust adjustments

Following our exploration of potential mechanisms in Section 3, we make the following assumptions about the baby boom and baby bust adjustments due to COVID-19. The baby boom adjustment assumes a net zero impact on fertility under age 30 and over age 40, but some increase in fertility among those aged 30-39. This is based on the idea that at ages 30-39 the impact of postponement due

to uncertainties is more limited and there may be some acceleration, especially of second and higher-order births, due to lockdown. Conversely, the baby bust adjustment assumes a net zero impact on fertility for ages 30+, but some decrease in fertility among those aged under 30. This is based on the idea that postponement of births due to uncertainty is likely to be greatest at ages under 30.

Quantification of the assumptions

We quantify these assumptions by performing empirical analyses of relevant past experiences. The baby boom adjustment is informed by the experience of England and Wales following the 1977 'pill scare' in which serious health concerns were raised about the use of oral contraceptives for women aged 35+ (Murphy, 1993). The shock of the pill scare resulted in a considerable decrease in pill sales and a subsequent rise in fertility (Murphy, 1993). Appendix Figure A.1 shows the trend in ASFRs for England and Wales between 1972 and 1980. It is clear that there was an immediate stalling in fertility declines at younger and older ages, with a reversal for women in their twenties and thirties who were more likely to be in stable sexual unions and therefore using contraception.

The baby bust adjustment is informed by the experience of selected North-West European countries following the 2008 recession. Following the 2008 recession some, but not all, European countries witnessed a decline in fertility which commentators have interpreted in terms of increased socio-economic uncertainty (Goldstein et al., 2013; Comolli, 2017). These countries do not include the UK, which continued to experience an overall increase in the TFR through to 2012 (Figure 1). Appendix Figure A.2 shows the trend in ASFRs for selected European countries where fertility declined subsequent to 2008, when it had previously been increasing or stable. It is clear that in most countries there was an immediate decline in fertility at younger ages, less so at older ages.

Returning to the baby boom adjustment, for a given five-year age group we calculate the average three-year trend of the log-rates observed between 1977 and 1980 inclusive (see dotted lines

in Appendix Figure A.1) and the corresponding adjustment factor. We present these adjustment factors in Table 2 (row 1). To complement the age ranges discussed in Table 1, we average across the age groups 20-29, and across age groups 30-39 (row 2). An adjustment factor of 0.95 means that the fertility rate for that country and age group decreased on average by 5% year-on-year in 1978-1980 compared to the 1977 level, whereas a value of 1.05 indicates a 5% year-on-year increase. For the baby bust adjustment we perform identical analyses for each of the selected North-West European countries across the 2008-2011 period, presenting the resulting adjustment factors and the overall mean adjustment factors for all of the countries in Table 3. The COVID-19 baby boom and baby bust adjustment factors are summarised in Table 4.

From Table 2, we can see that while the adjustment factors exceed 1 across the age range, the greatest average annual increase of 7% is experienced by women in their thirties. This confirms our assertions that older women, who were more likely to already be in a sexual union, were more likely to progress to higher parities following the pill scare. Due to the additional economic uncertainty and concerns about accessing health services, the magnitude of a baby boom resulting from the onset of the COVID-19 pandemic is likely to be smaller than the increases which followed the 1977 pill scare. Therefore we propose a 2% annual increase for women in their thirties (Table 4, column 1, row 3) and a net zero impact for all other ages (Table 4, column 1, rows 1, 2 and 4) to quantify our earlier assumptions. From Table 3, we can see that all of the adjustment factors for the ages under 30 are less than 1, whereas for ages 30+ the majority of the multiplicative factors exceed 1. This confirms our assertions that fertility declined at younger ages following the recession, and increased slightly at older ages. We propose a 5% annual decrease in teenage fertility (Table 4, column 2, row 1), a 3% annual decrease for 20-29 year-olds (Table 4, column 2, row 2) and a net zero impact for all other ages. We note that identical analyses performed for post-communist countries following the Fall of Communism in 1989 show similar magnitudes of decline; however, these are across the whole age range rather than just at the younger ages as in our analysis of the 2008 recession.

Bijak et al. (2007) use a similarly structured approach to specify scenarios in the projection of migration, whilst Charles-Edwards et al. (2021) provide an alternative scenario-based approach to explore the potential impact of COVID-19 on Australian population projections. Our scenarios represent a range of possible futures, each having a minute probability of being correct. Also, for a given baseline the baby boom and baby bust adjustments could occur simultaneously, as the respective increases and decreases are experienced by different age groups. Therefore although attaching probabilities to the scenarios may appear useful, we choose not to add more subjectivity to the projections by doing this (see Grienitz et al. (2014) for further discussion of the challenges associated with assigning probabilities to scenarios).

An alternative way of computing adjustment factors to inform the 'declining baseline' scenarios would take account of the trend in the ASFRs between 1972 and 1977 in England and Wales for Scenario 3 rather than simply the 1977 level, and the trend between 2003 and 2008 for the selected North-West European countries for Scenario 4 rather than simply the 2008 level (see Appendix A for details). As fertility levels were steeply declining prior to the 1977 pill scare (Appendix Figure A.1), the resulting alternative adjustment factors for Scenario 3 are significantly further above one as compared to those in Table 2. Using these alternative adjustment factors to inform our assumptions about the (more gradually declining) trend in ASFRs observed for the UK would therefore suggest very rapid increases that we did not think were reasonable. Conversely, as many Northern and Western European countries were experiencing either stable or increasing fertility just prior to the 2008 recession (Appendix Figure A.2), the alternative adjustment factors for Scenario 4 tend to be further below one as compared to those in Table 3, for older ages in particular. However, this would make little difference for Scenario 4 where we already assume net zero change at older ages. Therefore we decided on a less extreme approach, namely using the average adjustment factors in Tables 2 and 3 to inform Scenarios 3 and 4 as well as Scenarios 1 and 2.

Whilst we look to past empirical shocks to inform our analyses we also use expert judgement in deciding upon the adjustment factors. Underlying both the baby boom and baby bust scenarios there are opposing forces acting to both increase and decrease fertility. The main difference between the baby boom and baby bust scenario is the relative weight given to these forces. The baby boom and baby bust scenarios should be viewed as relatively conservative in their assumptions. We do not think that the fertility boom will be as large as that seen following either World War II or the 1977 pill scare due to the forces acting to reduce fertility. Similarly, the COVID pandemic is materially different to the economic recession of 2008 in that lockdowns provided an opportunity for couples to focus on family and decisions to have a(nother) child may have been brought forward.

4.4. Projected fertility rates under the four scenarios

In 2020 the highest TFR is found in Northern Ireland (1.76 births per woman) and lowest in Scotland (1.33 births per woman). England and Wales is between the two (TFR of 1.60) (Table 5). Therefore even before the pandemic all countries of the UK were experiencing unprecedentedly low fertility. Only one scenario (Scenario 1) is associated with an increase in the TFR between 2020 and 2023. All others suggest a decline, with Scenario 4 showing the largest decline (Figure 3). Under Scenario 1, we assume that in the absence of the COVID-19 pandemic, fertility would have remained at the 2020 levels, but that due to COVID-19 we will see a baby boom among those in their thirties (Table 4). This means that for England and Wales the TFR climbs from 1.60 births per woman in 2020 to 1.65 in 2023. Under Scenario 1, fertility increases to 1.37 births per woman in Scotland in 2023 and 1.82 births per woman in Northern Ireland. However, if we assume that the recent downward trend in birth rates observed in the UK were to continue in the future in the absence of COVID-19, we see that the effect of the baby boom (Scenario 3) would not outweigh the impact of declining trends; the TFR would be 1.53 in England and Wales, 1.25 in Scotland, and 1.71 in Northern Ireland.

Scenarios 2 and 4 assume that the net effect of the COVID-19 pandemic on ASFRs will be negative at younger ages (Table 4). Scenario 2, which assumes that in the absence of COVID-19

fertility would have remained at the 2020 level, shows the TFR reducing from 1.60 in England and Wales to 1.54, whilst in Scotland it reduces from 1.33 to 1.28 and from 1.76 to 1.69 in Northern Ireland. If however, we assume that the COVID-19 pandemic promotes already declining ASFRs, then we see the TFR reaching a low of 1.43 in England and Wales, 1.16 in Scotland, and 1.60 in Northern Ireland. These TFRs would be much lower than the low levels of fertility observed in previous baby busts in England and Wales during the 1930s (when the TFR declined to 1.72 in 1933), or the 1970s (when fertility declined to 1.66 in 1977) (Hobcraft, 1996), or the previous historical low seen in 2001 (1.63) (ONS, 2020a). The effect of the four scenarios on the TFR from 2015-2023 is shown in Figure 3 together with the two baseline projections. The choice of baseline has a significant impact on the future TFR, but for three scenarios out of four we observe a significant decline in the TFR in all four countries.

4.5. Projected numbers of births under the four scenarios

Since for planning purposes e.g. maternity services and school places, policy makers need to make assumptions about future births we estimate the effect of our four scenarios on the future numbers of births. We first obtain the mid-year population projections by five-year age group for females for 2021-2023 for England and Wales, Scotland and Northern Ireland from the ONS 2018-based National Population Projections (ONS, 2019). Next, for a given country, scenario and calendar year, for each age group we compute the projected number of births by multiplying the projected ASFR by the projected mid-year population. We then sum these birth projections across the age groups to obtain a total. We present the resulting number of births in Appendix Table B.1.

In order to visualize how many additional or fewer births are associated with each of the scenarios, we plot the projected number of births under each scenario alongside the two baseline trends (Figure 4). In Scenario 1 (stable baseline, baby boom) the overall number of births would increase from 2021 to 2023. However, in Scenario 3 (declining baseline, baby boom) we see the

opposite trend. This is because the presence of the baby boom is insufficient to outweigh the strong declines in fertility based on the trends from 2015-2020.

In Scenarios 2 and 4 (baby bust scenarios) the number of births also declines steadily from 2020 to 2023, with Scenario 4 being the most extreme as we saw in Figure 3. Using the estimated ASFRs for 2020 we estimate the total births in 2020 to be 620,288 in England and Wales, 48,183 in Scotland and 21,513 in Northern Ireland. For England and Wales, by 2023 the number of births could increase by 16,502 (Scenario 1) or decrease by 67,979 (Scenario 4) by 2023. This is an increase of 2.7% or a decrease of 11.0%. For Scotland, under the first scenario the absolute number of births could increase by 3.1% (1,484 births), or under Scenario 4 decrease by 12.2% (5,857 births). In Northern Ireland Scenario 1 is associated with an increase in the number of births by 1.3% (269 births), whilst Scenario 4 is associated with a decrease by 10.9% (2,338 births).

In terms of the baselines, from Figure 4 we see that the projected number of births under the stable baseline actually decreases year-on-year from 2020 for all of the UK countries, apart from a very slight increase in 2021 for Scotland. This is driven by the decreasing population at risk aged 20-29 across all countries, with the steeper rate of change for Northern Ireland caused by additional decreases in the 30-34 age group. Unsurprisingly, the projected number of births under the declining baseline decreases at a much faster rate. To assess our hypothesized impact of the pandemic on the projected overall number of births, for each scenario we compare the projected number of births in 2023 with that projected under its corresponding baseline. For England and Wales, the baby boom scenario would lead to an extra 20,083 births (compared to stable baseline) and 19,101 births (compared to declining baseline). The baby bust scenario would lead to 23,402 missing births (stable baseline) and 20,705 missing births (declining baseline). The equivalent quantities for Scotland are 1,626 and 1,513 extra births, and 1,755 and 1,526 missing births. For Northern Ireland, there would be 722 and 692 extra births, and 759 and 689 missing births. As shown in Appendix Figure B.1, baby bust Scenarios 2 and 4 are reducing the number of births to younger women in particular. Thus the average age of mothers requesting maternity services would increase under these scenarios.

5. Discussion

This paper examined recent trends in fertility and found that in all countries of the UK fertility rates have been declining at all ages, even women in their late thirties and forties among whom there had previously been sustained increases associated with the shift of childbearing to later ages. We have shown that although all countries of the UK have seen the same pattern of fluctuations in fertility over the past two decades, there are significant differences in the level. Fertility rates are persistently lower in Scotland than in England and Wales, and higher in Northern Ireland.

Provisional estimates of the TFR for England and Wales based on the first three quarters of 2020 (ONS, 2020b) suggest that fertility rates for England and Wales had fallen to historically unprecedented low levels before any impact due to the pandemic occurred. The provisionally estimated TFR of 1.60 for England and Wales (ONS, 2020b) is lower than that seen during the great recession of the 1930s, the 1970s baby bust, or the previous historic lows seen in 2001. Thus any impact of COVID-19 on fertility rates must be viewed in this already unusual context. We will not know the full impact of the COVID-19 pandemic on fertility rates in the UK between 2021 and 2023 until data become available. When revising the paper (September 2021), observed ASFRs for the whole of 2020 became available for England and Wales and Scotland (ONS, 2021b; NRS, 2021a). For England and Wales the observed TFR for 2020 of 1.58 is slightly lower than the provisional TFR of 1.60 based on the first nine months. This decline was largely due to fewer births in December 2020, an 8% drop compared to December 2019 (ONS, 2021c). This suggests that the downward pressures on fertility discussed in this paper outweighed the positive impacts at least in the early stages of the pandemic. For Scotland, the observed TFR for 2020 of 1.29 is again lower than our provisional estimate of 1.33 (see Section 4.1). This appears to be driven by consistently lower fertility levels throughout 2020 as compared to 2019, rather than a large drop at the end of 2020 (NRS, 2021b). In Appendix C we have updated our projections for England and Wales and Scotland to take account of

these new data so that the 2020 TFRs and numbers of births will be consistent with national estimates from ONS and NRS. However it is not appropriate to use these data in the quantification of the effect of the pandemic on fertility because the full year rates incorporate some of the effect of the pandemic.

We suggested that there are opposing forces operating among different population subgroups, for example according to individuals' ages and whether children are already present. Among those aged under 30, the majority of our postulated mechanisms exert a downward pressure on fertility rates. For example, we believe that the lack of socializing due to the lockdowns and increased economic uncertainties caused by the economic fallout from the COVID-19 pandemic will act to decrease the likelihood of childbearing among younger people. Historical evidence of fertility rates following the 2008 recession from other Northern and Western European countries suggests that it is young people who are most likely to see a decline in rates of childbearing, as births are postponed to later ages (Goldstein et al., 2013). We thus examined a set of future baby bust scenarios where fertility was reduced at the ages under 30 due to the pandemic.

Among those who already have at least one child, and among older couples who are more stable in their housing and financial situation, there are a number of mechanisms through which the COVID-19 pandemic could result in declines in fertility (e.g. concerns about the reduced support from health services or family and friends during the pandemic). However, there are also mechanisms through which the pandemic might result in an increase. For example, couples had more time to spend together at home during lockdown and among those who are currently unemployed, the opportunity costs of having a(nother) child might have been reduced due to the economic consequences of the pandemic. Historical evidence of fertility rates following the 1977 pill scare suggests that it is older women who are most likely to see an increase in fertility. Thus, we additionally examined a set of baby boom scenarios whereby fertility rates were seen to increase slightly among those aged in their thirties.

Before applying our baby boom and baby bust adjustments to fertility rates we had to project a baseline trend for fertility that represents what would have occurred in the absence of COVID-19.

On the one hand, given that fertility rates in the UK have been declining in recent years, a continuation of recent trends would imply further declines in fertility, even in the absence of COVID-19. On the other hand it could be that, in the absence of COVID-19, fertility rates would stabilize at 2020 levels. We applied our baby boom and baby bust scenarios to both of these baselines, resulting in four projections.

The projected TFRs from our four scenarios provided a range of possibilities, with the highest TFRs for 2023 resulting from Scenario 1 – a stable baseline level of fertility from 2020 and an annual 2% increase in fertility rates among those in their thirties. Under this scenario, the 2020 to 2023 increase in TFR would be 1.60 to 1.65 in England and Wales, 1.33 to 1.37 in Scotland, and from 1.76 to 1.82 in Northern Ireland. The lowest projected TFRs resulted from Scenario 4 where we assumed that fertility rates would have continued their recent downward trend in the absence of COVID-19, and that there will be further downward pressures on fertility at ages under 30 (an annual reduction of about 3%) due to the pandemic. Under Scenario 4 the TFR in 2023 would only reach 1.43 in England and Wales, 1.16 in Scotland, and 1.60 in Northern Ireland.

In order to estimate the additional effect of COVID-19 on the future number of births, we compared the projected number of births in 2023 with the number predicted using the different baseline trend which would have occurred in the absence of COVID. If we sum the extra/missing births compared to the relevant baseline from 2021 to 2023 we can see the potential cumulative effect of COVID by the end of 2023. For England and Wales, the different scenarios produced a range from 47,536 missing births (Scenario 2: Baby bust, stable baseline) to 39,912 additional births (Scenario 1: Baby boom, stable baseline). The equivalent range for Scotland was between 3,588 missing births (Scenario 2) and 3,215 extra births (Scenario 1). For Northern Ireland, there could be between 1,547 missing births (Scenario 2) up to 1,440 additional births (Scenario 1). These differences could have significant implications for service provision.

Although educational and ethnic heterogeneity in fertility rates are important (see Berrington et al. (2015a) and Kulu and Hannemann (2016)), we lack sufficient data to account for this in our

projections. The ethnicity and educational level of parents is not collected for all parents within birth registration in the UK. Fertility estimates and projections by education and ethnicity have been produced using alternative data sources such as censuses and surveys, e.g. see K. C. et al. (2010) and Norman et al. (2014). Wilson and Rees (2005) provide a review of developments in population projections accounting for additional variables such as education and ethnicity.

The principal variant of the 2018-based National Population Projections (NPPs) (ONS, 2019) assumed that, in the UK, under-20 fertility rates would continue to decline steadily, but that fertility among those in their early twenties would remain stable at the levels seen in 2018. In the subsequent years since this publication, fertility rates at all ages under 30 have continued to decline. Thus, even before any effects of the COVID-19 pandemic are factored in, the projected number of births for 2021-22 (mid-year to mid-year) under the 2018-based NPPs (645,846 in England Wales, 50,880 in Scotland and 21,988 in Northern Ireland) are significantly higher than all of our scenarios. Scenario 1 (stable baseline, baby boom) comes closest to the 2018-based NPPs (with 631,800, 49,220 and 21,712 projected births for the 2022 calendar year). An examination of some of the potential mechanisms through which the pandemic could affect childbearing suggests that recent declines in fertility rates could well be accelerated by the COVID-19 pandemic, moving the observed number of births even further below levels implied by the most recent national projections. There is likely therefore to be a significant difference in the assumptions used in the 2020-based National Population Projections (Robards, 2021), as compared the 2018-based projections.

References

Aassve, A., Cavalli, N., Mencarini, L., Plach, S. & Bacci, M. L. (2020.) The COVID-19 pandemic and human fertility. *Science*, 369(6502), 370-371.

All Party Parliamentary Group on Sexual and Reproductive Health in the UK (APPGSRH) (2020). Women's Lives, Women's Rights: Strengthening Access to Contraception Beyond the Pandemic. https://www.fsrh.org/policy-and-media/all-party-parliamentary-group-on-sexual-and-reproductive-health/

Anders, J., Macmillan, L., Sturgis, P. & Wyness G. (2020). Homeschooling during lockdown deepens inequality. LSE Blog. https://blogs.lse.ac.uk/COVID19/2020/06/05/homeschooling-during-lockdown-will-deepen-inequality/

Bank of England (2020). Home Bank Overground How has Covid affected household savings? How has Covid affected household savings? https://www.bankofengland.co.uk/bank-overground/2020/how-has-covid-affected-household-savings.

Bateson, D. J., Lohr, P. A., Norman, W. V., Moreau, C., Gemzell-Danielsson, K., Blumenthal, P. D. & Black, K. I. (2020). The impact of COVID-19 on contraception and abortion care policy and practice: experiences from selected countries. *BMJU Sexual and Reproductive Health* http://dx.doi.org/10.1136/bmjsrh-2020-200709 46(4).

Becker, G. S. (1981). *A Treatise on the Family*. Harvard University Press, Cambridge, MA.

Berrington, A., Stone, J. & Beaujouan, E. (2015a). Educational differences in timing and quantum of childbearing in Britain: a study of cohorts born 1940-1969. *Demographic Research,* 33(26), 733-764. https://doi.org/10.4054/DemRes.2015.33.26

Berrington, A., Perelli-Harris, B. & Trevena, P. (2015b). Commitment and the changing sequence of cohabitation, childbearing, and marriage: Insights from qualitative research in the UK. *Demographic Research,* 33, 327-362.

Bijak, J., Kupiszewska, D., Kupiszewski, M., Saczuk, K., & Kicinger, A. (2007). Population and labour force projections for 27 European countries, 2002-052: impact of international migration on population ageing. *European Journal of Population*, 23, 1.

Bohk-Ewald, C., Li, P. & Myrskylä, M. (2018). Forecast accuracy hardly improves with method complexity when completing cohort fertility. *Proceedings of the National Academy of Sciences*, 115(37), 9187-9192.

Charles-Edwards, E., Wilson, T., Bernard, A. & Wohland, P. (2021). How will COVID-19 impact Australia's future population? A scenario approach. *Applied Geography*, 134.

Comolli, C. L. (2017). The fertility response to the Great Recession in Europe and the United States: Structural economic conditions and perceived economic uncertainty. *Demographic Research*, 36, 1549-1600.

Comolli, C. L., et al. (2021). Beyond the economic gaze: Childbearing during and after recessions in the Nordic countries. *European Journal of Population*, 37, 473–520.

Davenport, A., Joyce, R., Rasul, I. & Waters, T. (2020). Spending and saving during the COVID-19 crisis: evidence from bank account data. Institute for Fiscal Studies. https://www.ifs.org.uk/publications/15146

Duvander, A. Z., Lappegård, T., Andersen, S. N., Garðarsdóttir, Ó., Neyer, G. & Viklund, I. (2019). Parental leave policies and continued childbearing in Iceland, Norway, and Sweden. *Demographic Research*, 40, 1501-1528.

Ellison, J., Dodd, E., & Forster, J. J. (2020). Forecasting of cohort fertility under a hierarchical Bayesian approach. *Journal of the Royal Statistical Society: Series A*, 183(3), 829-856.

Evandrou, M., Falkingham, J., Qin, M. & Vlachantoni, A. (2021). Changing living arrangements and stress during Covid-19 lockdown: Evidence from four birth cohorts in the UK. *SSM-Population Health*, 100761.

Furlong, A., Goodwin, J., O'Connor, H., Hadfield, S., Hall, S., Lowden, K., & Plugor, R. (2017). *Young people in the labour market: Past, present, future*. Routledge.

Goldscheider, F., Bernhardt, E., & Brandén, M. (2013). Domestic gender equality and childbearing in Sweden. *Demographic Research*, 29, 1097-1126.

Goldscheider, F., Bernhardt, E. & Lappegård, T. (2015). The gender revolution: A framework for understanding changing family and demographic behavior. *Population and Development Review*, 41(2), 207-239.

Goldstein, J. R., Kreyenfeld, M., Jasilioniene, A. & Örsal, D. K. (2013). Fertility reactions to the "Great Recession" in Europe: Recent evidence from order-specific data. *Demographic Research*, 29, 85-104.

Greater London Authority (2021) Trend-based population projections. https://data.london.gov.uk/dataset/trend-based-population-projections

Grienitz, V., Hausicke, M., & Schmidt, A.-M. (2014). Scenario development without probabilities - focusing on the most important scenario. *European Journal of Futures Research,* 2, 27.

Gustafsson, M, (2020). Young workers in the coronavirus crisis: Findings from the Resolution Foundation's coronavirus survey. https://www.resolutionfoundation.org/app/uploads/2020/05/Young-workers-in-the-coronavirus-crisis.pdf

Handscomb, K. & Judge, L. (2020). Caught in a (COVID) trap: Incomes, savings and spending through the coronavirus crisis. https://www.resolutionfoundation.org/app/uploads/2020/11/Caught-in-a-Covid-trap.pdf

Heap, K. L., Berrington, A., & Ingham, R. (2020). Understanding the decline in under-18 conception rates throughout England's local authorities between 1998 and 2017. *Health & Place*, 66, 102467.

Hellstrand, J., Nisén, J. & Myrskylä, M. (2020). All-time low period fertility in Finland: Demographic drivers, tempo effects, and cohort implications. *Population Studies*, 74, 315-329.

Hobcraft, J. (1996). Fertility in England and Wales: a fifty-year perspective. *Population Studies,* 50, 485-524.

Human Fertilisation and Embryology Authority (HFEA) (2020). Fertility treatment 2018: trends and figures. https://www.hfea.gov.uk/about-us/publications/research-and-data/fertility-treatment-2018-trends-and-figures/

Human Fertilisation and Embryology Authority (HFEA) (2021). Coronavirus (COVID-19) guidance for patients. https://www.hfea.gov.uk/treatments/COVID-19-and-fertility-treatment/coronavirus-COVID-19-guidance-for-patients/

Human Fertility Database (HFD) (2021). Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). Available at www.humanfertility.org (data downloaded on 04.03.2021).

K. C., S., Barakat, B., Skirbekk, V., Sanderson, W. C., & Lutz, W. (2010). Projection of populations by level of educational attainment, age, and sex for 120 countries for 2005-2050. *Demographic Research*, 22, 383–472.

Kreyenfeld, M. (2010). Uncertainties in female employment careers and the postponement of parenthood in Germany. *European Sociological Review*, 26, 351–366.

Kulu, H. & Hannemann, T. (2016). Why does fertility remain high among certain UK-born ethnic minority women? *Demographic Research*, 35, 1441–1488.

Kulu, H. & Washbrook, E. (2014). Residential context, migration and fertility in a modern urban society. *Advances in Life Course Research*, 21, 168–182.

Lappegård, T., Kristensen A. P. & Mamelund, S-E. (2020). COVID-19 could generate a baby 'bust' in the Nordic countries. LSE Blog. https://blogs.lse.ac.uk/europpblog/2020/06/26/COVID-19-could-generate-a-baby-bust-in-the-nordic-countries/

Lesthaeghe, R. (1995). The second demographic transition in Western countries: An interpretation. Pp 17-62 in K. Oppenheim Mason and A-M. Jensen (Eds.) *Gender and Family Change in Industrialized Countries.* Oxford University Press.

Lewis, R., Blake, C., Shimonovich, M., Coia, N., Duffy, J., Kerr, Y., Wilson, J., Graham, C., Mitchell, K. (2021). Disrupted prevention: condom and contraception access and use among young

adults during the initial months of the COVID-19 pandemic. An online survey. *BMJ Sexual & Reproductive Health*, 47, 269-276.

Lindberg, L D. (2021). The Coming Baby Bust. Guttmacher Institute. https://www.guttmacher.org/article/2021/01/coming-COVID-baby-bust

Lockett, J. (2020). On the brink: Boris Johnson warns NHS faces being 'overwhelmed' by coronavirus like Italy in just two weeks unless Brits heed lockdown. The Sun, 22 March 2020. https://www.thesun.co.uk/news/11226742/boris-johnson-nhs-overwhelmed-coronavirus/

Luppi, F., Arpino, B. & Rosina, A. (2020). The impact of COVID-19 on fertility plans in Italy, Germany, France, Spain, and the United Kingdom. *Demographic Research*, 43(47) 1399-1412.

Lynch, R. (2021) Covid 'baby bust' fears as fertility rate falls to record low. https://www.telegraph.co.uk/business/2021/03/26/covid-baby-bust-fears-fertility-rate-falls-record-low/

Mason, R. (2020). Support bubble' plan lets people living alone in England combine households. The Guardian 10th June 2020. https://www.theguardian.com/world/2020/jun/10/support-bubble-plan-lets-single-parents-in-england-combine-households

Matysiak, A., Sobotka, T., & Vignoli, D. (2021). The Great Recession and Fertility in Europe: A sub-national analysis. *European Journal of Population*, 37, 29-64.

McDonald, P. (2000). Gender equity in theories of fertility transition. *Population and Development Review*, 26, 427-439.

Murphy, M. (1993). The contraceptive pill and women's employment as factors in fertility change in Britain 1963-1980: a challenge to the conventional view. *Population Studies,* 46, 235–258.

Myrskylä, M., Goldstein, J. R. & Cheng, Y. H. A. (2013). New cohort fertility forecasts for the developed world: Rises, falls, and reversals. *Population and Development Review*, 39, 31-56.

Neyer, G., & Andersson, G. (2008). Consequences of family policies on childbearing behavior: Effects or artifacts? *Population and Development Review*, 34, 699-724.

NISRA (2021a). Registrar General Annual Reports 2011-2018. https://www.nisra.gov.uk/publications/registrar-general-annual-reports-2011-2018.

NISRA (2021b). Monthly Births. https://www.nisra.gov.uk/publications/monthly-births.

Norman, P., Rees, P., & Wohland, P. (2014). The use of a new indirect method to estimate ethnic-group fertility rates for subnational projections for England. *Population Studies*, 68, 43–64.

NRS (2020). Vital Events Reference Tables 2019. https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/vital-events-reference-tables/2019

NRS (2021a). Vital Events Reference Tables 2020. https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/vital-events-reference-tables/2020

NRS (2021b). Monthly Data on Births and Deaths Registered in Scotland. https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/monthly-data-on-births-and-deaths-registered-in-scotland

NSPCC (2020). Government is at risk of failing babies and parents during the coronavirus pandemic.https://www.nspcc.org.uk/about-us/news-opinion/2020/coronavirus-pandemic-babies/

ONS (2015). National Population Projections Accuracy Report. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/methodologies/nationalpopulationprojectionsaccuracyreport

ONS (2019). National population projections: 2018-based. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2018based

ONS (2020a). Births in England and Wales: 2019. https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/datasets/birthsummarytables/2019/birthsummarytables2019.xlsx

ONS (2020b). Provisional births in England and Wales: 2020. https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/articles/provisionalbirthsinenglandandwales/2020#:~:text=3.-,Number%20of%20live%20births%20and%20fertility%20rates,most%20recent%20peak%20in%202012

ONS (2021a).Recent trends in the housing market: January 2021. https://www.ons.gov.uk/economy/inflationandpriceindices/articles/priceseconomicanalysisquarterly/january2021

ONS (2021b). Births in England and Wales: 2020. https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/datasets/birthsummarytables/2020/workbooksummarytables2020.xlsx

ONS (2021c). Provisional births in England and Wales: Quarter 1 2021. https://www.ons.gov.uk/file?uri=%2fpeoplepopulationandcommunity%2fbirthsdeathsandmarriages%2flivebirths%2fdatasets%2fprovisionalbirthsinenglandandwales%2fquarter1jantomar2021/provisionalbirthtablesquarter12021.xlsx

Perelli-Harris, B., Chao, S-Y. & Berrington, A. (2020). Couples in crisis: how the government's furlough scheme has protected relationships during the COVID-19 pandemic CPC Policy Briefing, 61 http://www.cpc.ac.uk/docs/2020_PB61_Couples_in_crisis.pdf

Robards, J. (2021) National population projections, subnational population projections and household projections for England – future plans: June 2021. Office for National Statistics. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/articles/nationalpopulationprojectionssubnationalpopulationprojectionsandhouseholdprojectionsforenglandfutureplans/june2021

Royal College of Obstetricians and Gynaecologists (RCOG) (2021). Coronavirus infection and pregnancy: Information for pregnant women and their families. https://www.rcog.org.uk/en/guidelines-research-services/guidelines/coronavirus-pregnancy/covid-19-virus-infection-and-pregnancy/#c19

Schmertmann, C., Zagheni, E., Goldstein, J. R. & Myrskylä, M. (2014). Bayesian forecasting of cohort fertility. *Journal of the American Statistical Association*, 109(506), 500-513.

Schraer, R. (2020). Coronavirus: How will it affect my pregnancy, scans and the birth? BBC News September 14th 2020. https://www.bbc.co.uk/news/health-54059274

Soper, K. (2020). The pandemic is an opportunity to reconsider what makes a good life. The Guardian 8 September 2020.https://www.theguardian.com/commentisfree/2020/sep/08/pandemic-covid-19-work-society

Stone, J., Berrington, A. & Falkingham, J. (2014). Gender, turning points, and boomerangs: Returning home in young adulthood in Great Britain. *Demography*, 51, 257-276.

Tocchioni, V., Berrington, A., Vignoli, D. & Vitali, A. (2019). Housing uncertainty and the transition to parenthood among Britain's "generation rent". (CPC Working Paper; No. 92). University of Southampton.
http://www.cpc.ac.uk/docs/WP92_Tocchioni_Berrington_Vignoli_Vitali_Housing.pdf

UK Weddings Taskforce (2021). 824,000 UK weddings in the pipeline as the industry asks ministers “support us now or the entire country loses out”. Press Release 18 January 2021. https://ukweddings.org/updates/press-release-18-01-21

Van Kessel, P., Baronavski, C., Scheller, A. & Smith, A. (2021). In Their Own Words, Americans Describe the Struggles and Silver Linings of the COVID-19 Pandemic. Pew Research Centre https://www.pewresearch.org/2021/03/05/in-their-own-words-americans-describe-the-struggles-and-silver-linings-of-the-COVID-19-pandemic/

Walker, P. (Guardian 24th March 2020). Budding couples in UK told to live together or stay apart. https://www.theguardian.com/world/2020/mar/24/budding-couples-in-uk-told-to-live-together-or-stay-apart

Wellings, K., Jones, K. G., Mercer, C. H., Tanton, C., Clifton, S., Datta, J., Cpas, A., Erens, B., Gibson, L.J., Macdowell, W., Sonnenberg, P., Phelps, A. & Johnson, A. M. (2013). The prevalence

of unplanned pregnancy and associated factors in Britain: findings from the third National Survey of Sexual Attitudes and Lifestyles (Natsal-3). *The Lancet*, 382(9907), 1807-1816.

Wilde, J. Chen, W., Lohmann, S. (2020). COVID-19 and the future of US fertility: what can we learn from Google? https://www.demogr.mpg.de/en/publications_databases_6118/publications_1904/mpidr_working_papers/COVID_19_and_the_future_of_us_fertility_what_can_we_learn_from_google_6877/

Williams, L., Rollins, L., Young, D., Fleming, L., Grealy, M., Janssen, X., ... & Flowers, P. (2021). What have we learned about positive changes experienced during COVID-19 lockdown? Evidence of the social patterning of change. *PloS One*, 16(1), e0244873.

Wilson, T. & Rees, P. (2005). Recent developments in population projection methodology: a review. *Population, Space and Place*, 11, 337-360.

Table 1. Potential mechanisms through which the COVID-19 pandemic could affect childbearing in the UK.

	Age group and parity							
Mechanism	**15-19**		**20-29**		**30-39**		**40-44**	
	Childless	**Parents**	**Childless**	**Parents**	**Childless**	**Parents**	**Childless**	**Parents**
Perceived / actual reduced access to contraception and abortion services	↑↑	↑↑	↑	↑	↑	↑	↑	↑
Less sexual intercourse as fewer opportunities to socialise outside the home due to lockdowns	↓↓	↓↓	↓↓	↓	↓	↓	↓	↓
Increased inter-generational co-residence, less time alone for adults	↓↓	↓	↓↓	↓	↓	↓	↓	↓
Difficulties in finding and moving to a new home	↓↓	↓↓	↓↓	↓↓	↓	↓		
More opportunity for sexual intercourse among those who moved in together at start of lockdown	↑	↑↑	↑↑	↑↑	↑↑	↑↑	↑	↑
Concerns re health risks of pregnancy / access for male partners to hospital	↓	↓	↓↓	↓↓	↓↓	↓↓	↓↓	↓↓
Postponed marriages			↓↓	↓↓	↓↓	↓	↓	↓
Isolation from social support, informal childcare less available	↓	↓	↓	↓	↓	↓	↓	↓
Increased economic uncertainty – job loss, reductions in working hours: Difficulty in affording direct costs of children	↓↓	↓↓	↓↓	↓↓	↓	↓		
Increased economic uncertainty – job loss, reductions in working hours: Reduced opportunity costs of children		↑	↑	↑↑	↑	↑↑	↑	↑↑
Working from home could encourage re-thinking of work life balance and less postponement			↑↑	↑↑	↑↑	↑↑	↑↑	↑↑
More time spent with partner in home	↑	↑	↑	↑	↑	↑	↑	↑
Stress of childcare / schooling of existing child may deter from having additional children		↓		↓↓		↓↓		↓↓
Wealthier families saving more for costs of children			↑	↑	↑	↑	↑	↑
Reduced access to IVF / other fertility treatments					↓	↓	↓↓	↓↓

Note: Green up arrows denote positive impacts on fertility, red down arrows negative impacts. The number of arrows denotes strength of relationship with increased number indicating stronger association.

Table 2. Annual adjustment factors for England and Wales ASFRs in 1978-1980 compared to 1977 level. Values given to two decimal places.

Age group					
15-19	20-29		30-39		40-44
	20-24	25-29	30-34	35-39	
1.01	1.03	1.04	1.06	1.07	1.03
1.01	1.04		1.07		1.03

Note: We average over 20-29 and 30-39 so as to be consistent with the age groups for which we hypothesize mechanisms in Table 1.

Table 3. Average annual adjustment factors for ASFRs in 2009-2011 compared to 2008 level. Values given to two decimal places.

		Age group					
		15-19	20-29		30-39		40-44
			20-24	25-29	30-34	35-39	
Country	Estonia	0.88	0.92	0.97	1.02	1.03	1.06
	Finland	0.96	0.97	1.00	1.00	1.02	1.02
	France	0.98	0.98	0.99	1.01	1.01	1.03
	Iceland	0.94	0.93	0.98	1.00	0.97	1.03
	Netherlands	0.97	0.97	0.99	1.00	1.01	1.03
	Norway	0.90	0.95	0.98	1.00	1.01	1.02
	Sweden	0.99	0.97	0.99	0.99	1.01	1.04
	Average for all countries	0.95	0.97		1.01		1.03

Note: We average over 20-29 and 30-39 so as to be consistent with the age groups for which we hypothesize mechanisms in Table 1.

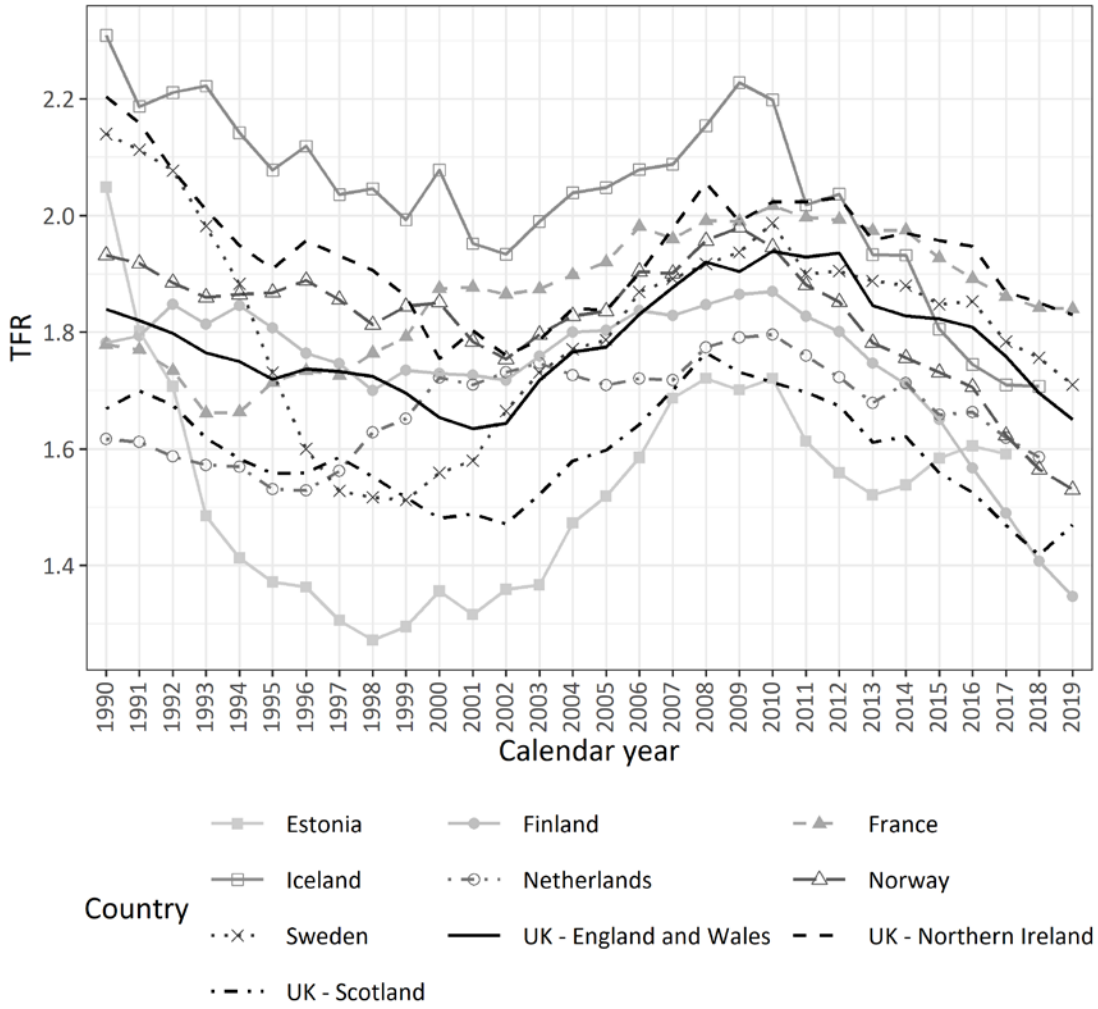
Table 4. Assumed COVID-19 annual adjustment factors for UK ASFRs under each scenario.

		Column 1	**Column 2**
Row	**Age group**	**Scenarios 1 and 3** COVID-19 Baby Boom	**Scenarios 2 and 4** COVID-19 Baby Bust
1	15-19	1.00	0.95
2	20-29	1.00	0.97
3	30-39	1.02	1.00
4	40-44	1.00	1.00

Table 5. TFR projections using the 2020 provisional ASFRs for England and Wales and adjusting the 2019 ASFRs for Scotland and Northern Ireland by the same ratio of 2020 to 2019 rates. Values given to two decimal places.

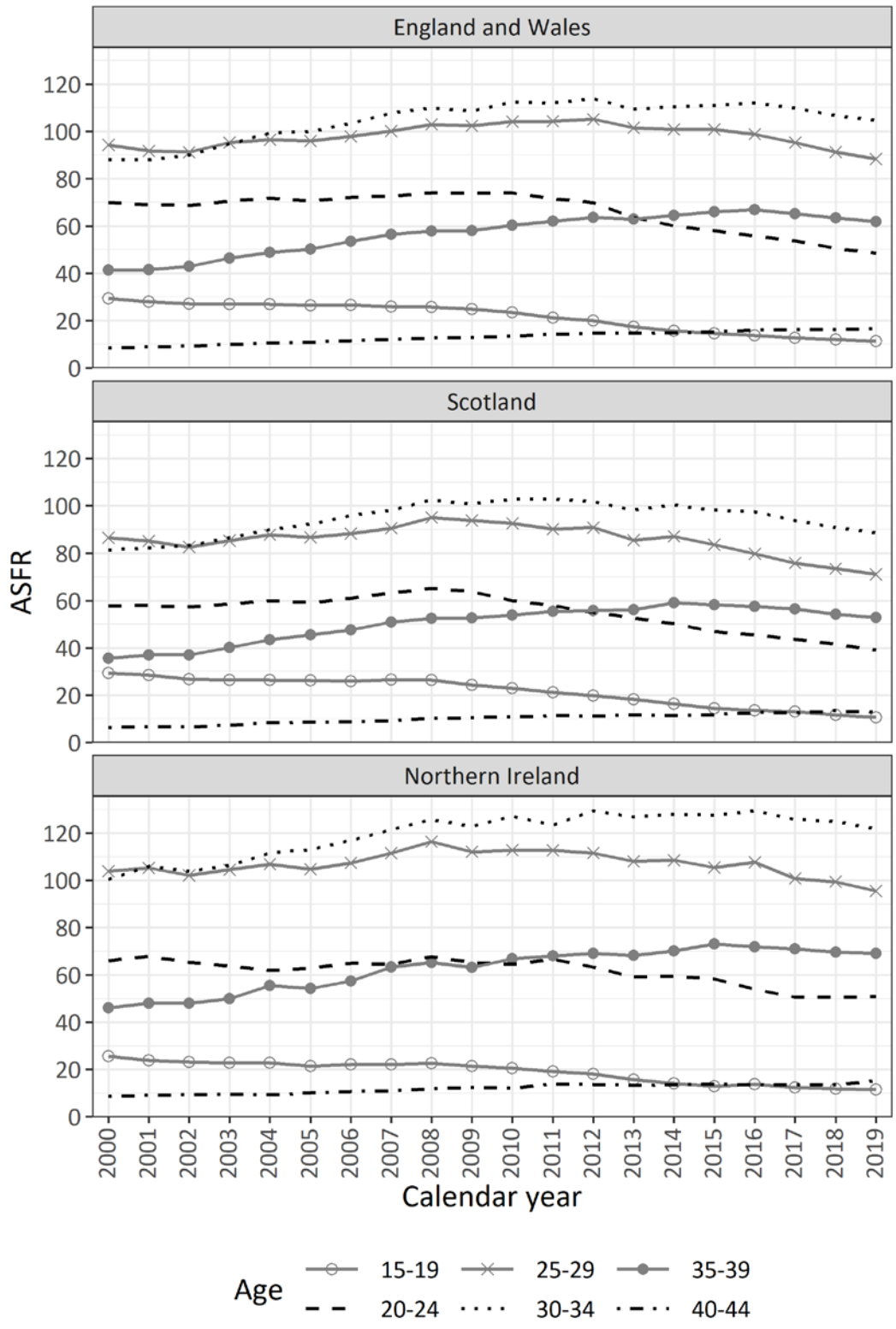
			Year			
		Scenario	2020	2021	2022	2023
Country	England and Wales	Scenario 1 Stable baseline COVID-19 Baby Boom	1.60	1.62	1.63	1.65
		Scenario 2 Stable baseline COVID-19 Baby Bust		1.58	1.56	1.54
		Scenario 3 Declining baseline COVID-19 Baby Boom		1.58	1.55	1.53
		Scenario 4 Declining baseline COVID-19 Baby Bust		1.54	1.48	1.43
	Scotland	Scenario 1 Stable baseline COVID-19 Baby Boom	1.33	1.34	1.36	1.37
		Scenario 2 Stable baseline COVID-19 Baby Bust		1.31	1.29	1.28
		Scenario 3 Declining baseline COVID-19 Baby Boom		1.30	1.27	1.25
		Scenario 4 Declining baseline COVID-19 Baby Bust		1.27	1.22	1.16
	Northern Ireland	Scenario 1 Stable baseline COVID-19 Baby Boom	1.76	1.78	1.80	1.82
		Scenario 2 Stable baseline COVID-19 Baby Bust		1.74	1.72	1.69
		Scenario 3 Declining baseline COVID-19 Baby Boom		1.75	1.73	1.71
		Scenario 4 Declining baseline COVID-19 Baby Bust		1.70	1.65	1.60

Figure 1. Trend in Total Fertility Rate, Selected North and West European Countries, 1990-2019.



Source: HFD (2021).

Figure 2. Trend in Age-Specific Fertility Rates for the UK countries, 2000-2019.



Sources: ONS (2020a), NRS (2020), NISRA (2021a).

Figure 3. TFR projections for each of the UK countries and scenarios, using the 2020 provisional ASFRs for England and Wales and adjusting the 2019 ASFRs for Scotland and Northern Ireland by the same ratio of 2020 to 2019 rates.

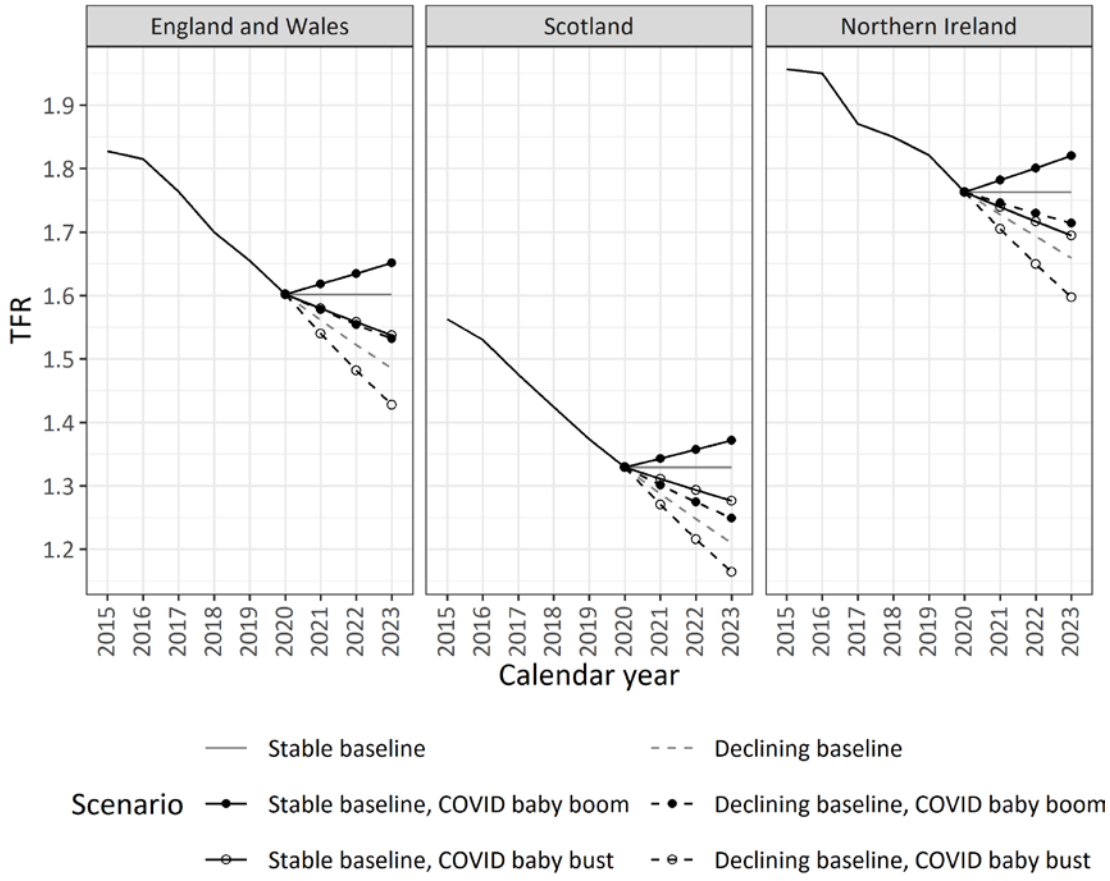
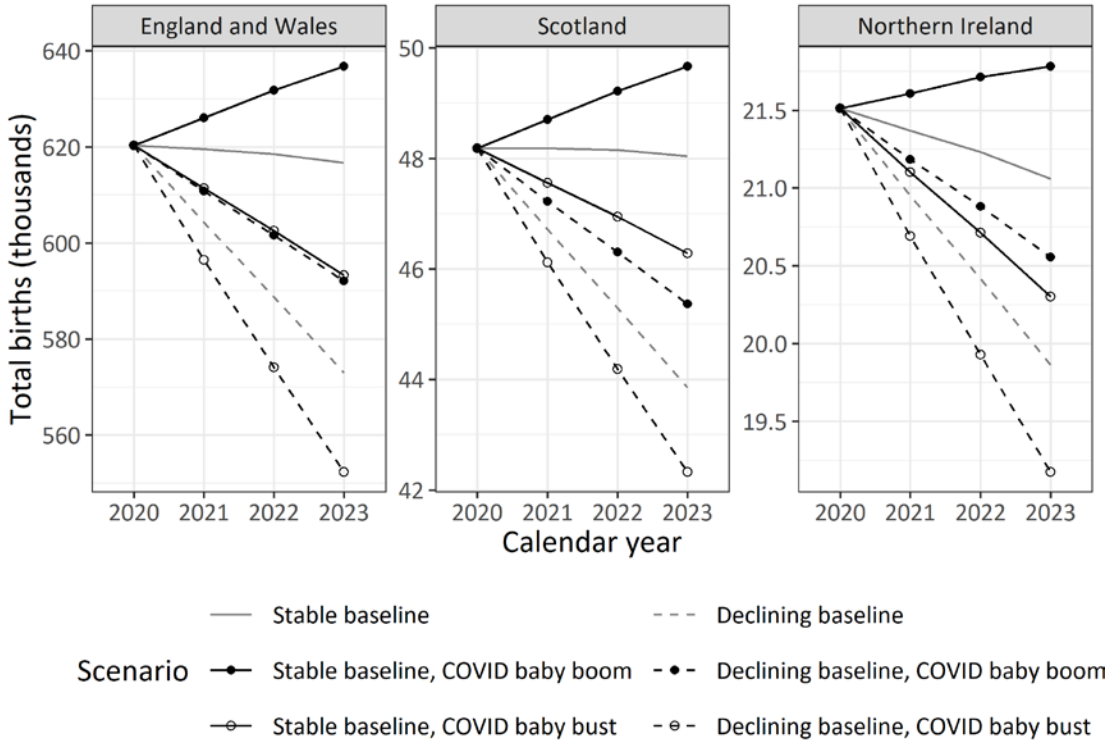


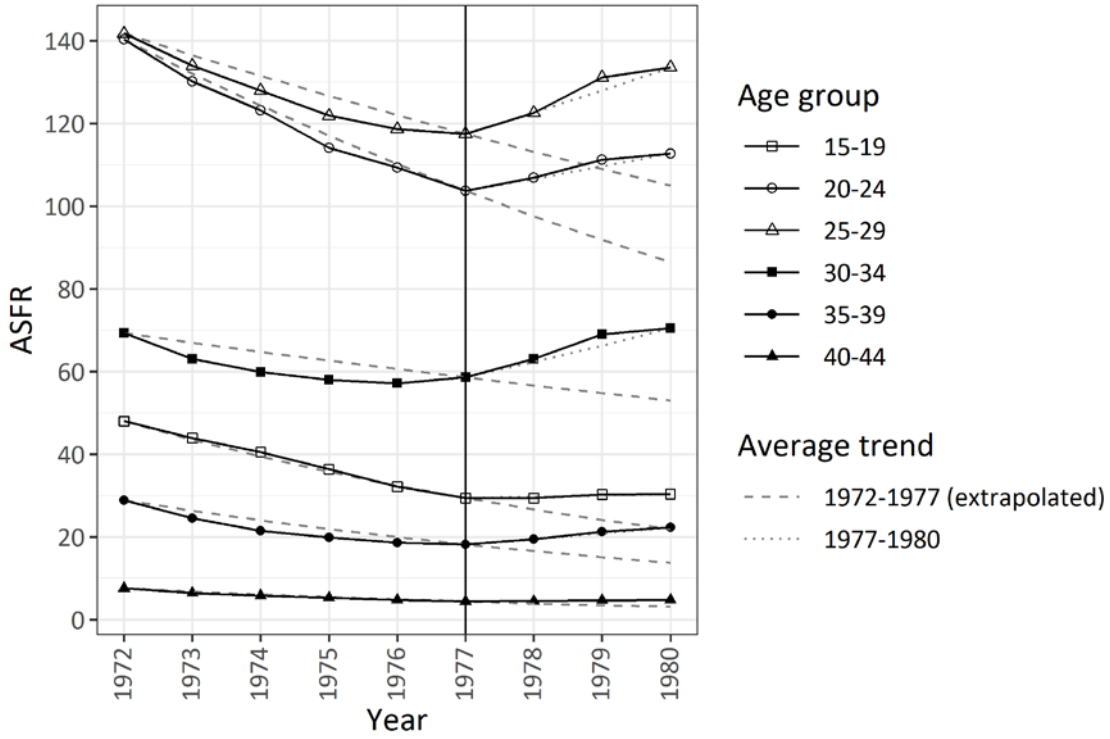
Figure 4. Projected total number of births across ages 15-44 for each of the UK countries and scenarios, using the 2020 provisional ASFRs for England and Wales and adjusting the 2019 ASFRs for Scotland and Northern Ireland by the same ratio of 2020 to 2019 rates.



Appendices

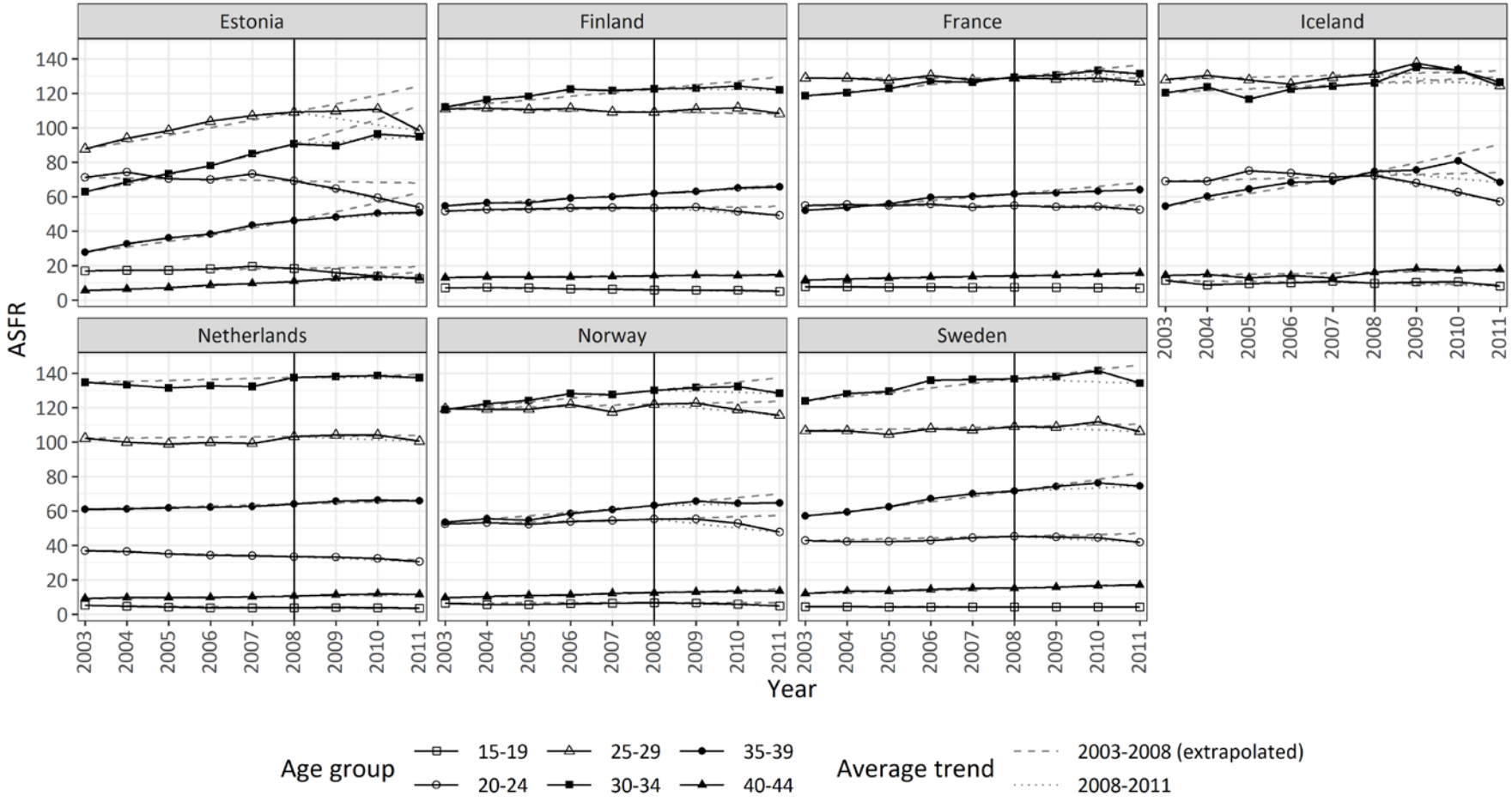
Appendix A: Informing COVID-19 adjustment factors by analysing relevant past experiences

Figure A.1. Trend in Age Specific Fertility Rates, England and Wales, 1972-1980. Dashed lines indicate average 5-year trend of 1972-1977 rates extrapolated to 1980; dotted lines indicate average 3-year trend of 1977-1980 rates.



Source: ONS (2020a).

Figure A.2. Trend in Age Specific Fertility Rates, Selected North and West European Countries, 2003-2011. Dashed lines indicate average 5-year trend of 2003-2008 rates extrapolated to 2011; dotted lines indicate average 3-year trend of 2008-2011 rates.



Source: HFD (2021).

Appendix A describes an alternative approach to determine correction factors to inform Scenarios 3 and 4 (the 'declining baseline' scenarios) based on the respective experiences of England and Wales and selected North-West European countries. Data are sourced from ONS (ONS, 2020a) and the Human Fertility Database (HFD, 2021) respectively. We describe the approach in the context of Scenario 3. For a given five-year age group, let α be the multiplicative factor corresponding to the 1977-1980 period (the values in Table 2). Then, let β be the multiplicative factor corresponding to the average five-year trend of the log-rates observed between 1972 and 1977 inclusive (see dashed lines in Figure A.1, where we have extrapolated this trend to 1980 for illustrative purposes). For Scenario 3, where the projected baseline trend is a continuation of the most recent five-year trend, our interest is in the ratio of the multiplicative factors, i.e. α/β. We present these ratios in Table A.1 below.

Table A.1. Annual adjustment factors for England and Wales ASFRs in 1978-1980 compared to the 5-year average trend in 1972-1977. Values given to two decimal places.

Age group					
15-19	20-29		30-39		40-44
	20-24	25-29	30-34	35-39	
1.12	1.09	1.08	1.10	1.17	1.15
1.12	1.09		1.14		1.15

Whereas the interpretation of the adjustment factors in Table 2 is straightforward, here it is slightly more complicated. For a given age group, they represent the average annual multiplicative change in the ASFRs when applied to the continuation of the 5-year trend from 1972-1977. We see that compared to Table 2, the average adjustment factors are greatly increased across the age range. As mentioned in Section 4.3, the trends in fertility in England and Wales were steeply declining pre-1977, followed by a sharp increase. In the UK, the COVID-19 pandemic has come at a time when fertility rates were already falling significantly, although not as steeply as in the 1970s. Therefore the use of these alternative adjustment factors to inform our assumptions about this different situation would not be appropriate, as their effect is to reverse a much steeper downward trend.

Performing identical analyses in the context of Scenario 4, we present the resulting ratios in Table A.2. We see that compared to Table 3, the average adjustment factors tend to be further below one, especially for ages 30 and over. As mentioned in Section 4.3, the trends in fertility exhibited by our selected Northern and Western countries during this period were

characterised by a stable or increasing fertility trend pre-2008, followed by a decline. Therefore the use of these alternative adjustment factors to inform our assumptions about the current situation in the UK would not be appropriate, as their effect is to intensify a downward trend rather than reverse an upward trend. However, we note that as we assume net zero change at older ages under Scenario 4, the alternative adjustment factors would have little impact on our projections in this case.

Table A.2. Average annual adjustment factors for ASFRs in 2009-2011 compared to the 5-year average trend in 2003-2008. Values given to two decimal places.

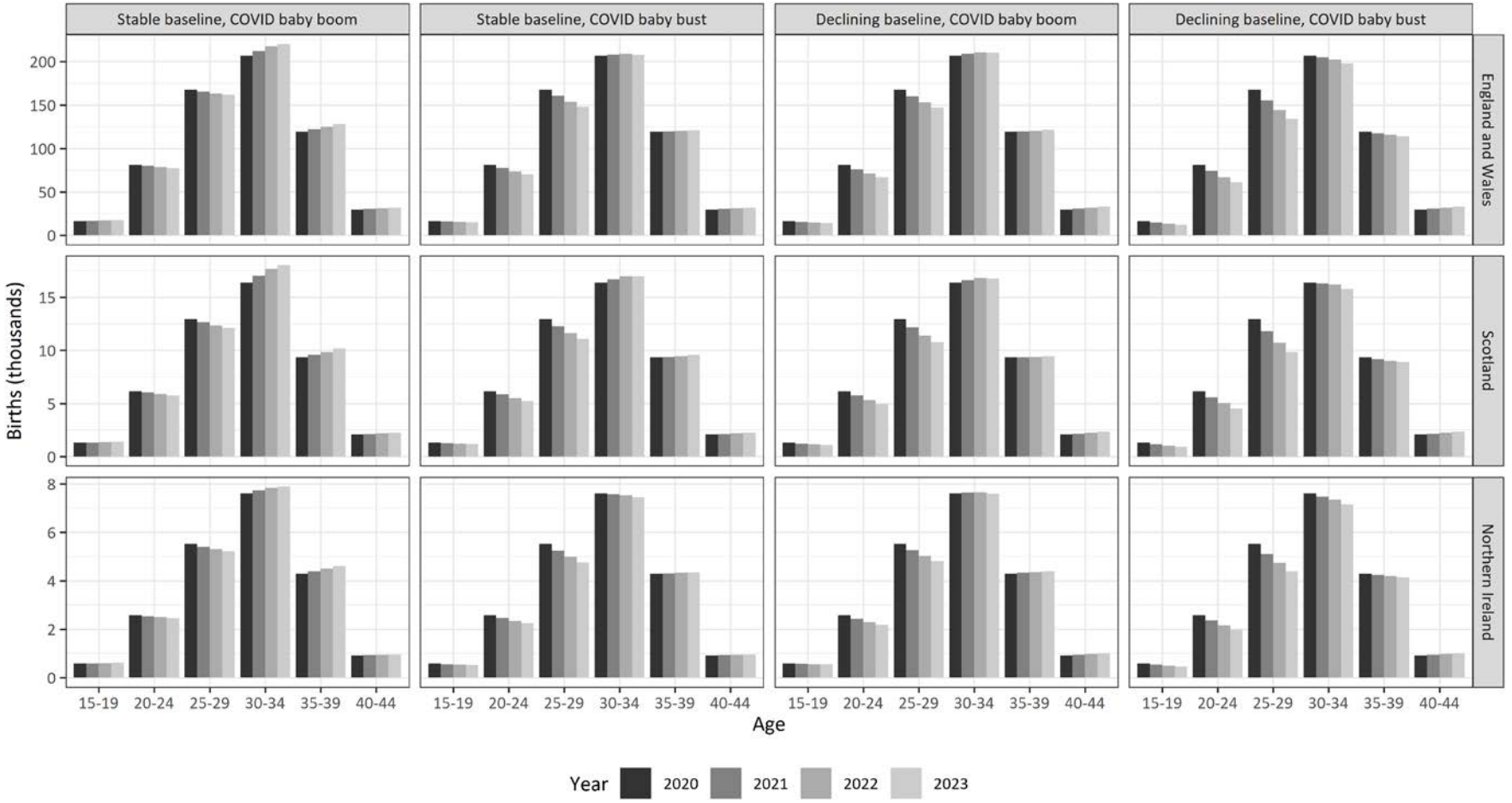
		Age group					
		15-19	20-29		30-39		40-44
			20-24	25-29	30-34	35-39	
Country	Estonia	0.86	0.93	0.92	0.94	0.93	0.93
	Finland	0.99	0.97	1.00	0.98	0.99	1.00
	France	0.98	0.98	0.99	0.99	0.98	1.00
	Iceland	0.97	0.92	0.98	0.99	0.91	1.01
	Netherlands	1.03	0.99	0.99	1.00	1.00	1.00
	Norway	0.90	0.94	0.98	0.98	0.97	0.97
	Sweden	1.00	0.96	0.99	0.97	0.97	0.99
	Average for all countries	0.96	0.97		0.97		0.98

Appendix B: Projected numbers of births under the four scenarios

Table B.1. Projected number of births using the 2020 provisional ASFRs for England and Wales and adjusting the 2019 ASFRs for Scotland and Northern Ireland by the same ratio of 2020 to 2019 rates. Births are rounded to the nearest whole number, so totals may differ slightly from the sums of the values in the relevant cells.

		England and Wales			Scotland			Northern Ireland		
	Age	Year			Year			Year		
		2021	2022	2023	2021	2022	2023	2021	2022	2023
Scenario 1	15-19	16614	17093	17640	1312	1336	1372	589	602	623
	20-24	79889	78314	77318	6039	5869	5731	2538	2490	2459
	25-29	165281	163330	161856	12648	12341	12126	5407	5309	5218
	30-34	212125	217222	220103	17018	17657	18023	7734	7847	7900
	35-39	121883	124754	128092	9579	9830	10170	4400	4509	4615
	40-44	30305	31087	31780	2112	2188	2245	940	954	967
	Total	626097	631800	636790	48708	49220	49667	21606	21712	21782
Scenario 2	15-19	15783	15427	15124	1246	1206	1177	559	544	534
	20-24	77492	73686	70566	5858	5522	5231	2462	2343	2245
	25-29	160323	153677	147722	12269	11611	11067	5244	4995	4762
	30-34	207965	208787	207408	16684	16971	16983	7582	7543	7445
	35-39	119494	119910	120704	9392	9448	9584	4313	4334	4349
	40-44	30305	31087	31780	2112	2188	2245	940	954	967
	Total	611362	602573	593305	47560	46946	46285	21101	20713	20301
Scenario 3	15-19	15485	14850	14284	1210	1137	1078	565	554	550
	20-24	76137	71130	66928	5750	5320	4946	2437	2295	2177
	25-29	160003	153064	146839	12157	11402	10769	5265	5034	4817
	30-34	208853	210573	210075	16614	16828	16769	7634	7646	7599
	35-39	119622	120167	121093	9351	9367	9461	4330	4369	4401
	40-44	30655	31811	32896	2142	2251	2343	954	984	1012
	Total	610755	601595	592115	47224	46305	45365	21185	20882	20556
Scenario 4	15-19	14711	13402	12247	1150	1027	924	537	500	471
	20-24	73853	66927	61083	5577	5005	4514	2364	2160	1987
	25-29	155203	144018	134016	11793	10728	9828	5107	4736	4397
	30-34	204758	202396	197959	16288	16174	15801	7485	7349	7161
	35-39	117276	115501	114109	9168	9003	8915	4246	4199	4147
	40-44	30655	31811	32896	2142	2251	2343	954	984	1012
	Total	596456	574054	552309	46118	44189	42326	20691	19929	19175

Figure B.1. Projected number of births by age group for each of the UK countries and scenarios, using the 2020 provisional ASFRs for England and Wales and adjusting the 2019 ASFRs for Scotland and Northern Ireland by the same ratio of 2020 to 2019 rates.



Appendix C: Updated projections for England and Wales and Scotland using observed Age-Specific Fertility Rates (ASFRs) for the whole of 2020

At the time of revision (September 2021) ASFRs for the whole of 2020 (January-December) became available for England and Wales and Scotland. No data are currently available for Northern Ireland. In order for our work to be consistent with estimates from the national statistical offices in terms of the 2020 jump-off point, we have used these new data to repeat the scenario projections. In this way future 2020-based NPPs will also be comparable. See Section 5 for further details.

The updated TFR projections using the observed rates for the whole of 2020 are shown in Table C.1 and plotted in Figure C.1. With the slightly lower 2020 jump-off points, the projected TFRs are shifted downwards. For England and Wales, the projected TFR in 2023 ranges from 1.41 (Scenario 4) to 1.64 (Scenario 1) compared to values of 1.43 and 1.65 in Table 5. For Scotland the equivalent range is 1.11-1.33 compared to 1.16-1.37 in Table 5. Figure C.2 shows the projected number of births using the observed rates for the whole of 2020. We do not repeat the analyses of excess/missing births - this would not make sense as we are now incorporating some of the effect of COVID into our 2020 jump-off point.

Table C.1. TFR projections for England and Wales and Scotland and each of the scenarios, using observed ASFRs for the whole of 2020. Values given to two decimal places.

			Year			
		Scenario	2020	2021	2022	2023
Country	England and Wales	Scenario 1 Stable baseline COVID-19 Baby Boom	1.58	1.60	1.62	1.64
		Scenario 2 Stable baseline COVID-19 Baby Bust		1.57	1.55	1.53
		Scenario 3 Declining baseline COVID-19 Baby Boom		1.56	1.54	1.51
		Scenario 4 Declining baseline COVID-19 Baby Bust		1.53	1.47	1.41
	Scotland	Scenario 1 Stable baseline COVID-19 Baby Boom	1.29	1.30	1.32	1.33
		Scenario 2 Stable baseline COVID-19 Baby Bust		1.27	1.26	1.24
		Scenario 3 Declining baseline COVID-19 Baby Boom		1.26	1.22	1.19
		Scenario 4 Declining baseline COVID-19 Baby Bust		1.23	1.17	1.11

Figure C.1. TFR projections for England and Wales and Scotland and each of the scenarios, using observed ASFRs for the whole of 2020.

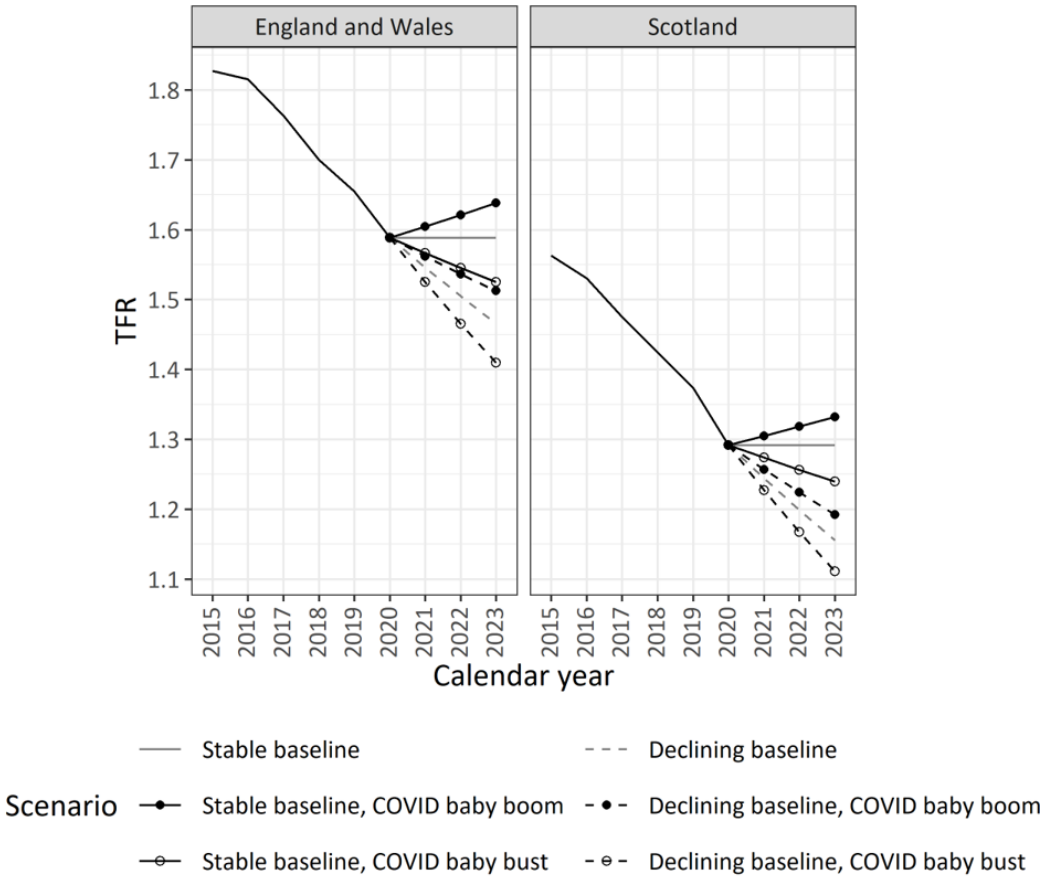


Figure C.2. Projected total number of births across ages 15-44 for England and Wales and Scotland and each of the scenarios, using observed ASFRs for the whole of 2020.