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ABSTRACT

The COVID-19 Baby Bump: The Unexpected Increase in U.S. Fertility Rates in Response to the Pandemic*

We use restricted natality microdata covering the universe of U.S. births for 2015-2021 and California births from 2015 to August 2022 to examine the childbearing response to the COVID-19 pandemic. Although fertility rates declined in 2020, these declines appear to reflect reductions in travel to the U.S. Childbearing in the U.S. among foreign-born mothers declined immediately after lockdowns began—nine months too soon to reflect the pandemic's effects on conceptions. We also find that the COVID pandemic resulted in a small "baby bump" among U.S.-born mothers. The 2021 baby bump is the first major reversal in declining U.S. fertility rates since 2007 and was most pronounced for first births and women under age 25, which suggests the pandemic led some women to start their families earlier. Above age 25, the baby bump was also pronounced for women ages 30-34 and women with a college education, who were more likely to benefit from working from home. The data for California track the U.S. data closely and suggest that U.S. births remained elevated through the third quarter of 2022.

JEL Classification: J13, I14

Keywords: fertility rates, pregnancy, COVID-19, pandemic, recession

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I. Introduction

Between 2007 and 2020, the U.S. total fertility rate (TFR), a measure of the average number of children expected over a woman's lifetime, declined from 2.1 to 1.6 (Hamilton et al., 2021), setting new records for historic lows and prompting widespread concerns about the future of the American family, the strength of the labor force, and the solvency of public programs that rely on the contributions of younger generations.

The COVID-19 pandemic and skyrocketing unemployment rates served to heighten these concerns. Based on over a century of research describing the procyclicality of fertility (Yule, 1906; Andorka 1978; Sobotka et al. 2011; Currie and Schwandt 2014), economists forecasted the pandemic would cause a dramatic baby bust—a missing 300,000 to 500,000 children (Kearney & Levine 2020a, 2020b). By early 2021, data from the Centers for Disease Control appeared to confirm the start of this baby bust (Hamilton et al., 2022) and were widely reported. The *New York Times* noted that "The U.S. Birthrate Has Dropped Again. The Pandemic May Be Accelerating the Decline" (Tavernise, 2021) and *FiveThirtyEight.com* provocatively asked, "How Low Can America's Birth Rate Go Before It's a Problem?" (Murray, 2021).

This paper uses newly available microdata covering the universe of childbirth in the U.S. for 2015 to 2021 and from the state of California through August 2022 to examine how childbearing changed after the pandemic began. Similar to a recent analysis by Kearney and Levine (2022), our results show that the dire forecasts of a massive COVID-induced baby bust failed to materialize. In 2020, U.S. fertility rates fell by a mere 76,000 (or 2%) more than expected by the pre-pandemic trend—a fraction of the forecasted decline. But the new restricted microdata show that this moderate decline in childbearing belies a far more interesting story of how U.S. childbearing changed during the pandemic.

Importantly, the 2020 decline in fertility rates occurred too soon for the decline to be a response to economic uncertainty or job loss during the COVID-19 recession, as predicted by standard economic models. Rather, the bulk of the decline was driven by sharp reductions in births to foreign-born mothers who accounted for 23% of all U.S. births in 2019. Consistent with reductions in international travel due to restrictions and angst about travel, fertility rates among foreign-born mothers fell *immediately* in 2020—nine months too soon to reflect the pandemic's effects on conceptions. U.S. births to mothers born in China declined by almost 60% in 2020, a decline which began in January as the pandemic in China was taking hold and just before the U.S. barred the entry of people who had been in China in the prior two weeks.[1] By January 2021, births to women from Latin America had fallen 17% after U.S. land borders were closed except for essential travel by Presidential Proclamation on March 21, 2020.[2] Reductions in U.S. childbearing in 2020-2021 reflect 91,000 missing births from foreign-born mothers, a 5.2% decrease relative to a linear trend. In contrast, aggregate fertility rates among U.S.-born women declined by less than 1% relative to trend in 2020—a deviation too small to be statistically meaningful.

A second and more surprising finding is that the COVID pandemic resulted in a small baby *boom* among U.S.-born mothers in 2021, *raising* the total fertility rate relative to its pre-pandemic trend by roughly 6.2% at the end of the year. This 2021 "baby bump" is the first major reversal in the U.S. fertility rates since the 2007 Great Recession and was large enough to reverse two years of declining fertility rates. The baby bump was most pronounced among first births and among women under 25, suggesting that the pandemic led many women to start their

[1] The U.S. restriction on entry from China was announced on January 31, 2020 and effective Feb. 5, 2020. No one who had been in China in the previous 14 days was allowed entry. Similar restrictions on the entry of residents of the Schengen area of Europe were enacted on March 13.
[2] See https://mx.usembassy.gov/travel-restrictions-fact-sheet

families sooner. The baby bump was also pronounced among women 30-34 and among those ages 25-44 with a college degree or more. The latter group were more likely to retain their jobs during the pandemic and to be able to work from home. Combining the modest 2020 fertility decline and the 2021 baby bump, the COVID-19 pandemic led to a net *increase* in births among U.S.-born mothers of around 46,000 children.

Our results suggest that unlike any other economic downturn in recent history, the COVID-19 recession increased rather than decreased fertility among U.S.-born women (Currie and Schwandt, 2014). A possible reason for the reversal of the regular relationship of unemployment and fertility is that the COVID-19 induced recession was unlike previous downturns. In an unprecedented response to job losses affecting 22 million workers, the federal government spent $650 billion in federal pandemic unemployment benefits between March 2020 and September 2021 (Gwyn, 2022). The U.S. Census Bureau reports that, as a result of these programs, poverty fell in 2020 in every race and age group (Chen and Shrider, 2021). There was also an unprecedented rise in remote work, particularly for more educated workers, and 40% of days worked were still at home by spring 2021 (Barrero et al., 2021). Affluent families also saw increases in the value of their assets as both stock markets and home prices soared (Cian and Rebillard, 2021). At the same time, access to reproductive health care and abortion was disrupted and, in some cases, completely shut down (Kavanaugh, 2022), which may have reduced fertility at older ages while also tending to increase unintended childbirth (Bailey et al., 2022). Also these differences make it important to examine fertility trends by demographic group in order to gain a better understanding of the role of these factors.

II. Data and Methods

Our analysis draws on restricted natality data and population estimates to create seasonally adjusted estimates of childbearing between 2015-2022 for the U.S. and between 2015 and August 2022 for California. The following sections discuss our data and methods.

A. Natality Data

We obtained restricted natality data from the National Center for Health Statistics (NCHS) for 2015-2021 and the California Department of Health for January 2015 to August 2022. Although California mothers are slightly older and more educated than U.S. mothers as a whole, the state's size allows us to provide a rich description of multiple subgroups and includes real-time information on fertility rates through August 2022. National microdata are only available through December 2021. These data contain detailed information about every birth in the U.S. and California, respectively, including the month and year of the birth and birth order (e.g., first birth, second birth). The data also include the nativity of the mother, mother's race and ethnicity, age, and education. Our subsample of U.S.-born mothers includes those born in the 50 U.S. states.[3] Although this analysis focuses on births that occurred in 2020 through 2022, births in 2015-2019 were also examined in order to assess deviations from pre-pandemic natality trends.

B. Construction of Fertility Rates

Our analysis focuses on birth counts, total fertility rates, and birth rates to allow comparisons to other estimates in the literature and aid in interpretation. We follow the literature and construct the total fertility rate (TFR), a standard construct in demography, which projects

[3] This coding follows the CDC's coding of MBSTATE_REC, "Mother's Nativity."

the number of children a woman would have over her lifetime if she experienced the age-specific birth rates in a particular period. The TFR is calculated for month *m* as follows:

$$TFR_m = 5 \times \sum_a \frac{12 \times births_{a,m}}{population_{a,m}},$$

where *births* captures the number of births to women in age group *a* in month *m*, population the number of women in age group *a* in month *m*. Age groups are five-year age groups for women ages 10 to 49. We multiply by 12 to translate monthly birth rates into an annual equivalent in order to facilitate comparisons with more typically reported *annual* TFRs. Multiplying by five relates to the fact that birth rates are measured for five-year groups, and women are expected to experience an age-group specific birth rate for five years. In addition, birth rates by month *m* are computed for specific demographic groups *g* as follows:

$$B_m^g = \frac{12{,}000 \times births_m^g}{population_m^g},$$

where $births_m^g$ is the number of births to women in group *g* in month *m*, and population is for the same group in the same month. It is standard to report birth rates per 1,000 in the population, but multiplying by 12,000 translates monthly birth rates into an annual equivalent and facilitates comparisons with *annual* birth rates.

Groups *g* are defined as five-year age groups, race groups[4] (White Non-Hispanic, Black Non-Hispanic, Hispanic/Latina, Asian/Pacific Islander Non-Hispanic), education groups (high school or less, some college, college attainment), and birth parity (first birth, second births, or higher order births). One complication relates to the rise of multi-race reporting, because the

[4] In the Vital Statistics Natality data, the six race classifications are American Indian or Alaska Native; Asian; Black or African American; more than one race; Native Hawaiian or Other Pacific Islander; White; Unknown or Not Stated. In the ACS, individuals can choose White, Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, or Other Race, and can check more than one box. In our primary analysis of natality and ACS data, we omit individuals reporting multiple races from our race estimates.

incidence of people reporting that they are multi-race has risen dramatically over the last decade. For transparency, our main results classify only individuals who report a single race group. See Appendix Figure A2 which reports supplemental figures for women reporting multiple races or without a race/ethnicity specified.

Another difficulty relates to classifying individuals by education. To compute birth rates by education, we select a narrower sample of women aged 25 to 44 because these women are most likely to have finished with their education. Younger cohorts may have had their education disrupted by the pandemic.

C. Population Estimates

Calculations of fertility rates require population estimates, which are not straightforward in all cases. For instance, it is difficult to know the exact number of foreign-born women in the United States, because some are not U.S. residents. For this reason, we do not compute fertility rates for the subgroup of foreign-born women. In addition, well-documented problems with the 2020 Census complicate the direct calculation of populations in 2020 and 2021 (Ross, 2021). Consequently, we use indirect methods to compute populations by group, which avoids issues with measurement error affecting the results.

Overall population counts (and by age group, nativity, race and ethnicity group, and education group) were calculated by mother's individual birth-year cohort based on the mean population in the 5-year American Community Surveys (ACS) for 2015-2019. To avoid problems with the 2020 Census and 2021 ACS enumeration, we then assume the cohort population remained the same in 2020 and 2021 (for California through August 2022). This number will overstate population denominators in these years due to deaths and emigration but only very slightly, because both are rare for the U.S.-born women of childbearing age considered

in this paper. Annual population counts are assigned to December of the corresponding calendar year, and smoothed across months using cubic interpolation to avoid inducing discontinuities or kinks in population denominators. This procedure results in population estimates by month.

For U.S.-born mothers, cohort counts are summed up to correspond to the groups g defined previously. For race and parity birth rates, we use women ages 15-49 to construct the population denominators.[5] The education birth rates are based on a narrower sample of women ages 25-49, because they are likely to have completed their education. To account for the fact that education increases with age, we regress education shares in 2015-2019 on age-specific linear trend to predict each cohort's educational distribution in 2020 and 2021. Population estimates by subgroup are plotted in Appendix Figure A4.

D. Seasonal Adjustment, Pre-Pandemic Trends and Deviations from Trends

Childbearing is highly seasonal, and seasonality differs across different subgroups in the population (Buckles and Hungerman, 2013). To adjust for seasonality, monthly birth counts or rates from 2015-2019, overall or for a subgroup, are regressed on calendar month fixed effects, and we use the residuals from these regressions in the analysis. The regression is estimated using the pre-pandemic period, but the residuals are computed for the entire period, either for January 2015 to December 2021 in the U.S. or January 2015 to August 2022 in California. These residuals are then added to the mean of the outcome for 2015-2019, so that the level (either the count or rate) is easily interpretable. We refer to these constructs as "seasonality adjusted" birth or fertility rates.

Trends in seasonally adjusted births or birth rates are computed by regressing these outcomes on a linear trend in month using data for the pre-pandemic period, January 2015 to

[5] For comparability with the natality data, our denominators for race/ethnicity groups only count individuals in single race categories.

December 2019, which is plotted as a solid line in the figures.[6] The figures present the projection of this trend as a dashed line to January 2020-December 2021 for the U.S. overall and through September 2022 for California. In addition, 95-percent confidence intervals for the linear prediction are displayed as a shaded region on the figures. Total deviations from pre-pandemic trends are computed by taking the difference in monthly births or fertility rates from the trend at a particular point in time or by summing over all months in a given period. Percent deviations are computed by dividing the sum of total deviations by the average level of the trend in the same period.

III. Results: The COVID-19 Baby Bump

Figure 1A shows that the decline in childbearing in the U.S. accelerated between March 2020 and January 2021, with Table 1 showing the number of births falling by 76,000 more than anticipated by the pre-pandemic trend (column 3). The qualitative pattern for the total fertility rate is remarkably similar: TFR fell from around 1.75 in January 2020 to 1.6 in January 2021, over 3 times the rate of decline from 2007 to 2020. Notably, the accelerated decline in childbearing began around March 2020, about nine months too soon for domestic pandemic lockdowns or the April 2020 pandemic surge in unemployment to affect conceptions. In order for the shortfall in births beginning in early 2020 to reflect falling conceptions, behavioral changes would have had to start in June 2019, well before COVID-19 had even been identified. In short, declines in fertility rates during 2020 happened too quickly to reflect changes in childbearing desires in response to the economic uncertainty and job losses caused by COVID-19.

[6] Similar to Kearney and Levine (2022), we deseason monthly birth data using month fixed effects. However, our time period used to estimate these month effects and the pre-pandemic time trend extends from January 2015 to December 2019, whereas they use October 2016 to September 2020 births. Importantly, their pre-pandemic time trend will be more sharply downward sloped in some cases due to changes occurring in early 2020 in response to the pandemic (see Figure 2).

Figure 1B provides a clearer visualization of the departures of the U.S. TFR from its pre-pandemic trend. By February 2021 (i.e. for conceptions occurring around May 2020), the total fertility rate had surged back to its pre-pandemic trend and then went on to exceed that trend by around 5% by the end of 2021. Panel B also includes the data for California. Where the time periods overlap, the figure indicates that the trends in TFR were remarkably similar in California and in the U.S. as a whole. Since the California data are available through August 2022, the California data suggest that U.S. fertility rates may also have remained slightly elevated through most of 2022.

In their analysis of births through September 2021, Kearney and Levine (2022) also note the early onset of a reduction in births, saying that this pattern "could reflect pregnancy avoidance on the part of people who were paying attention to emerging news of the pandemic. It could also reflect the imprecise nature of dating births to conceptions nine months prior. In addition, some of these missing births could be due to miscarriages and abortions occurring in or after March 2020, which would have been conceived in January or February, as opposed to reduced conceptions in those months. Although we are unable to definitively assign missing births in these months to the pandemic, the fact that births changed in these months proximate to the pandemic suggests that the decline is likely to be, in some way, pandemic related" (p. 11).

Our estimates by nativity suggest that the reductions in childbearing early in the pandemic may not solely reflect missing conceptions. A large part of the decline reflects a change in the location where births occurred, from the U.S. to other countries. Figure 2A shows birth counts by nativity, that is for U.S.-born and foreign-born women. Births among U.S.-born women remained within a 95-percent confidence interval around the linear trend through the first nine months of the pandemic, and then began to rise after January 2021. In contrast, births to

foreign-born women fell sharply beginning in the first months of the pandemic and continued to fall until early 2021 when they began to rebound. Numerically, the largest numbers of births to foreign-born women are those to women from Mexico and Latin America.

Figure 2B shows that when looked at as deviations from trend, births to women born in Latin America follow the overall pattern shown in Figure 2A. However, births to women born in China fell earlier, declining by more than 50% by January 2021, and have remained essentially unchanged as lockdowns in China have continued. The rapid recovery in the number of births to mothers born in Latin America suggests that official restrictions on mobility in response to COVID-19 cannot have been the only factor involved in changing these flows, since official restrictions on travel into the U.S. were not lifted until November 2021. One possibility is that foreign born women who were resident in the U.S. experienced changes in childbearing similar to U.S.-born women.

Figure 2C shows birth counts and total fertility rates for all U.S.-born women as well as the total fertility rate for U.S.-born women in California. Where they can be compared, the two TFR series track closely. However, the California data is available through August 2022, which enables us to ask whether the increased fertility observed in 2021 continued into 2022. The figure suggests that after peaking at the end of 2021, California's TFR fell, but remained elevated relative to prior year trends. If patterns in the entire U.S. evolved similarly, that would mean that the COVID baby bump continued well into 2022.

Together Figures 1 and 2 establish that the reduction in births during the first nine months of the pandemic was largely due to a sharp decline in births to foreign-born women in the U.S. Table 1 shows births to this group declined by almost 48,000 in 2020 relative to their pre-pandemic trend. Among U.S.-born women there was a much smaller deviation in births of

around 29,000, and a rapid uptick in births beginning in February 2021, suggesting that conceptions were strongly increasing by June 2020. Combining changes in fertility rates in 2020 and 2021, the COVID-19 pandemic raised births to U.S.-born mothers by around 46,000 by relative to pre-pandemic trends through the end of 2021. The next sections break down these patterns by different subgroups of U.S.-born women.

A. Childbearing Patterns by Age Group among U.S.-born Women

Figure 3 provides a breakdown of fertility rates and deviations from pre-pandemic trends by five-year age groups.[7] Panel A shows that there was no apparent decline in fertility in the two youngest age groups, 15-19 and 20-24, in 2020, although there was a brief dip in January 2021, suggesting responses in conceptions right at the start of pandemic lockdowns. Both groups quickly recovered, however, and experienced birth rates above the earlier trend during the rest of2021. Among women 20-24 years old, fertility rates exceeded pre-pandemic trends by 10% in December 2021. Panel B of Table 2 shows that women under age 25 had an *additional* 39,500 births relative to trend when aggregated over 2020 and 2021.

Panel B of Figure 3 shows results for 25-29 and 30-34 year olds, who together account for the majority of births to U.S.-born women. These two groups saw some reduction in births during 2020, though these reductions generally fall within the bounds of a 95-percent confidence interval around the pre-pandemic linear trend. Beginning in January 2021, both groups show a sharp rise in birth rates relative to trend of roughly 5% for women ages 30-34 and over 7% for women ages 25-29. Aggregating over both 2020 and 2021, Panel B of Table 2 shows women ages 25-34 had around 7,000 more births than expected based on pre-pandemic trends.

[7]Appendix Figure A1 shows all age groups and percent deviations in one figure to facilitate comparisons.

Panel C of Figure 3 shows results for women ages 35 and older. Pregnancies in this age range are considered "geriatric" by the medical community and treated as higher risk for the mother and infant. Women ages 35 and older show a striking 8-10% decline relative to the pre-pandemic trends in January 2021, which might reflect disrupted access to assisted reproductive technology services that they are more likely to use (Tierney and Cai, 2019). The dip however was quickly reversed and both groups show large jumps in birth rates in 2021—for women 40 and older, the birth rate peaked at 13% above trend by mid-2021. Despite concerns that reductions in childbearing might be permanent at older ages, Panel B of Table 2 shows virtually no change in *net* childbearing by the end of 2021 for these groups combined.

B. Childbearing Patterns by Parity among U.S.-born Women

Figure 4 shows birth rates by parity. Panel A indicates that there was no change in first births during the first nine months of the pandemic, other than the sharp dip in January 2021. For the rest of 2021, rates of first birth jumped rapidly, so that they were up almost 8% by the end of 2021. Panel B shows that second births showed more of a decline during the first nine months of the pandemic, but again rose sharply by February 2021, indicating that large increases in the number of conceptions of second births had begun already by June 2020. Finally, Panel C shows births of parity three and higher. These births began to decline in 2019 and continued to decline through December 2020. Births then rose and had almost resumed their pre-pandemic trend by the end of 2021. These patterns suggest that the baby bump was driven primarily by first and to some extent second births rather than by higher-order births, perhaps consistent with college-educated women being the most likely to have increased their fertility (as shown in section D). In total, Panel C of Table 2 shows that compared to pre-pandemic trends, there were

an additional 68,619 first births, and 11,914 additional second births during 2020 and 2021, which were somewhat offset by a reduction of 44,202 third and higher order births.

C. Childbearing Patterns by Race and Ethnicity among U.S.-born Women

Figure 5 provides a breakdown of fertility rates by race and Hispanic/Latina origin. Panel A shows that there was a slight reduction in births to white non-Hispanic women during the first nine months of the pandemic, followed by an upswing after January 2021 which left fertility rates almost 5% higher than the previous trend as of the end of 2021. Panel B shows a quite different pattern for Black Non-Hispanic births—there is a sharp decline over the first nine months of the pandemic which looks like it may have begun in 2019. And although there is some recovery during 2021, the birth rate remained about 5% lower than the pre-pandemic trend as of the end of 2021.

Patterns for Hispanic/Latina women and for non-Hispanic Asian/Pacific Islanders are shown in Panels C and D of Figure 5. These figures both show that birth rates for both groups followed their pre-pandemic trend during the first nine months of the pandemic, except for a sharp dip in January 2021 (corresponding to fewer conceptions in March 2020). The recovery in 2021 was large and rapid, peaking at almost 12% for Hispanic/Latina mothers and 8% for non-Hispanic Asian/Pacific Islander mothers. In summary, Black women saw declines in birth rates during the first nine months of the pandemic which have yet to recover–all other groups saw little or no decline during the first nine months of the pandemic and a large baby bump during 2021.

Panel D of Table 2 shows that in total there were an additional 44,909 births to white non-Hispanic women, 22,807 additional births to Hispanic/Latina women, and losses of 22,353

births to African-American women. There were also small increases of 2,264 births to Asian/Pacific Islander women offset by a small reduction in births to other/not specified women.

D. Childbearing Patterns by Education among U.S.-born Women

Figure 6 shows birth rates by education for women 25-44 only. These figures suggest a sharp divergence between women with and without a college education. Panel A shows that college-educated women experienced little to no reduction in fertility relative to the pre-pandemic trend during the first nine months of the pandemic. Beginning in 2021, these women saw a dramatic increase in birth rates, such that by the end of 2021, birth rates were 5.6% higher than anticipated by the pre-pandemic. In contrast, women with less education saw continuing declines in birth rates relative to trend, which appears to have begun in mid-2020. And although they saw some recovery in birth rates after January 2021, rates remained below trend as of the end of 2021.

Changes in births to women aged 25-49 by education are summarized in Panel E of Table 2. There were an additional 39,209 births to women with college or more, and a similarly sized increase in births to women whose education was not specified. These gains were largely offset by reductions in births to women with high school or less or some college.

IV. Summary and Conclusions

This paper shows that, although U.S. fertility rates declined in 2020, these declines were concentrated among mothers born outside the U.S. Moreover, 2020 declines began abruptly at the very beginning of the pandemic, suggesting that they reflect sharp declines in the entry of foreign-born, non-resident mothers into the U.S.—declines potentially reflecting travel restrictions, health concerns, and the sudden disappearance of economic opportunities for migrants. Among U.S.-born mothers, there is little evidence of a protracted baby bust. Aside

from a sharp reduction in births in January 2021 (9 months after the COVID-19 pandemic began in the U.S.), birth rates among U.S.-born women exceed their trend level for 2021 and 2022, suggesting that conceptions soared in May and June 2020 while the pandemic was still raging and have remained higher than before the pandemic began. Births to foreign-born women also began to recover months before the border reopened. Presumably this reflects a fertility response among the many foreign-born women who are U.S. residents, which was similar to responses among U.S.-born resident women.

The 2021 "baby bump" is the first major reversal in declining U.S. fertility rates since 2007 and was most pronounced for first births, women less than 25 and 30-34, and women with a college education—the women most likely to benefit from working from home. This baby bump appears to be ongoing. The data for California, which tracks the overall U.S. data closely where it can be compared, suggests that births remained elevated at a level similar to 2021 through the third quarter of 2022.

One inherent limitation of our analysis is that while the number of births is easily measured, our calculations of deviations from pre-pandemic trends necessarily depend on how trends are measured. There is no intrinsic reason, for example, that trends must be linear over time. We have experimented with computing trends using different time windows, and with allowing trends to differ for different groups rather than using a linear trend computed using data for 2015-2019 for all groups. The change that makes the most substantive difference is computing the trend for foreign-born mothers using the shorter time period 2017-2019. An argument for this is that births to foreign-born mothers began to trend downwards in 2017 relative to previous years. Comparing the actual drop in births to a lower predicted number results in a smaller deviation of actual from predicted births of 62,082. That is, while we still see

a large drop in births to foreign-born mothers, the size of the deviation relative to trend is sensitive to the computation of the trend.

What can we take away from this episode in terms of our understanding of the underlying economic drivers of U.S. childbearing? Our estimates highlight the very important role of foreign-born women in bolstering U.S. fertility rates. Without these births, the U.S. birth rate would be much lower and closer to other low-fertility countries found in Europe or Japan. Moreover, the fact that births fell so drastically when the borders were closed, suggests that the phenomenon of women seeking to give birth in the U.S. is an important one and worthy of more study in terms of what eventually happens to these new U.S. citizens and their mothers.

Another takeaway might seem to be that the standard model linking unemployment to reductions in fertility failed. Unemployment rose to heights not seen since the Great Depression, and yet the fertility of U.S.-born women actually increased. Important to note is that the underlying economic model of childbearing emphasizes the role of both income effects *and* opportunity costs (Becker, 1960). Many women saw little income loss and even income gains due to pandemic support programs. Yet fertility gains were concentrated in groups such as college-educated women who saw drastic reductions in the opportunity cost of having a child, when they were able to work from home and work schedules became more flexible. The reduction in opportunity costs may have been greatest for childless women, who did not have to cope with the simultaneous loss of day care and schooling opportunities for older children. Previous analyses suggest that the organization of labor markets has an important impact on fertility rates through institutions such as stable public sector employment and maternity leave (Adsera, 2004). This episode points to the large time costs of childbearing as an additional important driver of falling fertility rates and suggests that measures to alleviate these costs, such

as improving child care and allowing parents more flexibility to work from home, might be associated with higher future fertility.

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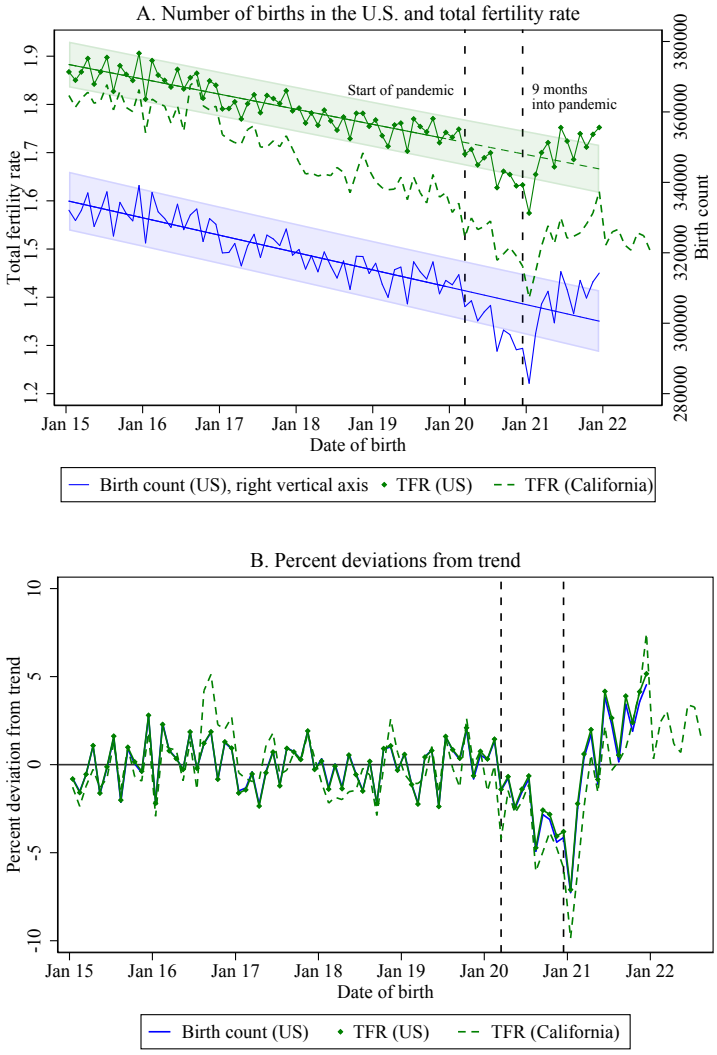
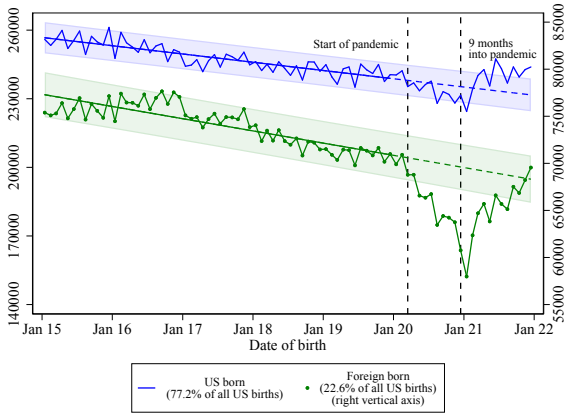
Figure 1: Seasonally Adjusted Births and Total Fertility Rate, 2015-2022



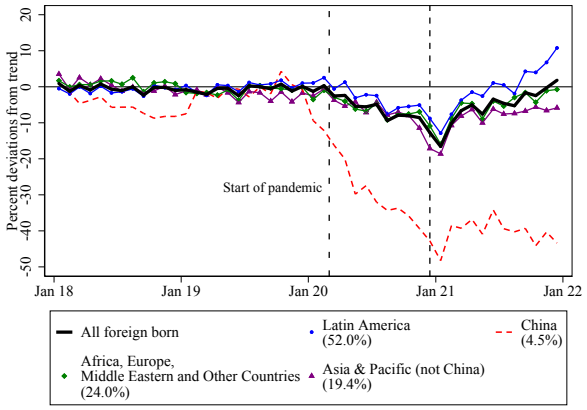
Notes: Calculations use all births occurring in the U.S. Births and fertility rates have been seasonally adjusted as indicated in the paper. Panel A presents the annualized total fertility rate (TFR) constructed as described in the paper (right vertical axis) alongside birth counts (left vertical axis). Linear pre-pandemic trends are fit for each series using January 2015 to December 2019 (presented in a solid line, projection in dashed line) Shaded region is the 95-percent confidence interval constructed using the standard error of the linear forecast. Panel B presents the percent deviations from trend for the same series. In both panels, the first dashed line from the left indicates the start of the pandemic in March 2020 and the second dashed line indicates nine months after the pandemic began in January 2021. Restricted data for all births in the U.S. for January 2015 to December 2021 come from natality data from the National Center for Health Statistics (NCHS). Restricted data for all births in California for January 2015 to August 2022 come from the California Department of Health.

Figure 2: Seasonally Adjusted Births 2015-2021, by Mothers' Nativity

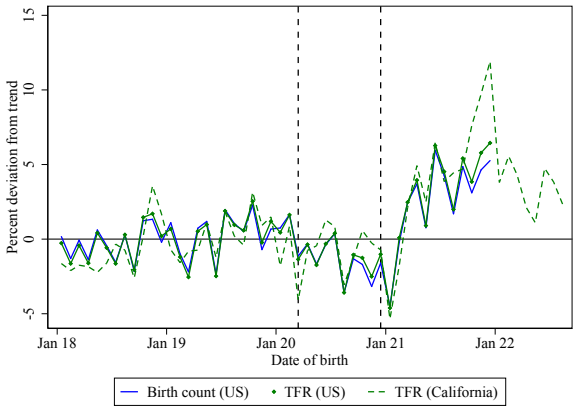
A. Birth count, by mothers' nativity



B. Percent deviation from trend among foreign-born women, by mothers' region of birth



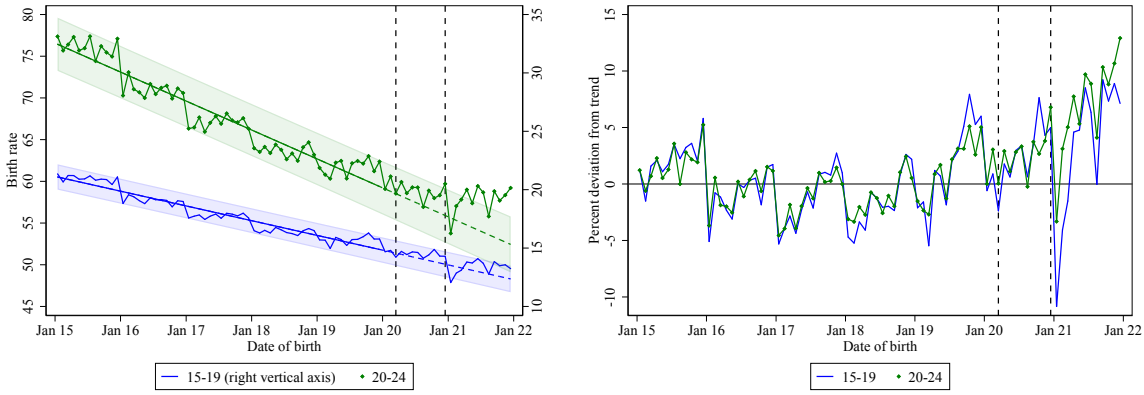
C. Percent deviation from trend among US-born women



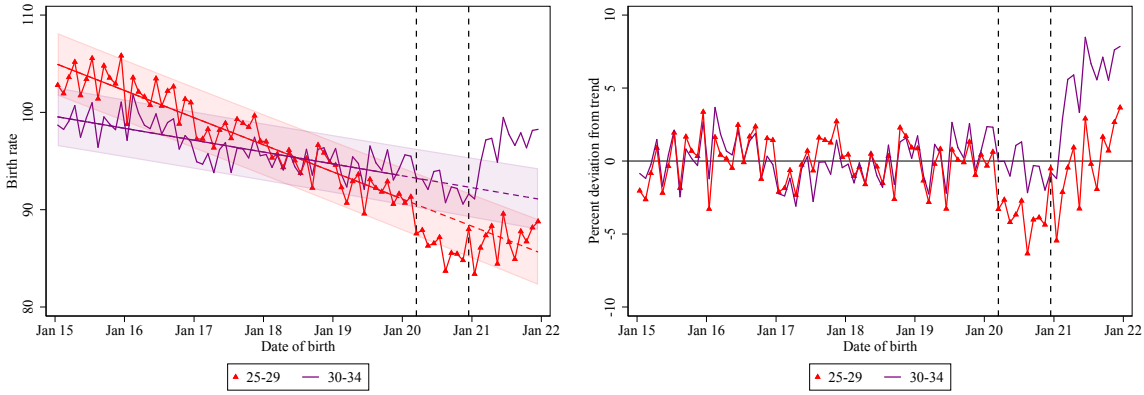
Notes: Calculations use all births occurring in the U.S. and stratify by whether the mother was born in or outside the U.S. The legends in panel A and B indicate the percent of all births falling into each category in parentheses. See also Figure 1 notes.

Figure 3: Seasonally Adjusted Birth Rates and Percent Deviation from Trend among US-Born Women, by Five-Year Age Group

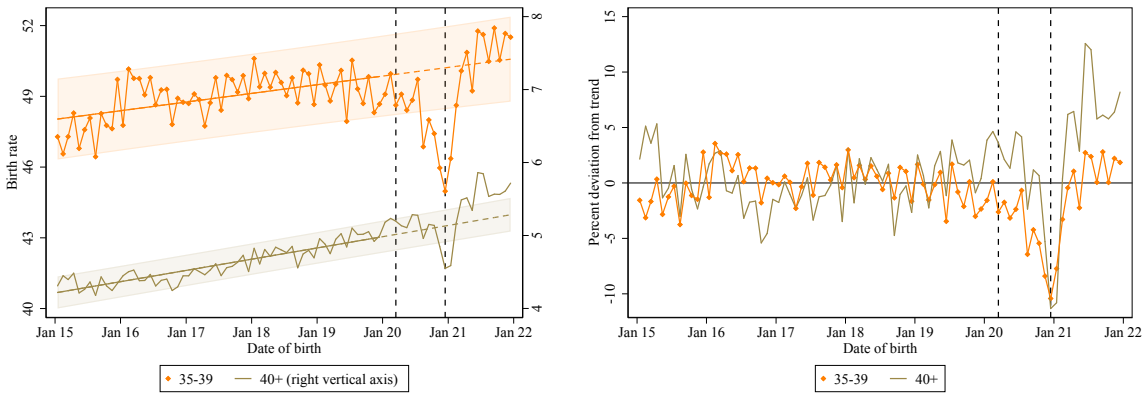
A. Ages 15-19 and 20-24



B. Ages 25-29 and 30-34



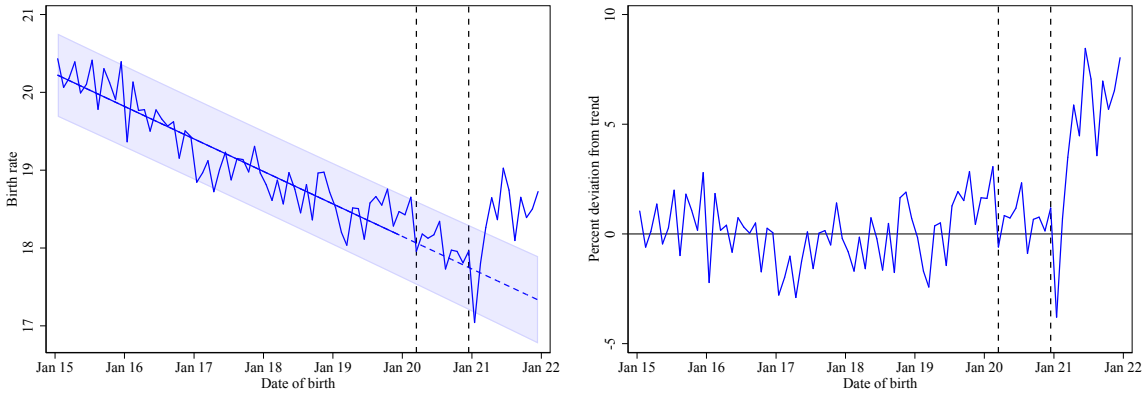
C. Ages 35-39 and 40+



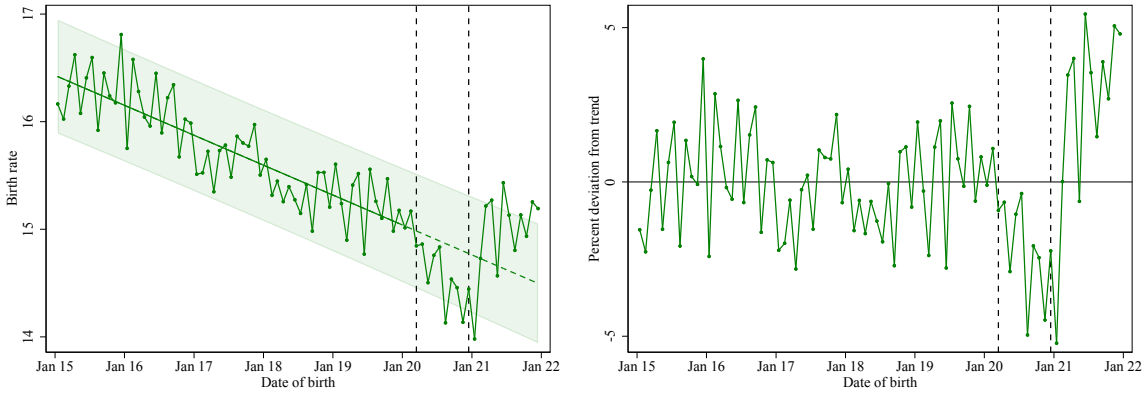
Notes: The figure presents seasonally adjusted, monthly birth rates for five-year age groups among US-born women and linear pre-pandemic trends in birth rates (solid line, projection in dashed line) on the left side. On the right side, figures show percent deviations from pre-pandemic trends. Panels A and C present birth rates very different in levels, which motivates the use of separate vertical axes. Population denominators use US-born women in the same five-year age groups. See also Figure 1 notes.

Figure 4: Seasonally Adjusted Birth Rates and Percent Deviation from Trend among US-Born Women, by Parity

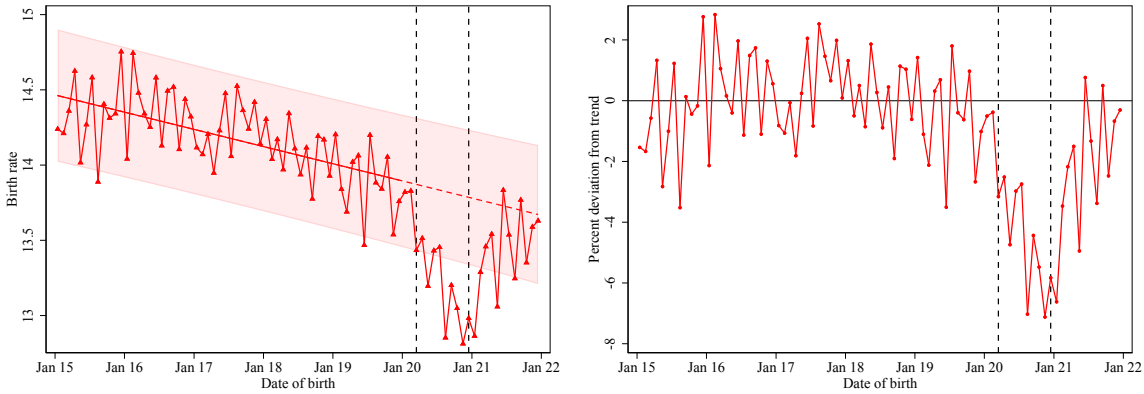
A. First Births



B. Second Births



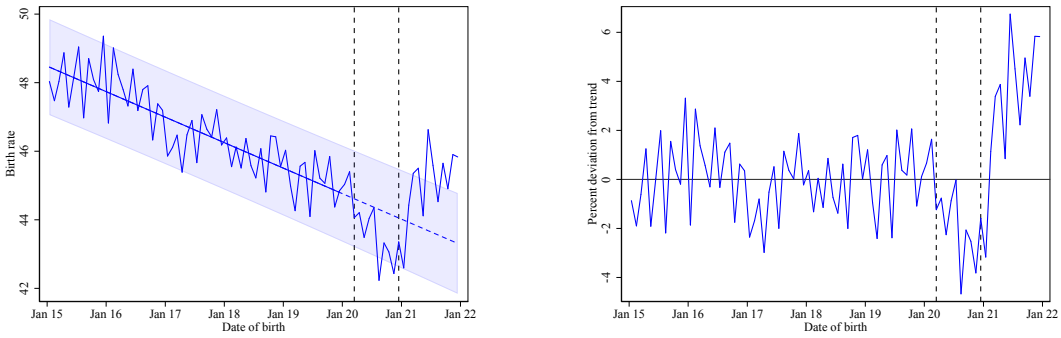
C. Higher Order Births (3+)



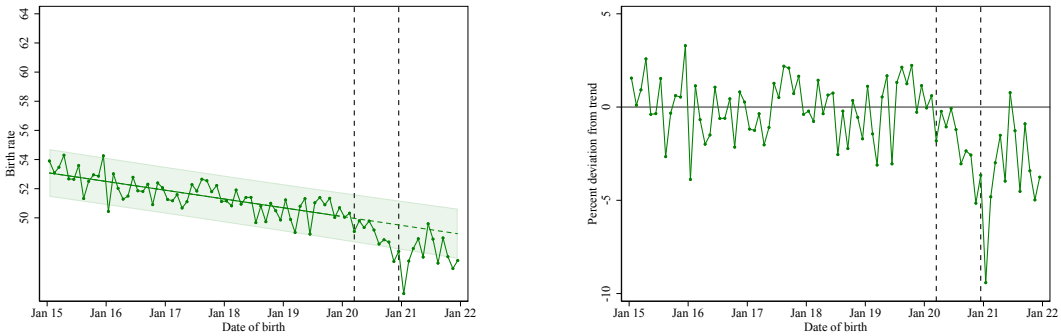
Notes: The figure presents seasonally adjusted, monthly birth rates among US-born women by parity and linear pre-pandemic trends in birth rates (solid line, projection in dashed line) on the left side. On the right side, figures show percent deviations from pre-pandemic trends. Population denominators use US-born women ages 15 to 49. Appendix Figure 2 presents estimates for women with no information on parity on the birth certificate. See also Figure 1 notes.

Figure 5: Seasonally Adjusted Birth Rates and Percent Deviation from Trend among US-Born Women, by Race/Ethnicity

A. White Non-Hispanic



B. Black Non-Hispanic



C. Hispanic/Latina

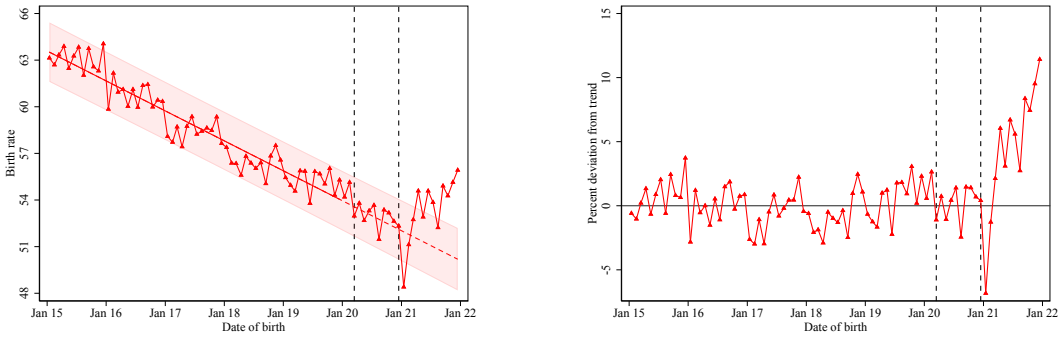
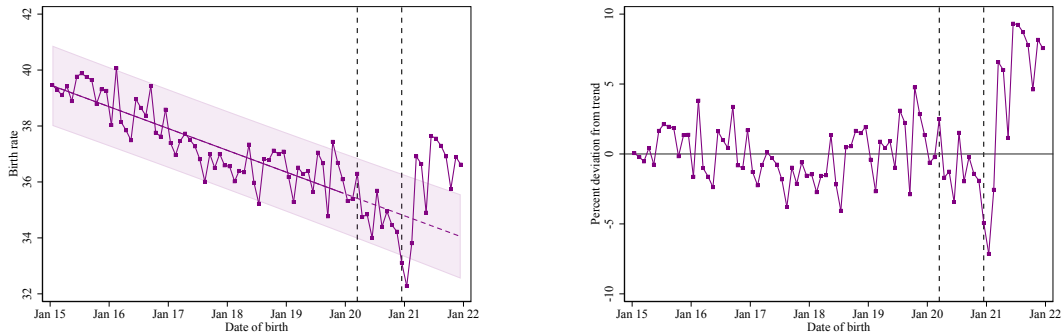


Figure 5: Seasonally Adjusted Birth Rates and Percent Deviation from Trend among US-Born Women, by Race/Ethnicity (continued)

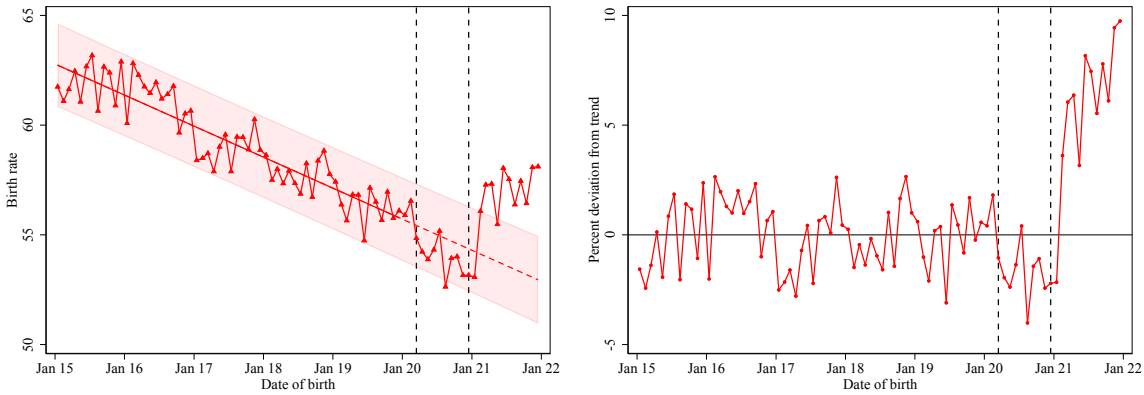
D. Asian/Pacific Islander Non-Hispanic



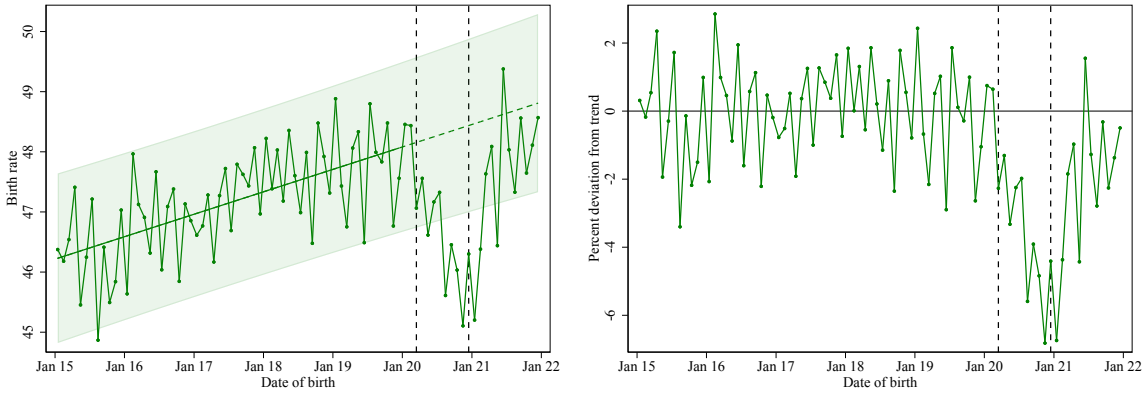
Notes: The figure presents seasonally adjusted, monthly birth rates among US-born women by race/ethnicity and linear pre-pandemic trends in birth rates (solid line, projection in dashed line) on the left side. On the right side, figures show percent deviations from pre-pandemic trends. Panels A, B, and D are restricted to women who do not report Hispanic/Latina origin and only report a single race/ethnicity category, whereas Panel C includes all women who report Hispanic/Latina origin. Population denominators use US-born women ages 15 to 49 in the same subgroups. Appendix Figure 2 presents estimates for women reporting multiple races or other race/ethnicity categories. See also Figure 1 notes.

Figure 6: Seasonally Adjusted Birth Rates and Percent Deviation from Trend among US-Born Women, by Education

A. Four or More Years of College



B. Less than Four Years of College



Notes: The figure presents seasonally adjusted, monthly birth rates among US-born women by education and linear pre-pandemic trends in birth rates (solid line, projection in dashed line) on the left side. On the right side, figures show percent deviations from pre-pandemic trends. Population denominators use US-born women ages 25 to 49 in the same educational groups. Appendix Figure 2 presents estimates for women with no information on education on the birth certificate. See also Figure 1 notes.

Table 1: U.S. Birth Counts, Birth Rates, and Deviations from Pre-Pandemic Trends, 2019-2021

	2019	2020			2021			2020-2021
	All births or TFR	All births or TFR	Total deviation	% deviation	All births or TFR	Total deviation	% deviation	Net births relative to trend
A. Births in US to women ages 15-49								
Number	3,754,688	3,617,034	-76,304	-2.07	3,666,993	32,777	0.91	-43,528
Total Fertility Rate (TFR)	1.74	1.68		-1.89	1.70		1.28	
B. Births in US to women ages 15-49, by nativity of mother								
Number, US-born mothers	2,894,714	2,814,937	-28,577	-1.01	2,874,639	74,439	2.67	45,863
TFR, US-born mothers	1.62	1.56		-0.89	1.58		3.09	
Number, foreign-born mothers	852,040	794,649	-47,865	-5.70	784,122	-42,832	-5.16	-90,697
Number, nativity not specified	7,934	7,448	138	1.88	8,232	1,169	16.71	1,307
C. Number of births in US to foreign-born women								
Asia & Pacific (not China)	166,181	157,383	-11,103	-6.60	153,412	-13,915	-8.31	-25,017
China	42,569	31,033	-11,918	-27.76	25,496	-17,284	-40.40	-29,202
Latin America	439,270	415,680	-12,856	-3.02	416,913	-1,174	-0.24	-14,030
Africa, Europe, Middle East and Other Regions	204,020	190,553	-11,989	-5.93	188,301	-10,458	-5.24	-22,448

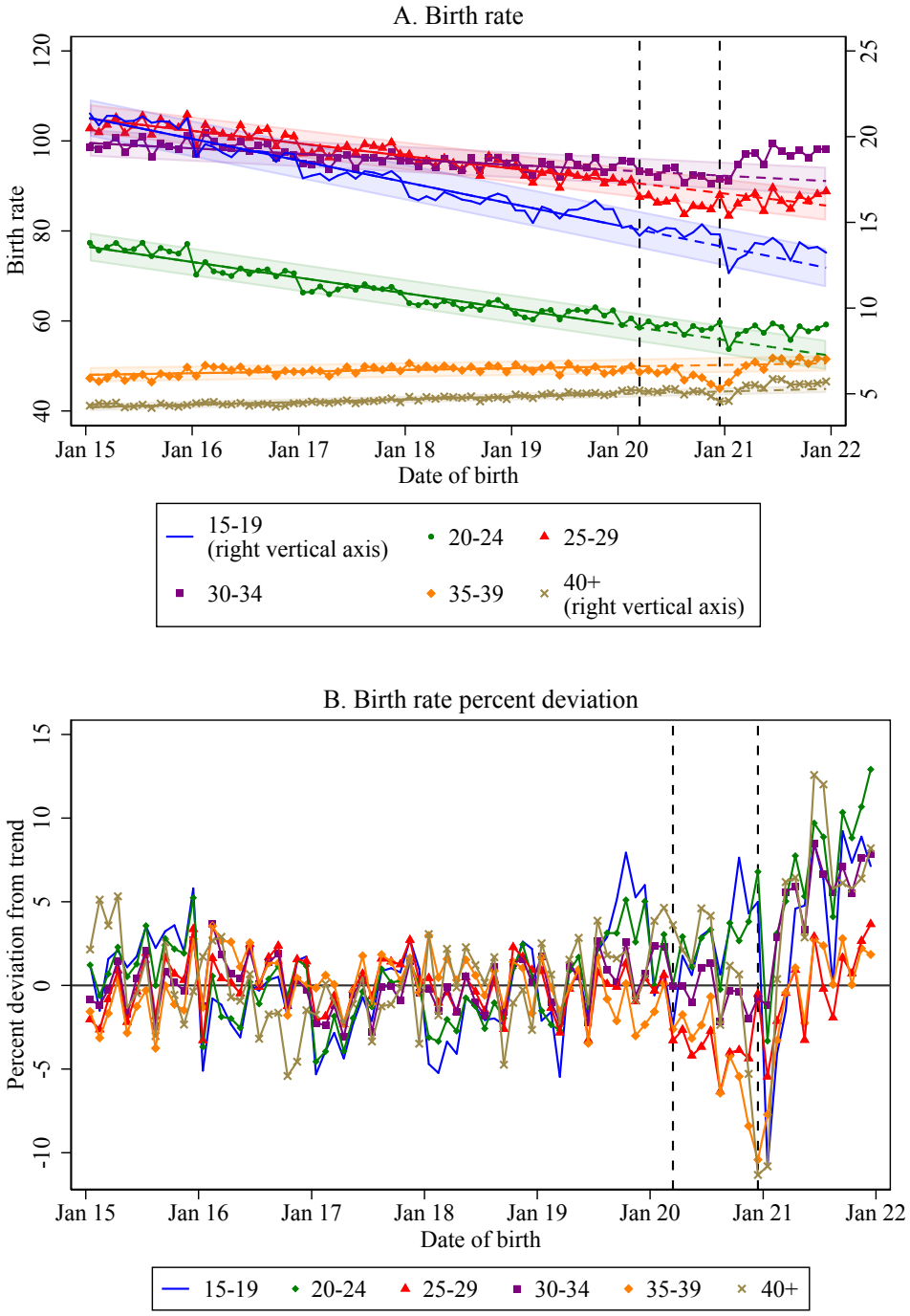
Notes: Columns labeled "All births or TFR" present the number of births in the U.S. or the total fertility rate (TFR) for the indicated calendar year. "Total deviation" is computed by summing over the difference between the seasonally adjusted, monthly births or fertility rates and the pre-pandemic trend for the indicated year. "% deviation" is calculated by dividing the total deviation by the average level of the trend in the same year. "Net births relative to trend" is calculated by adding the total deviations in 2020 and 2021 together. "Number" indicates the total count of births in a calendar year. "Total fertility rate (TFR)" is constructed as described in the paper. Restricted data for all births in the U.S. for January 2015 to December 2021 come from natality data from the National Center for Health Statistics (NCHS).

Table 2: U.S. Birth Counts, Birth Rates, and Deviations from Pre-Pandemic Trends among US-Born Women, 2019-2021 by Subgroup

	2019	2020			2021			2020-2021
	All births or TFR	All births or TFR	Total deviation	% deviation	All births or TFR	Total deviation	% deviation	Net births relative to trend
A. Number of births in US to US-born women ages 15-49								
Number	2,894,714	2,814,937	-28,577	-1.01	2,874,639	74,439	2.67	45,863
Total fertility rate (TFR)	1.62	1.56		-0.89	1.58		3.09	
B. Number of births in US to US-born women, by age group								
Age 15-19	149,236	138,109	3,942	3.00	127,171	5,516	4.68	9,458
Age 20-24	595,843	565,729	6,156	1.11	552,584	23,985	4.59	30,141
Age 25-29	864,301	828,113	-28,577	-3.34	833,263	-13,375	-1.58	-41,951
Age 30-34	813,211	811,613	993	0.12	858,696	48,124	5.94	49,118
Age 35-39	394,890	392,629	-12,171	-2.99	418,372	4,668	1.12	-7,503
Age 40-44	72,814	74,412	1,069	1.47	79,939	5,141	6.85	6,211
Age 45-49	4,419	4,332	10	0.20	4,614	380	9.01	390
C. Number of births in US to US-born women, by parity								
First birth	1,119,286	1,104,545	12,963	1.19	1,125,007	55,656	5.22	68,619
Second birth	925,947	893,093	-13,460	-1.49	917,582	25,374	2.85	11,914
Third or higher	842,836	811,159	-30,477	-3.62	823,194	-13,725	-1.64	-44,202
Not specified	6,645	6,140	2,397	*	8,856	7,134	*	9,532
D. Number of births in US to US-born women, by race/ethnicity								
White Non-Hispanic	1,784,651	1,720,348	-20,432	-1.18	1,764,372	65,341	3.86	44,909
Hispanic/Latina	474,504	474,319	1,934	0.41	493,394	19,873	4.19	21,807
Black Non-Hispanic	455,790	442,788	-7,471	-1.66	431,279	-14,882	-3.33	-22,353
Asian/Pacific Islander	50,457	50,400	-441	-0.86	54,434	2,705	5.22	2,264
Other or not specified	129,312	127,082	-2,166	-1.68	131,160	1,402	1.08	-765
E. Number of births in US to US-born women ages 25-49, by education								
Number, ages 25-49	2,149,635	2,111,099	-38,676	-1.80	2,194,884	44,939	2.09	6,264
Less than 4 years of college	1,205,617	1,174,152	-39,625	-3.26	1,184,956	-30,852	-2.54	-70,476
Four or more years of colllege	920,162	913,563	-12,720	-1.37	982,825	51,929	5.58	39,209
Not specified	23,856	23,384	13,669	*	27,103	23,861	*	37,531

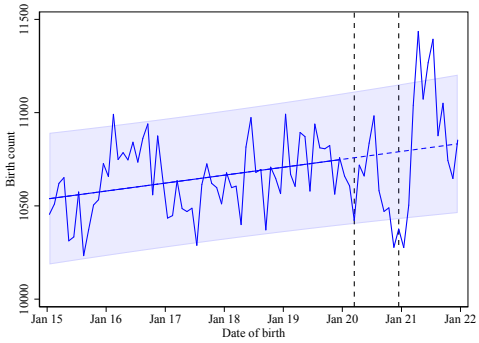
Notes: See Table 1 notes. Restricted data for all births in the U.S. to US-born women ages 15 to 49 for January 2015 to December 2021 come from natality data from the National Center for Health Statistics (NCHS). * Denominator too small to calculate percent changes

Appendix Figure A1: Seasonally Adjusted Birth Rates and Percent Deviation from Trend among US-Born Women, by Five-Year Age Group

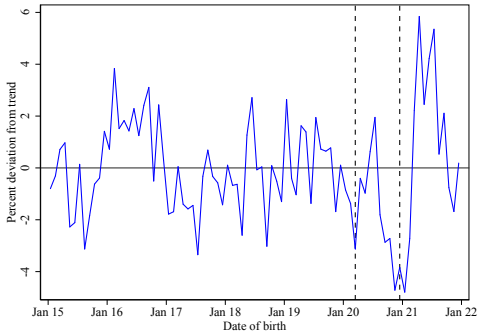


Appendix Figure A2: Seasonally Adjusted Birth Counts and Percent Deviation from Trend among US-Born Women for Not-Reported or Other Categories

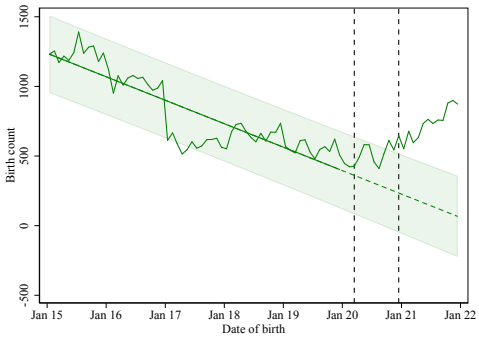
A. Seasonally Adjusted Birth Counts among US-Born Women, Race Not Specified or Other



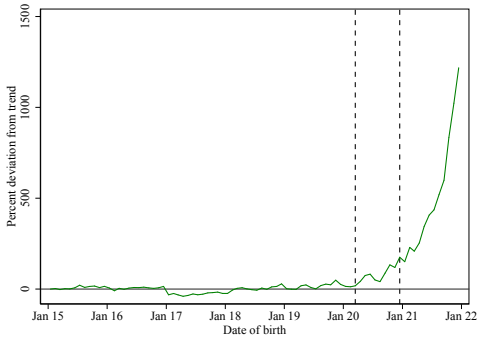
B. Seasonally Adjusted Percent Deviation from Trend among US-Born Women, Race Not Specified or Other



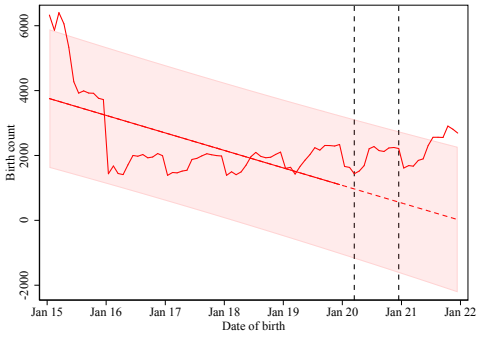
C. Seasonally Adjusted Birth Counts among US-Born Women, Parity Not Specified



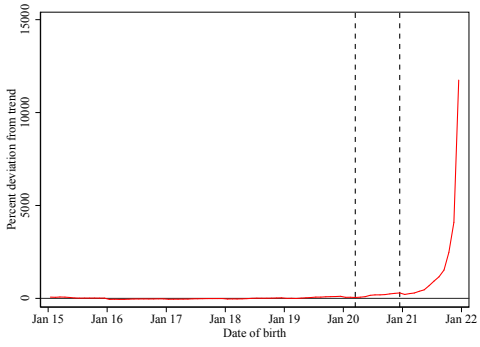
D. Seasonally Adjusted Percent Deviation from Trend among US-Born Women, Parity Not Specified



E. Seasonally Adjusted Birth Counts among US-Born Women, Education Not Specified

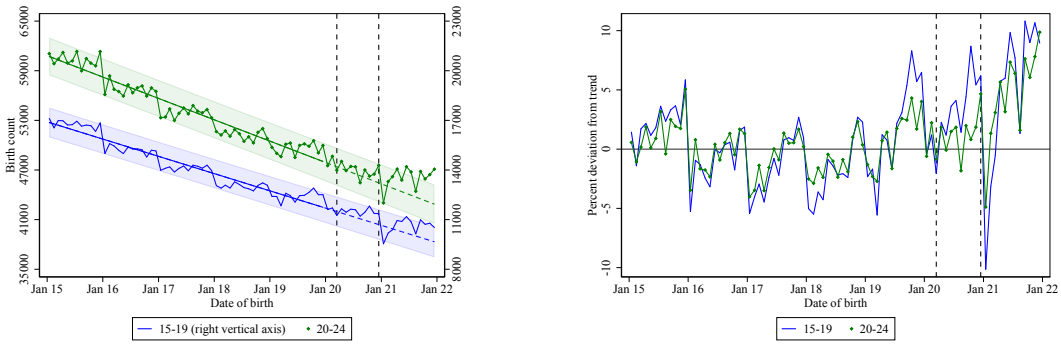


F. Seasonally Adjusted Percent Deviation from Trend among US-Born Women, Education Not Specified

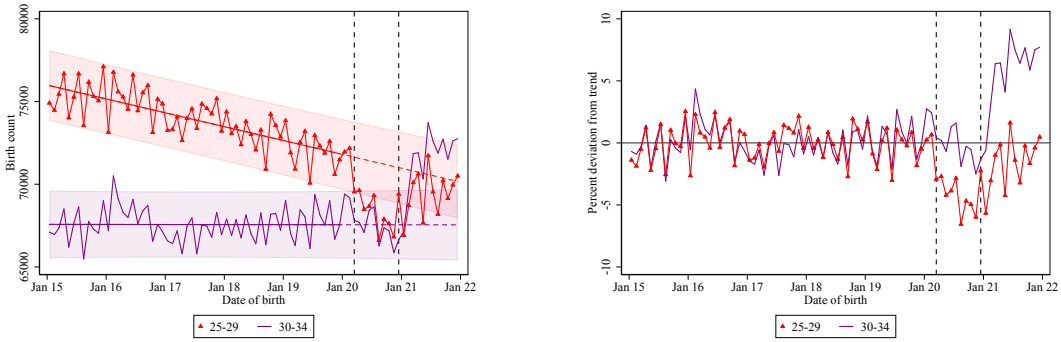


Appendix Figure A3: Seasonally Adjusted Birth Counts among US-Born Women, by Population Subgroup

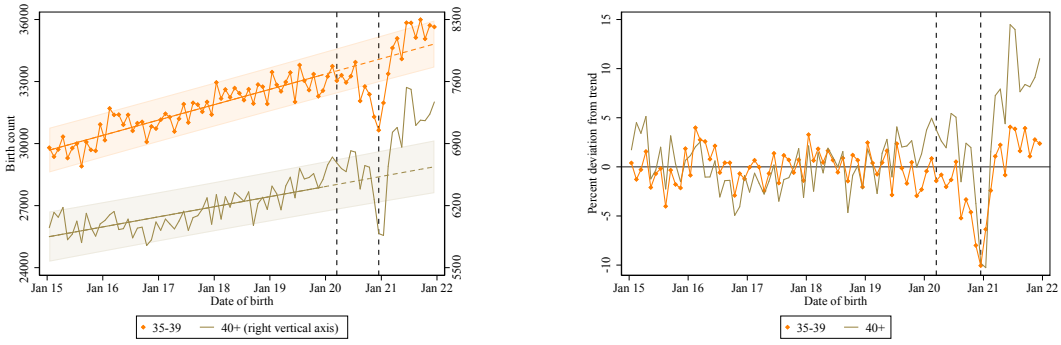
A. Ages 15-19 and 20-24



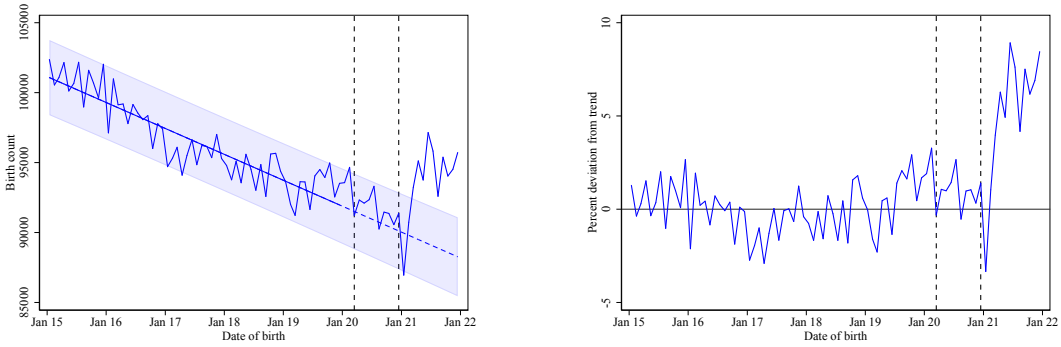
B. Ages 25-29 and 30-34



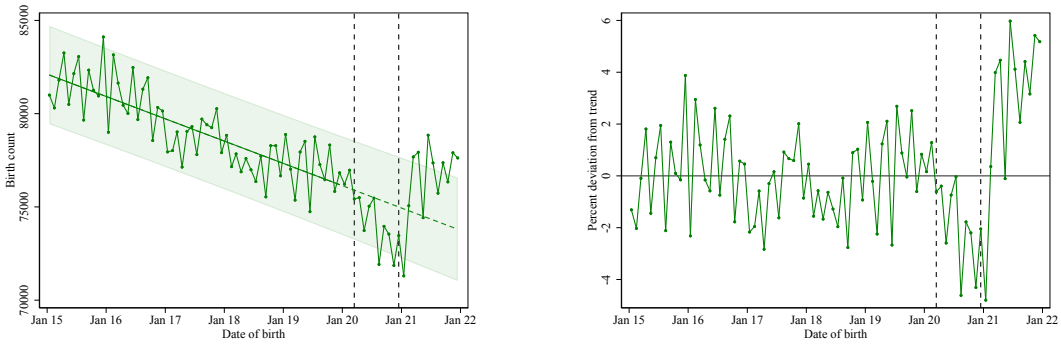
C. Ages 35-39 and 40+



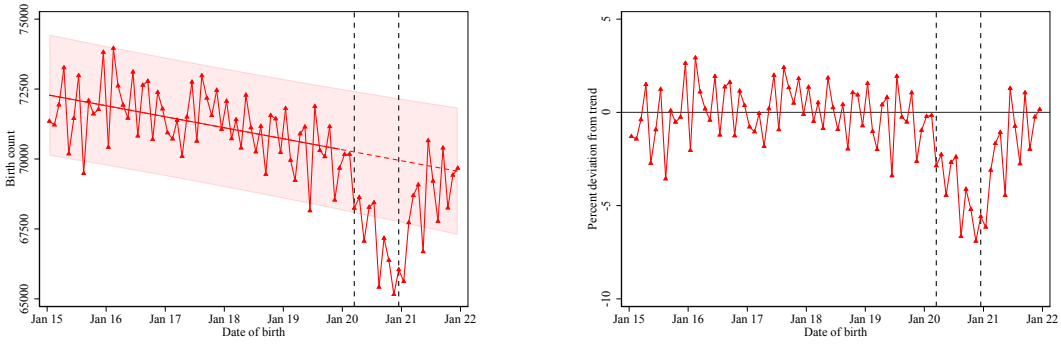
D. First births



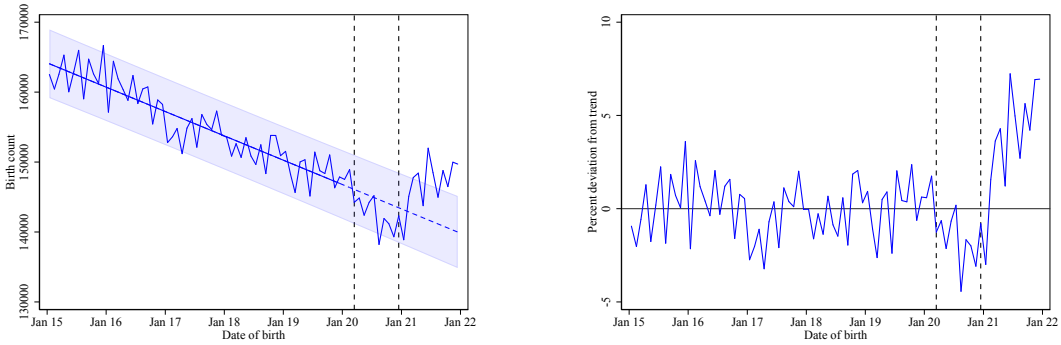
E. Second births



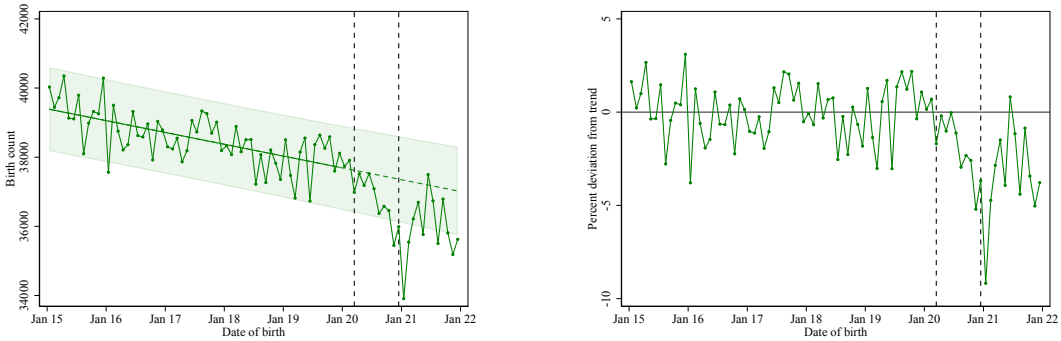
F. Third births



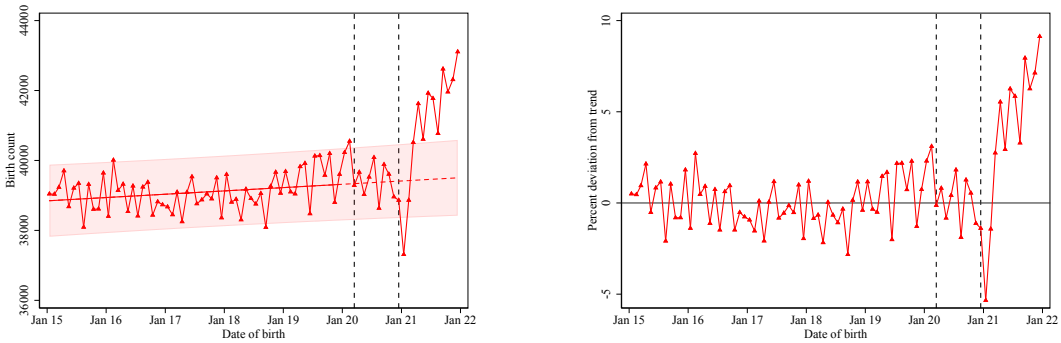
G. White Non-Hispanic



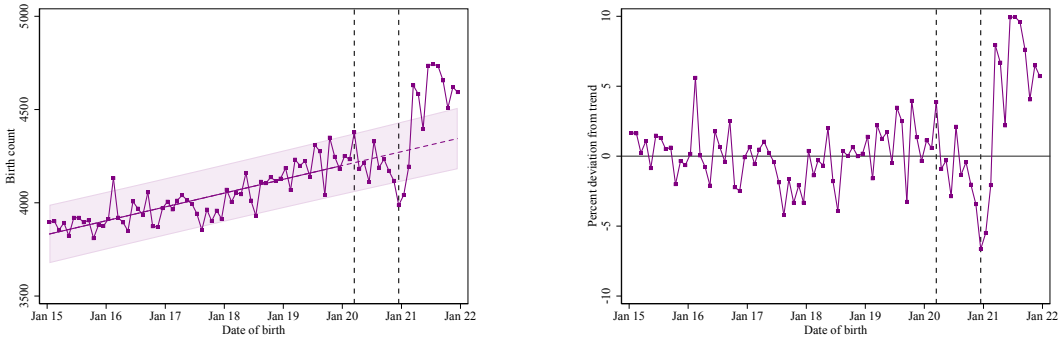
H. Black Non-Hispanic



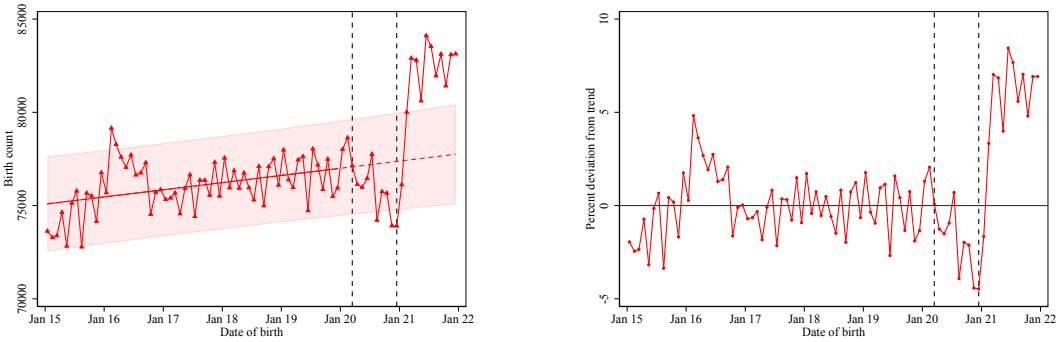
I. Hispanic/Latina



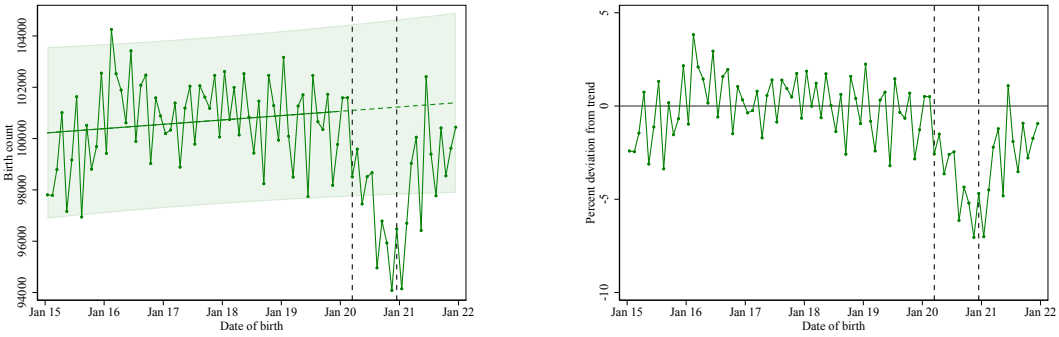
J. Asian/Pacific Islander Non-Hispanic



K. Four or more years of college

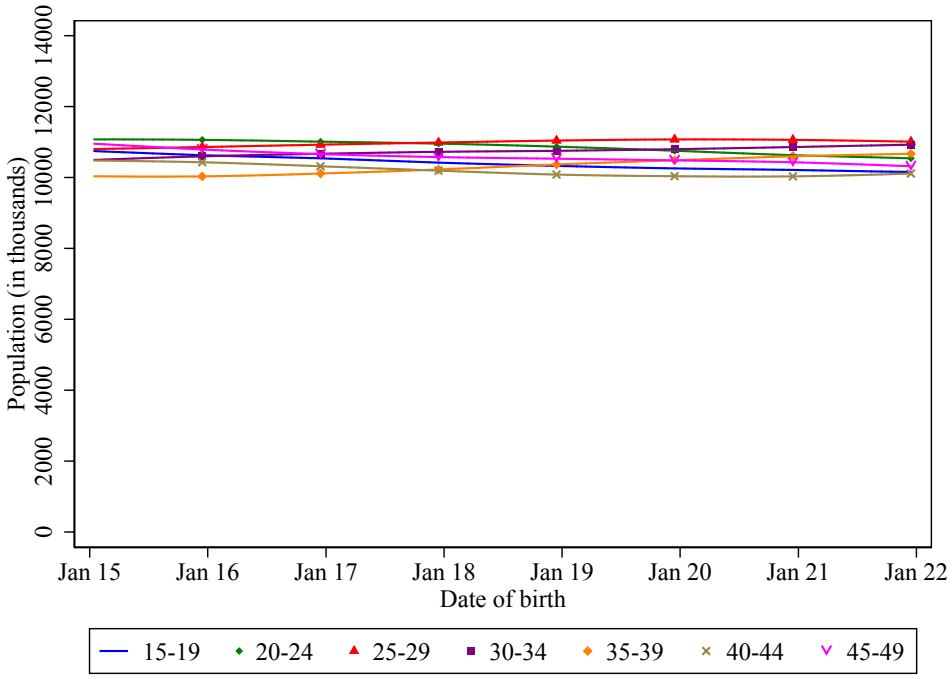


L. Less than four years of college

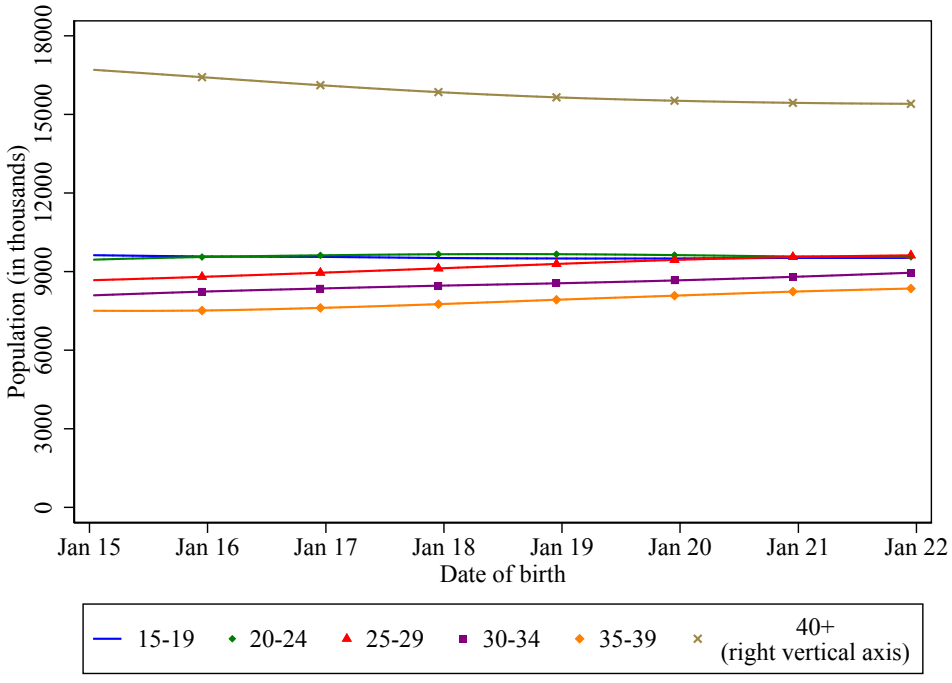


Appendix Figure A4: Population Estimates, by Month and Population Subgroup

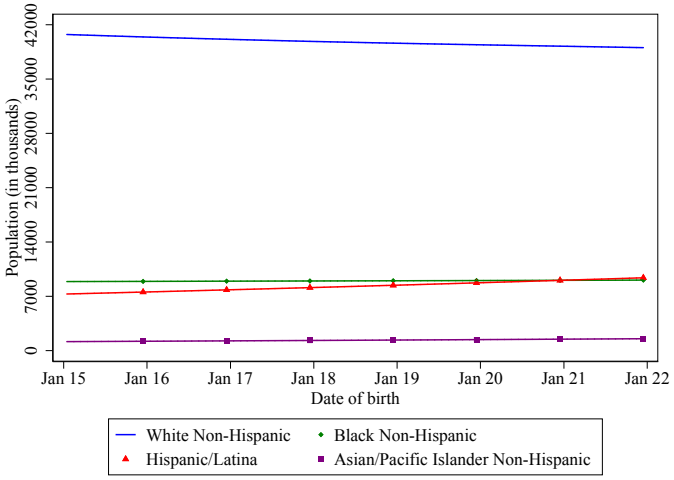
A. Population denominators by Five-Year Age Group (7 groups)



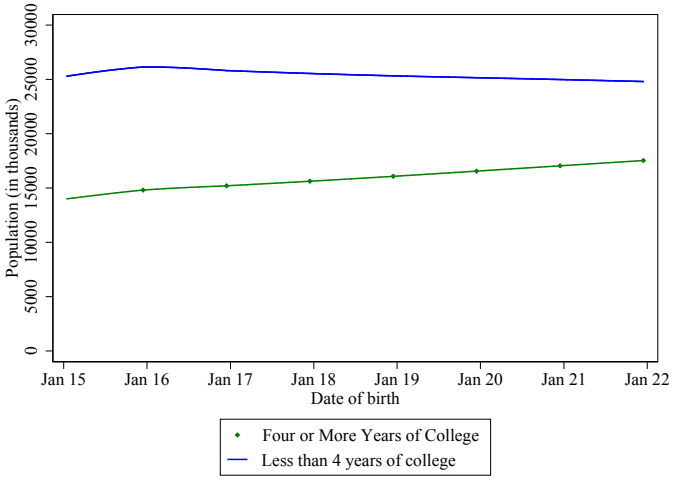
B. Population denominators by Five-Year Age Group (6 groups)



C. Population denominators by Race/Ethnicity



D. Population denominators by Education



Appendix Table A1: California birth counts, birth rates, and deviations from trend

	2019	2020			2021			1/2022-8/2022			1/2020-8/2022
	# births	# births	Devation		# births	Devation		# births	Devation		Net births re-
	or TFR	or TFR	Total	%	or TFR	Total	%	or TFR	Total	%	lative to trend
A. Births in California to women ages 15-49											
Number	447,300	420,660	-15,097	-3.48	420,845	-2,976	-0.67	279,271	3,355	1.22	-14,719
Total Fertility Rate (TFR)	1.63	1.53		-3.23	1.53		-0.20	1.52		1.97	
B. Births in California to women ages 15-49, by nativity of mother											
Number, US-born mothers	289,006	280,487	-2,710	-0.96	287,961	9,699	3.50	187,364	4,598	2.51	11,587
TFR, US-born mothers	1.50	1.42		-0.74	1.44		4.26	1.38		3.47	
Number, foreign-born mothers	158,294	140,173	-12,387	-8.17	132,884	-12,676	-8.64	91,907	-1,243	-1.32	-26,306

Notes: Columns labeled "# births or TFR" present the number of births in the California or the total fertility rate (TFR) for the indicated calendar year. "Total deviation" is computed by summing over the difference between the seasonally adjusted, monthly births or fertility rates and the pre-pandemic trend for the indicated year. "% deviation" is calculated by dividing the total deviation by the average level of the trend in the same year. "Net births relative to trend" is calculated by adding the total deviations in 2020-8/2022 together. "Number" indicates the total count of births in a calendar year. "Total fertility rate (TFR)" is constructed as described in the paper. Restricted data for all births in the California for January 2015 to August 2022 come from natality data from the California Department of Health.

Appendix Table A2: California birth counts and deviations from trend among U.S.-born women, by subgroup

	2019	2020			2021			1/2022-8/2022			1/2020-8/2022
	# births	# births	Devation		# births	Devation		# births	Devation		Net births re-
	or TFR	or TFR	Total	%	or TFR	Total	%	or TFR	Total	%	lative to trend
A. Number of births in California to US-born women ages 15-49											
Number	289,006	280,487	-2,710	-0.96	287,961	9,699	3.50	187,364	4,598	2.51	11,587
Total fertility rate (TFR)	1.50	1.42		-0.74	1.44		4.26	1.38		3.47	
B. Number of births in California to US-born women, by age group											
Age 15-19	12,286	11,105	827	8.37	10,126	1,608	19.52	6,453	1,752	37.60	4,188
Age 20-24	51,269	47,406	563	1.28	46,024	3,401	8.10	28,937	2,866	11.01	6,831
Age 25-29	81,324	77,640	-3,174	-3.93	77,626	-2,485	-3.10	49,239	-3,778	-7.13	-9,436
Age 30-34	84,517	84,998	1,228	1.47	90,953	7,368	8.82	59,743	4,122	7.41	12,717
Age 35-39	49,075	48,646	-2,132	-4.17	51,606	-823	-1.59	34,917	-954	-2.65	-3,909
Age 40-44	9,695	9,897	-17	-0.14	10,792	582	5.66	7,507	536	7.69	1,101
Age 45-49	738	699	-30	-4.16	729	-5	-0.74	498	6	1.19	-30
C. Number of births in California to US-born women, by parity											
First birth	119,399	116,928	1,056	0.91	119,801	6,176	5.45	78,070	3,567	4.79	10,799
Second or higher	169,389	163,312	-3,854	-2.31	167,810	3,304	2.03	108,934	741	0.68	191
D. Number of births in California to US-born women, by race/ethnicity											
White Non-Hispanic	101,146	96,644	187	0.19	97,239	4,577	4.97	60,088	422	0.69	5,187
Hispanic/Latina	127,763	124,607	-1,857	-1.47	129,017	4,236	3.41	88,151	5,899	7.17	8,278
Black Non-Hispanic	19,393	18,636	-128	-0.68	18,478	169	0.94	11,547	-406	-3.41	-365
Asian/Pacific Islander	16,762	16,721	-314	-1.83	18,079	705	4.04	11,891	120	1.02	511
E. Number of births in California to US-born women ages 25-49, by education											
High school or less	54,730	52,986	-1,436	-2.64	53,338	-1,100	-2.02	34,742	-1,558	-4.29	-4,094
Some college	69,152	66,880	-2,526	-3.64	68,029	-1,168	-1.69	44,084	-1,931	-4.20	-5,625
College or more	89,264	88,859	-882	-0.98	95,044	4,640	5.13	62,418	1,780	2.94	5,538

Notes: Other/missing categories have been omitted. See also Appendix Table A1 notes.