The US COVID-19 Baby Bust and Rebound

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Abstract:

This paper documents how the COVID-19 pandemic in the U.S. affected birth rates. We review the economics of fertility, describing the evidence that would predict a COVID baby bust. We then use Vital Statistics birth data to estimate the size of that bust and its rebound, for the country as a whole and separately for each state, and relate those changes to state-level factors. The onset of the pandemic in the late winter and early spring of 2020 resulted in 62,000 fewer conceptions leading to a live birth. This baby bust was followed by a rebound of 51,000 conceptions later that year, leading to a small net reduction in births conceived in 2020. We also find that a larger increase in the aggregate unemployment rate, a larger reduction in household spending, and higher cumulative COVID caseloads were associated with larger baby busts in the first part of the year. Births rebounded more in states that saw a larger improvement in the labor market and household spending. COVID caseloads played a smaller role. We conclude the paper by observing that these changes pale in comparison to the large decline in US birth rates that has occurred over the past 15 years.

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On March 13, 2020, the outbreak of the novel coronavirus disease COVID-19 was declared a national emergency in the United States. By the end of April 2020, the U.S. had recorded nearly one million COVID-19 cases and over 65,000 related deaths.[1] In response, government shutdowns were imposed on businesses, schools, and social gatherings around the country. The unemployment rate skyrocketed to 14.7 percent. The potential societal consequences of a nation-wide public health crisis and associated recession were widespread and far-reaching. They included the potential for a dramatic reduction in birth rates.

We document in this paper that the pandemic conditions that existed in the late winter and spring of 2020 led to a roughly 4 percent reduction in the birth rate in the U.S. Our estimates suggest that that there were 62,000 fewer births conceived during these first few months of the pandemic than one would have expected otherwise. However, the number of births conceived rebounded through the remainder of 2020, amounting to an additional 51,000 births in the latter part of the year. Combined, throughout 2020, there were only 10,000 fewer conceptions resulting in live births in the United States.

We also show that there was substantial variation across US states in the extent of the initial baby bust and subsequent rebound. Births fell in almost all states, but it was much larger in some than in others. The rebound completely reversed that decline in some states, but not in others.

We then examine the role of potential explanatory factors in driving the extent of a state's baby bust and rebound. We relate state monthly birth rates to a set of explanatory factors, separately examining the bust period and rebound period. The explanatory factors we consider are the state unemployment rate, levels of household spending, and the monthly COVID

[1] From CDC covid data tracker, https://covid.cdc.gov/covid-data-tracker/#trends_totalcases, accessed 3/8/2022.

caseload rate. For the rebound period, we additionally consider the presence of state mandates to keep schools open in the fall of 2020 and for wearing masks in public places.

Consistent with past research, we find a strong relationship between the unemployment rate and the birth rate, although that statistical relationship is attenuated when we also control for changes in household spending. This suggests that at least part of the negative effect of higher unemployment on birth rates arises through an effect on family's budgets (as captured by spending levels). The data also indicate that a higher level of COVID caseloads per capita is associated with larger birth rate declines, particularly during the bust period. This fits with earlier descriptive evidence that states with higher initial caseload rates, such as New York, experienced larger baby busts (Kearney and Levine, 2021). During the rebound period, however, that observed relationship is much smaller, suggesting that the behavioral response to COVID caseloads differed later in the year. We also find that states that mandated wearing masks in public in the summer of 2020 experienced smaller rebounds in birth rates holding constant the extent of COVID exposure in the state. This suggests a role for the social atmosphere surrounding pandemic worries and restrictions, beyond actual COVID caseloads.

The Economics of Birth Rates

The standard economic approach to modeling and studying the determinants of birth rates is based on Becker's (1960) seminal work, which modeled the decision to have a baby – or the "demand for children" – as a constrained utility maximization problem. This approach recognizes that children bring people "utility," more usefully thought of as life satisfaction or happiness, but also require the outlay of both financial resources and time. This standard framework predicts that all else equal, a relaxation of the budget constraint from additional income would increase the number of children a couple decides to have.[2] It also predicts that all else equal, a change in the costs associated with raising a child would lead to fewer children. A key cost associated with childrearing is the cost of time, as captured by market wages. Economists frequently consider the opportunity cost of an hour spent tending to one's child with the price of that hour in terms of what the parent could command from spending that hour in market work instead.[3]

There is ample evidence supporting the predictions of the basic framework outlined above. First, there is evidence that increases in household income lead to an increase in births, holding other factors, like women's wages, constant. The strongest such evidence comes from contexts where researchers have been able to study the impact of changes in income in a particular place or time. This surmounts the problem of comparing birth rates across places or over time since such comparisons are plagued by confounding factors that have independent effects on birth rates (such as women's economic opportunities or preferences for market work). For instance, Black, Kolesnikova, Sanders, and Taylor (2013) show that an increase in male earnings in coal-producing areas, driven by exogenous changes in coal prices, led to an increase in births among married couples; Kearney and Wilson (2018) document an increase in birth rates in response to localized "fracking booms" that increased household income in areas where fracking was geologically feasible; Dettling and Kearney (2014) and Lovenheim and Mumford (2013) show that exogenous increases in house prices lead to increases in births among existing

[2] For the sake of language convenience, we refer to a couple when we describe the unit making a decision about having a child; the logic applies equivalently if the choice is modeled as that of an individual. When we describe birth data, we refer specifically to births to women since that is the data we observe.

[3] Economic models that take as given historical gender roles yield opposite-signed predictions for the effects of changes in male and female wages on birth rates. Butz and Ward (1979) posited that an increase in male earnings will lead to an increase in the total demand for children under standard income effects, but an increase in female wages will have both positive income effects and negative price effects on birth rates, since women are more likely to expend time on the act of raising children.

homeowners, consistent with a positive wealth or home equity effect, while Dettling and Kearney (2014) further show that increases in house prices lead to reductions in births among renters, consistent with a negative price effect.

Past research also finds that employment and income losses lead to lower birth rates. Lindo (2010) finds that women whose husbands lose their jobs at some point during their marriage ultimately have fewer children. Autor, Dorn, and Hanson (2019) show that places that experienced a reduction in employment and earnings – resulting from increased import competition from China - consequently had lower birth rates. Schaller (2016) provides evidence in favor of the prediction of opposite-signed effects of increases in wages for men and women. Studying the period 1980 to 2009, she documents that exogenously determined improvements in men's labor market conditions led to increases in birth rates, while exogenously determined improvements in women's labor market conditions led to small decreases in birth rates.

There is also abundant evidence from recent decades showing that aggregate birth rates follow a pro-cycle pattern (e.g., Schaller 2016; Dettling and Kearney 2014; Schaller, Fishback, and Marquardt, 2020). This is consistent with the notion that people are more likely to become parents when they have income available to pay for the associated costs of childbearing. If credit markets were perfect, parents could borrow and save to finance the cost of children and optimally choose when to have them without regard to business cycles (see, for instance, Hotz, Klerman, and Willis, 1997). But credit markets are imperfect, and many people are liquidity constrained. Couples might thus refrain from having a child at times when household income is low or the threat of earnings loss is elevated —that is, when the economy is weak.

To the extent that delayed fertility results in lower total fertility for some women, then a reduction in births during a downturn could lead to a persistent reduction in births. Currie and

Schwandt (2014) examine this issue by tracking birth rates for cohorts of US-born women (based on their state and year of birth) between 1975–2010. They find large and persistent negative effects of the average unemployment rate experienced during the years a cohort is age 20-24 on total fertility of that cohort. They additionally find that the long-run effect on cohort birth rates is driven largely by an increase in rates of childlessness.

Finally, in the uncertain context of pregnancy and childbearing, optimized choices about how many children to have and when to have them are not always realized. The availability, price, and efficacy of family planning tools will all affect the degree to which women are able to achieve their desired level of pregnancy and birth avoidance. A variety of evidence from US contexts shows that expanded access to affordable and efficacious contraception has led to a reduction in births among affected populations (for example, Kearney and Levine 2009; Bailey 2010; Lindo and Packham 2017; Kelly, Lindo, and Packham 2020).

The COVID-19 Pandemic: Expected Effects on Birth Rates in the U.S.

When the public health crisis first took hold, some observers playfully speculated that there would be a spike in births in nine months, as people were "stuck home" with their romantic partners. Such speculation is based on persistent myths about birth spikes occurring nine months after blizzards or major electricity blackouts. As it turns out, those stories tend not to hold up to statistical examination (Udry, 1970). But the COVID-19 pandemic was, of course, much more than a temporary period of staying at home. It led to deep economic loss, uncertainty, and insecurity. Economic theory and evidence would lead one to expect a corresponding reduction in births.

In this section we conceptually apply lessons from the economics of birth rates (as discussed above) to the specific context of the COVID pandemic on births. First, labor market conditions are an important determinant of current birth rates. The domestic recession induced by the onset of COVID in the U.S. was extremely sharp, with the unemployment rate surging from 3.5 percent in February 2020 to over 14.7 percent in April 2020 (U.S. Bureau of Labor Statistics, 2022a). However, the massive spike in unemployment receded quickly. By October 2020, the unemployment rate had declined by more than half, falling to 6.9 percent. By the end of 2021, the unemployment rate had returned to 3.9 percent. This rapid recovery of the labor market likely dampened the total reduction in births, even though employment rates remain below pre-pandemic levels through March 2022 (U.S. Bureau of Labor Statistics, 2022c).[4] In our empirical analyses below, we document the link between aggregate unemployment rates and the size of the birth response across periods of the COVID pandemic.

Second, in addition to the rapid recovery of the labor market, the federal government responded with policies providing tremendous financial support to the economy and to families. This had the effect of bolstering household income and spending. The first of these steps included the passage of the CARES Act in March of 2020, which provided $2 trillion in fiscal relief (Congressional Research Service, 2020). It immediately provided $1,200 stimulus checks and increased unemployment insurance (UI) benefits by $600 per week, among other provisions like an expanded Child Tax Credit that eligible households could begin receiving in July 2020. For lower-wage workers, the UI benefit increase provided them income greater than their lost earnings (Anderson and Levine, 2020). In total, the economic assistance provided through CARES Act provisions allowed most households to maintain consumption levels (Bhutta, Blair,

[4] In June 2020, we predicted that a year of pandemic conditions could lead to a birth rate reduction of between 8 percent to 13 percent in the US (Kearney and Levine, 2020a). That forecast was largely based on an anticipated large and lengthy recession. In recognition of the stronger than expected labor market later in 2020, we revised our estimate of the impact of COVID on births downward (Levine and Kearney, 2020b). That revision, though, was still insufficient to capture the factors dampening the size of the baby bust.

Dettling, and Moore, 2020). Poverty rates did not increase by as much as previous experience would have predicted, and in fact, in the initial months after the CARES act, poverty rates actually fell (Han, Meyer, Sullivan, 2020).

The provision of government income assistance to maintain household income and consumption would be expected to mute the typical relationship between economic downturns and birth rates. In a different context, Cumming and Dettling (2020) show how government policy can mediate the effect of recessionary pressures on birth rates. Using administrative data from the United Kingdom on mortgages and births, they show that a policy change that resulted in lower interest rates on mortgages led to an increase in birth rates. Their calculations imply that the pass-through of accommodative monetary policy to mortgage rates was sufficiently large to outweigh the cyclical effects of the Great Recession and prevented a reduction in births as large as that experienced in the U.S. in the wake of the Great Recession. In our empirical analyses below, we document how household spending correlates with the size of the birth response during the COVID pandemic.

Third, beyond the economic conditions surrounding the COVID-19 pandemic, the public health aspects of the crisis likely affected birth rates.[5] The social conditions surrounding the COVID-19 public health crisis directly affected people's social activities, access to schools and childcare, and access to health services. All of these features of the pandemic could have had both practical effects that might either increase in decrease birth rates and psychic effects. For instance, social activities were restricted in ways that might have led to less romantic

[5] In our June 2020 Brookings report, we addressed issues like these by drawing lessons from the experience of the Spanish Flu episode of 1918 and 1919, which was a public health crisis without a corresponding economic recession. However, there are many obvious differences between that public health context and the COVID pandemic. For instance, the Spanish flu had a high mortality rate among women of childbearing age (Simonsen, et al., 1998).

partnerships forming. The stress on parents from closed schools and childcare centers might have amplified any potential birth reduction, driven by a reduction in higher parity births. Restricted access to health care facilities might have reduced births among women who would have been seeking fertility treatments. In the other direction, it might have made it more difficult for some women to access contraceptive services or abortions and thereby dampened any reduction in births. For instance, Bailey, Bart, and Lang (2021) document a reduction in reproductive health visits to planned parent health centers in Michigan among a sample of low-income women who rely on Title X funded clinics for reproductive health care. Our empirical analysis below only indirectly sheds light on the role of these non-economic factors.

From a practical standpoint, pinpointing the exact mechanisms by which these aspects of the public health crisis affected birth rates is a daunting task. The simple point we are making here is that at times and in places where COVID is more pervasive, there may be a differential impact on birth rates. Furthermore, as the social anxiety surrounding the virus wanes, so too will individual behavioral responses. We attempt to assess that effect by including in our empirical analyses below two policy indicators: a state-wide mask mandate and a state-wide mandate to open schools.

This discussion previews our state-level empirical analysis below. In that analysis we examine the link between state-level factors and the birth rate in the post-COVID period. The factors we include are labor market conditions, a measure of household spending, the COVID caseload rate, and public policies that may capture the social anxiety associated with COVID.

National Evidence from US Birth Records through September 2021

We calculate the number of "missing" US births attributable to the COVID-19 pandemic using data from the U.S. CDC National Center for Health Statistics. We use five years of monthly birth data from October 2016 through September 2021, the most recent month available when we conducted our analysis. All of the birth data we use through December 2020 are final birth counts obtained from CDC Wonder based on birth certificates. The birth data we use from January 2021 through September 2021 are provisional birth data from the National Center for Health Statistics, National Vital Statistics System (2022).[6] Data are not yet available on births that would have been conceived in 2021, which includes much of the 2020/21 winter wave of the COVID pandemic and the beginning of the Omicron wave later that year, so we cannot make a final determination on the ultimate size of the US COVID baby bust and rebound.

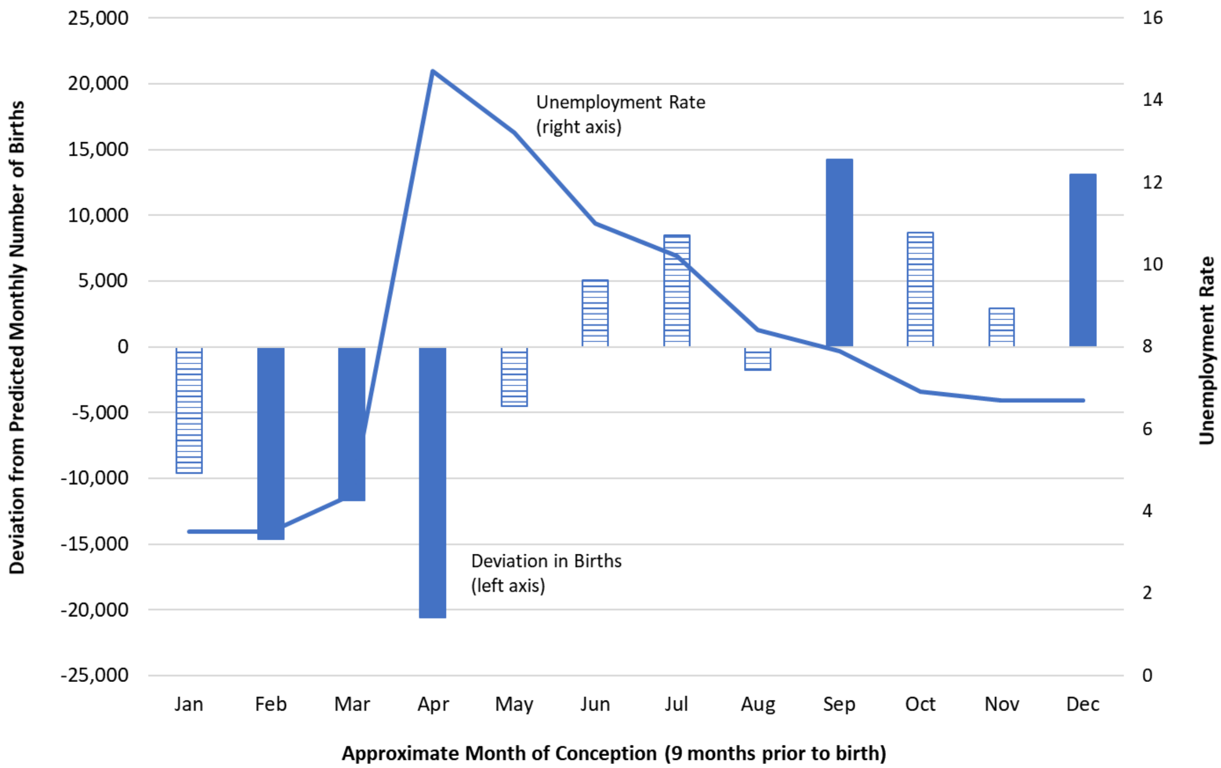
We calculate missing births as the shortfall between actual births and the number of births predicted based on pre-pandemic trends. Throughout this analysis, all births are dated by the likely month of conception, assuming a nine-month gestation period. The number of predicted births is based on pre-pandemic monthly birth data from conceptions likely occurring between January 2016 and December 2019. The predicted number of births conceived in 2020 takes into account the pre-pandemic downward trend in births and typical seasonality in birth rates.

Figure 1 depicts the calculated deviation of the number of births from the number of predicted births, by the likely month of conception. The solid bars indicate estimates that are

[6] The CDC notes the following on their website, accessed 03/11/2022: "Provisional counts may differ by approximately 2 percent from final counts, due to rounding and reporting variation. Additionally, the accuracy of the provisional counts may change over time. For discussion of the nature, source, and limitations of the data, see "Technical Notes" of the report, Births, Marriages, Divorces, and Deaths: Provisional Data for 2009. Available from URL: https://www.cdc.gov/nchs/data/nvsr/nvsr58/nvsr58_25.htm."

statistically different from zero at the 5 percent level. The data show a baby bust of 62,000 missing births for those likely conceived between January and May 2020.

Figure 1: Deviation from Predicted Monthly Births in 2020



Notes: Predicted monthly birth rates are based on detrended and deseasoned monthly birth rates using data on births by months of conception from January 2016 through December 2020 (births between October 2016 and September 2021). Solid bars are statistically significant at the 5 percent level.

Conceptions fell the most in April 2020 (missing births in January 2021). It stands to reason that the events of March 2020 would have led many people to decide to postpone or avert any plans to get pregnant around that time. President Trump declared a COVID-19 national emergency on March 13th and local shut-down orders soon followed in various places around the country.

However, there are missing births linked to conceptions occurring as early as January 2020 (births in October 2020). The global pandemic was beginning to take hold in January and

February 2020, but it had not yet affected daily life in the U.S. The early onset of a reduction in births 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.

After a five-month bust in conceptions between January and May 2020, conceptions rebounded from June to December 2020. The "excess conceptions" across those seven months total around 51,000, largely offsetting the baby bust that occurred from reduced conceptions in the early months of 2020.

Why might birth rates have recovered so quickly? One reason is that the unemployment rate had fallen from a high of 14.7 percent in April 2020 to 6.9 percent by October. This can be seen in the unemployment rate series also plotted in Figure 1. Another possible reason is that the number of daily cases and deaths attributed to COVID nationally had just fallen following a summer surge and preceded the massive winter spike to come. And finally, the vast amounts of government assistance transferred to individuals and households in the summer of 2020 meant household balance sheets were strong. Our analysis below of state level factors that correlate with the size of a state's busts and recoveries shed more light on the likely effects of these factors.

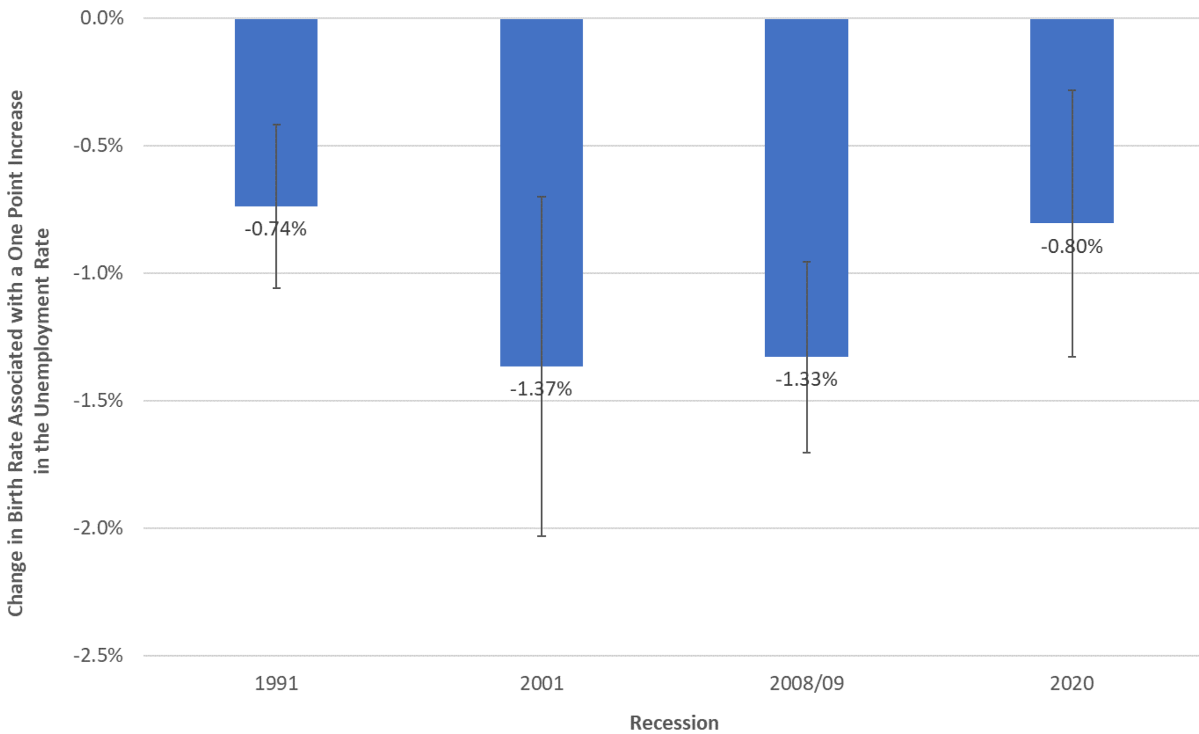
Was the Cyclical Sensitivity of Births to Labor Market Conditions Different During COVID?

We estimate the relationship between births and the unemployment rate, separately for the COVID recession and each of the three preceding recessions: 1991, 2001, and 2008/09. We are interested in seeing whether the relationship in the COVID era is statistically smaller than in previous recessions. For the 1991, 2001, and 2008/09 recessions, we estimate annual, state-level birth rates (dated by likely month of conception) for the three years before and after each recession: 1988-1994, 1998-2004, and 2005-2012. We then estimate regression models relating these birth rates to annual, state-level unemployment rates, along with state and year fixed effects. The coefficient on the unemployment rate provides an estimate of the cyclical sensitivity of births to labor market conditions in each of these recessions. For the COVID period, we do not have post-recession data, so we instead use data from 2017-2020.

The results of this analysis suggest that the responsiveness of births to the unemployment rate was similar in each of these recessions, including the COVID recession. Around the Great Recession, a one percentage point increase in the unemployment rate is associated with a 1.3 percent reduction in the birth rate, as estimated at the state level. The cyclical responsiveness of births was similar in the 2001 recession. For the 1991 and COVID recessions, the point estimate of the cyclical sensitivity is smaller, but the associated standard errors are sufficiently large that the estimates are not statistically different from one another across recessions. The finding of a sizable, robust negative link between the unemployment rate and the birth rate during the rebound period of June 2020-December 2020 suggests that the shortened recession period is likely an important contributor to the small magnitude of the baby bust.[7]

[7] The rapid recovery of the recession seems to have been at least partially accomplished through massive government spending, cf. Bhutta, et al., 2020, and Scheiner, et al., 2021.

Figure 2: Cyclical Responsiveness of Births to Recessions



Source and Notes: Authors' calculations based on annual, state-level birth rates (dated by month of conception) in the three years before and after the recession. No post-recession data is available for the 2020 recession.

State Level Evidence on the Magnitude of the COVID Baby Bust and Rebound

In this section analyze monthly birth patterns at the state level. We calculate a predicted number of births in each month of 2020 at the state level, using the same methodology used in our analysis of national birth data above, but now based on aggregate birth counts at the state/month level. Predicted births are calculated statistically accounting for pre-existing state-level linear trends and seasonal (monthly) variation in birth rates. We calculate the size of the baby bust by totaling up the difference in actual and predicted births between January and May of 2020. We calculate the magnitude of the rebound by totaling up the difference in actual and predicted births between June and December of 2020. We conduct this exercise 51 times (one for each state and the District of Columbia) to obtain state-level estimates.

In this state-level analysis we take an additional step to scale the size of both the COVID baby bust and rebound by the number of births in the state in January through May of 2019. This scaling facilitates a comparison across states, adjusting for differences in baseline birth counts, which will obviously differ greatly across states with different population counts.

Table 1 provides bust and rebound estimates for the 10 most populous states, which are more statistically reliable. Note that we report the absolute value of the size of the bust for expositional expediency; for example, a bust of 62,000 means that births fell by 62,000. The largest baby bust in percentage terms was in New York, where the birth deficit was 7.7 percent relative to the January through May 2019 birth count. This corresponds to a bust of 7,000 births that would have been conceived between January and May of 2020 in New York, which was the epicenter of the pandemic at its outset. The birth rebound in New York amounts to under 3,000 additional births, representing 40 percent of the reduction in births conceived earlier in the year. This is lower than the national average, where the birth rebound of 51,000 is 83 percent of the baby bust of 62,000. The largest absolute baby bust occurred in California – 9,200 births – which is 5.1 percent of the state's January through May 2019 birth count. California also had significant, early COVID exposure and is the state with the most births overall. The rebound in California offset more than half of the state's earlier bust.

Table 1: Size of COVID-19 Baby Bust and Rebound in the 10 Highest Birth States and in the United States

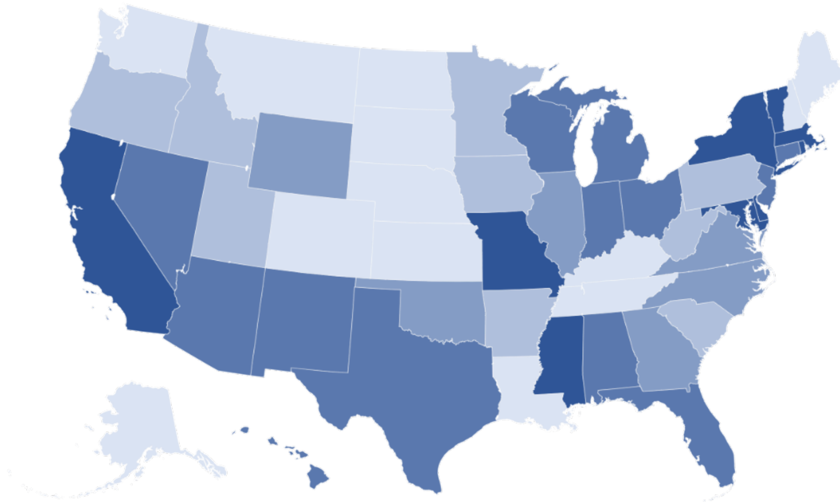
state	Baseline Births	Baby Bust	Baby Bust Rebound	Bust as % of Baseline Births	Rebound as % of Baseline Births
New York	89,399	6,879	2,755	7.7%	3.1%
California	181,004	9,207	5,808	5.1%	3.2%
Michigan	43,013	2,070	1,360	4.8%	3.2%
Florida	91,650	4,196	4,100	4.6%	4.5%
Ohio	53,917	2,252	279	4.2%	0.5%
Texas	156,243	6,429	4,014	4.1%	2.6%
Illinois	55,626	1,938	2,043	3.5%	3.7%
Georgia	51,956	1,820	1,618	3.5%	3.1%
North Carolina	48,573	1,602	1,937	3.3%	4.0%
Pennsylvania	53,812	1,396	1,675	2.6%	3.1%
United States	1,519,307	60,990	50,746	4.0%	3.3%

Notes: Column definitions are as follows: Baseline = births conceived between January and May of 2019; Bust = the estimated missing number of births conceived between January and May of 2020 (note: positive values reflect declines in births); Rebound = the estimated number of surplus births conceived between June and December of 2020.
Source: Authors' calculations based on CDC birth data for births conceived between January 2016 and December 2020 (births between October 2016 and September 2021).

Figure 3 displays the relative magnitude of the changes in births during the bust period (Map A) and rebound period (Map B) of 2020. Many of the states that experienced larger relative baby busts were those where the pandemic struck severely and quickly at the outset of the pandemic. The 10 states with the greatest COVID infection rates included New York, New Jersey, Connecticut, Massachusetts, the District of Columbia, Rhode Island, Louisiana, Michigan, Maryland, and Illinois. The baby bust in all those states and D.C. was at or above average except for Louisiana.[8] Missouri stands out as an exception, having a very large baby bust, despite fairly low COVID exposure.

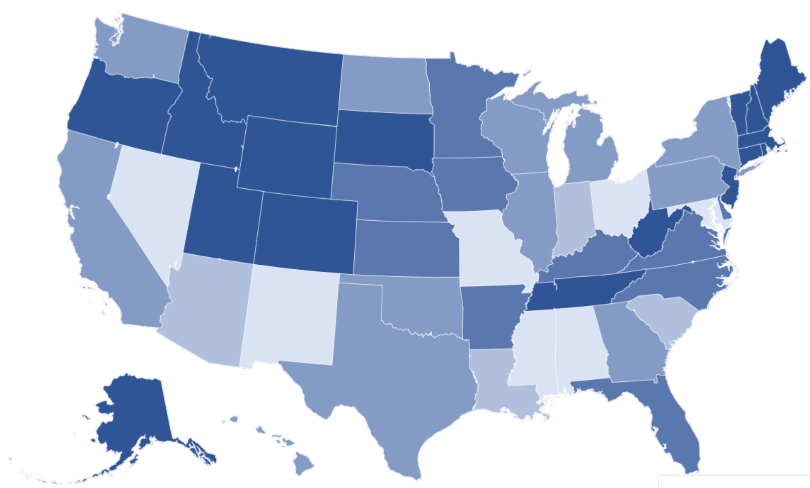
[8]Although DC is not displayed on the map, its bust was 6.2 percent of its baseline number of births.

Figure 3: Size of COVID-19 Baby Bust and Rebound (as Percent of 2019 Births), by State



Map A: Bust (in absolute value)

> 5%　> 4%　> 2.5%　> 1%　< 1%



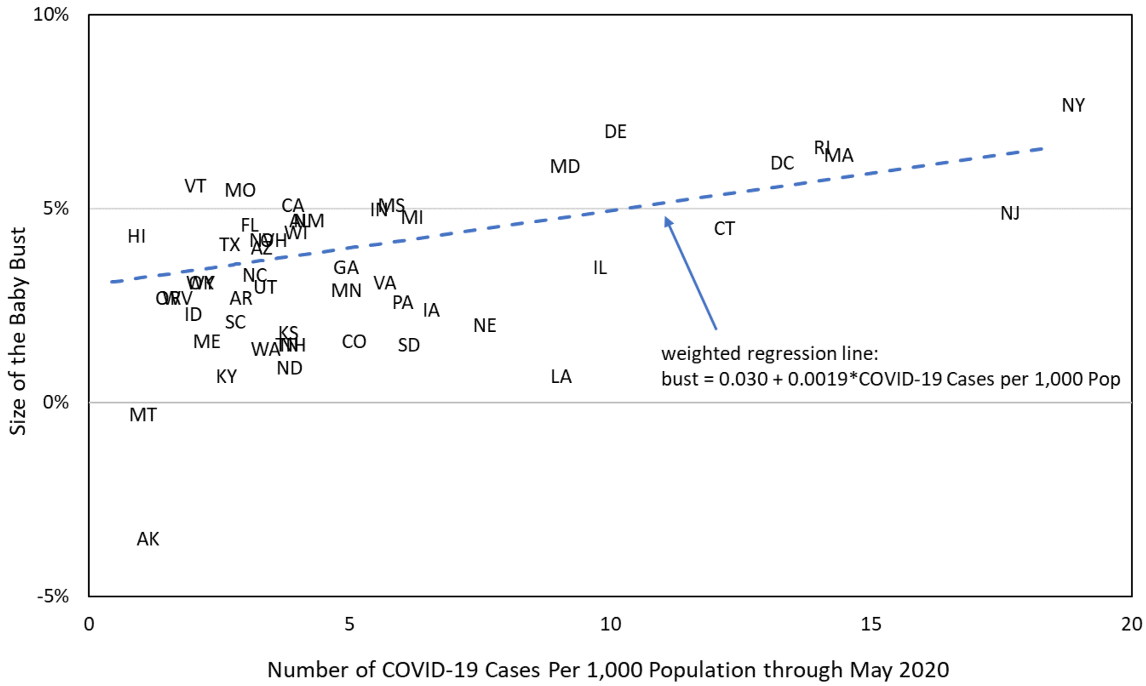
Map B: Rebound

> 5%　> 4%　> 2.5%　> 1%　< 1%

Notes: The relative size of the COVID-19 baby bust (rebound) is measured as the reduction (increase) in births between January and May 2020 (June and December, 2020) relative to a baseline number of births taken from January through May 2019. Each measure is estimated using the state-level analog of the methodology used in the construction of Figure 1.

Figure 4 presents a scatter plot relating the size of the baby bust to the cumulative COVID caseload rates per 1,000 population, calculated based on data available from USAFACTS (2022) through the end of May 2020. There is a clear positive association between a state's cumulative COVID caseload and the extent of the baby bust in the first part of 2020.

Figure 4: COVID-19 Caseload through May 2020 and the Size of the Baby Bust



Note: The size of the baby bust is the absolute value of the birth rate decline (in percentage terms) attributable to COVID-19.
Sources: COVID-19 caseload statistics are from USAFACTS (2022).

Map (b) in Figure 3 shades states by the size of their rebound, in percentage terms scaled by state 2019 birth counts. There is no obvious pattern to be seen in this map relative to the geographical patterns of the baby bust. Many New England states had a sizable bust, and then a sizable rebound. Many states in the Mountain region had small busts, but sizable rebounds. The population-weighted correlation between the size of the bust and the rebound is -0.256. This low correlation suggests that the size of the rebound is not just about delayed births being conceived later in the year.

How State Specific Conditions Relate to the Size of the State Baby Bust and Recovery

In this section, we statistically explore determinants of the size of a state's baby bust and rebound. We begin by estimating ordinary least squares (OLS) regression models to relate the natural log of the birth rate during the baby "bust" period (January 2020 to May 2020) to three explanatory factors, motivated by the conceptual framework described above: the state unemployment rate, state-level COVID cases per capita, and a measure of household spending.[9] These regression models also control for state fixed effects. We subsequently estimate analogous models during the baby "rebound" period (June 2020 to December 2020) to these same three explanatory factors, plus two COVID policy variables – a state-level public mask mandate in place as of July 2020 and a state requirement that schools open in-person for the 2020-21 school year (measured in July 2020).

We hypothesize that births should fall with a higher unemployment rate, a higher rate of COVID cases, and larger declines in household spending. We discussed the relationship between labor market conditions and birth rates above. We additionally expect that a larger COVID caseload would lead to a great reduction in births if the public health crisis affected things like access to health care or general life anxiety (although reduced access to family planning services, particularly for women from lower-income households, might lead to increases in births). A larger decline in household spending might be associated with a larger reduction in births because it would reflect greater financial strain, less confidence in the economic recovery, and/or more restricted activities. The presence of a mask mandate may be linked to fewer births if it

[9] Appendix Table 1 reports the national averages of the birth rate by month of conception along with monthly values of each explanatory variable used here and in the subsequent analysis of the rebound period. These national averages are constructed using the state level data and weighted by the population of women between the ages of 15 to 44 in each state. These data may not exactly match other reported national averages because we are not using total population weights.

reflects greater social anxiety associated with the pandemic. Mandated school opening policies might do the opposite. It is an empirical question as to how much of these relationships are mediated by the others.

In the estimated regressions, each observation is a state-by-month observation (5 months in the bust period, 7 months in the rebound period, and 51 states, including DC, resulting in 255 observations and 357 observations in the two periods, respectively). The regressions are weighted by the 2020 population of women between the ages of 15 and 44 in each state. This enhances the statistical precision of the model and yields a population-level estimate of the relationship between explanatory factors and the change in birth rates.

Data on state unemployment rates come from the U.S. Bureau of Labor Statistics (2022b). Our measure of state-level COVID exposure is cases per thousand population, aggregated between March and May of 2020, obtained from USAFACTS (2022). We use a state-level measure of household spending tracked since the pandemic began by Opportunity Insights (described in Chetty, et al., 2020) in its "Economic Tracker" tool (https://tracktherecovery.org/). These spending data are based on credit- and debit-card spending and reflect changes in spending levels relative to January of 2020 (i.e. the January 2020 value is zero and a value of -0.265 in April indicates that spending was 26.5 percent lower in April than in January).[10] Mask mandate policies effective as of July 2020 are obtained from Harring (2021); data indicating which states had a statewide mandate for K-12 schools to be open in the 2020-2021 academic year, recorded as of July 2020 are reported in EducationWeek (2020).

[10] These data show that national spending plunged in March and April before recovering completely by the end of 2020. Note that these statistics are based on credit and debit-card receipts, which may not accurately reflect all forms of spending.

The top panel of Table 2 reports the results of these state-by-month level regressions for the baby bust period. In Model 1, we see a statistically significant negative relationship between the unemployment rate and birth rate. This is consistent with the well-documented pro-cyclicality of birth rates, discussed above. The estimated coefficient on the unemployment rate suggests that a one percentage point increase in the unemployment rate is associated with a 0.46 percent reduction.[11] The peak unemployment rate during this period across states (weighted by women 15-44, not total population – see Appendix Table 1) was 14.6 percent compared to 3.8 percent in January. The estimated conditional bivariate relationship implies that this increase of 10.8 percentage points in the unemployment rate would lead to about a 5 percent reduction in the birth rate.

Model 2 includes the measure of cumulative reported COVID caseloads per capita. As expected, states with greater COVID exposure during the bust period experienced a greater decline in their birth rates. The coefficient on the unemployment rate is attenuated in this specification, but it maintains statistical significance. The attenuation of the estimated coefficient on the unemployment rate suggests that some of the estimated relationship between the unemployment rate and birth rates in model 1 is capturing the public health effect of the pandemic recession, independent from the labor market conditions.

[11] The coefficient on the unemployment rate in the bust period is likely biased downward for two reasons. First, the difficulty in precisely assigning births to the month of conception introduces measurement error. Births that we have assigned to conceptions in February or perhaps even January may have really been conceived in March. This dating problem is always present in analyses examining the cyclical sensitivity of births, but it is more extreme in instances in which monthly changes in the unemployment rate are as dramatic as those observed in early 2020. Second, the March unemployment rate was measured in the week of the month including the 12th, which really does not capture the devastating labor market impact that took place later that month following the shutdowns.

Table 2: OLS Relationship between State-level Factors and Birth Rates in the COVID-19 Baby Bust and Rebound Periods

(a) Bust Period (January 2020- May 2020)

	Model 1	Model 2	Model 3
Unemployment Rate	-0.464	-0.250	0.011
	(0.066)	(0.070)	(0.088)
Covid Cases per 1,000 population		-1.285	-0.799
		(0.205)	(0.223)
Spending Relative to Jan 2020			20.82
			(4.604)

(b) Rebound Period (June 2020-December 2020)

	Model 1	Model 2	Model 3	Model 4
Unemployment Rate	-1.936	-1.652	-1.033	-1.486
	(0.157)	(0.172)	(0.203)	(0.212)
Covid Cases per 1,000 population		0.137	0.161	0.158
		(0.037)	(0.035)	(0.034)
Spending Relative to Jan 2020			42.105	56.935
			(8.049)	(8.144)
Mask in Public Mandate				-4.454
				(0.956)
Schools Open Mandate				-1.703
				(1.157)

Sources: Author's calculations based on various data sources:
Births: Vital Statistics birth data from US Center for Disease Control
Unemployment Rate: US Bureau of Labor Statistics
COVID Cases per 1,000 population: USAFACTS (2022)
Spending Relative to January 2020: Opportunity Insights, Economic Tracker
Mask Mandates: Harring (2020)
Schools Open Mandate: EducationWeek (2020).
Notes: The dependent variable is measured in natural logs. All regression models include state fixed effects and are weighted by the 2020 population of women between the ages of 15 and 44. All coefficients are multiplied by 100.

Model 3 additionally includes the measure of household spending. The estimated coefficient on this spending measure indicates a statistically significant, economically important positive relationship between household spending and birth rates. Furthermore, the estimated effect of the unemployment rate is greatly attenuated in this model and is no longer statistically significant. We interpret this pattern as suggestive evidence that the link between aggregate economic conditions and birth rates is driven by reduced household income or expected income and the larger the reduction in household spending/income in a state, the larger their baby bust.[12]

Table 2 panel (b) reports the estimated coefficients from analogous OLS models estimated during the rebound period. The estimated relationship between the unemployment rate and birth rates is much larger during the rebound period than during the bust period. In all four models, the estimated relationship between the unemployment rate and the birth rate is negative and strongly statistically significant. The exact coefficients are larger in the rebound period than in the bust period. This suggests that the recovery of the unemployment rate during the second part of 2020 was a meaningful contributor to the rapid turnaround of the COVID baby bust. The weighted average unemployment rate across state observations fell from 11.2 to 6.5 between May and December, or 4.7 points lower. Based on the coefficient in model 4, this would have led to a 7 percent increase in births.

The relationship between COVID caseloads and birth rates was very different in the rebound period than it was during the bust period. The coefficient estimates are still negative and significant, but orders of magnitude smaller (10 to 1 in some specifications) in the rebound period than in the bust period. We interpret this as suggesting that the public health concerns around COVID caseloads at the beginning of 2020, which led to an immediate reduction in birth rates, were generally not maintained in the latter part of the year. Perhaps people were willing to delay their childbearing intentions for a few months, but after that, they become resigned to

[12] A working paper by Dettling and Kearney (2022) tests this relationship directly by examining the mitigating effect of unemployment insurance replacement rates on the link between unemployment rates and birth rates during the period 2000-2019. They similarly find that the negative effect of aggregate unemployment rates on fertility is driven by individual income loss, not temporal substitution of birth timing (as some life-time models of fertility posit.)

living among COVID and no longer responded to case counts by further delaying or averting their childbearing intentions.

Model 3 adds our measure of household spending. Similar to the finding from the bust period, household spending is positively and statistically significantly related to birth rates. As was the case for Model 3 in the bust period, including spending in this model again attenuates the impact of the unemployment rate, albeit not completely. Model 4 yields a negative point estimate on the state mask mandate policy. This is consistent with the conjecture that places with a state-wide mask mandate tended to have more public anxiety and social restrictions around COVID which we hypothesized would be associated with a smaller birth rebound. The estimated effect of the school opening mandate is not statistically significant.

Conclusion

The onset of the COVID pandemic in early 2020 brought about an immediate, sizable drop in conception rates in the U.S., which was largely reversed later in the year. Consistent with past theory and evidence, changes in economic conditions played an important role in these fluctuations. Our empirical analyses finds that the initial recession, along with a substantial drop in household spending, statistically explains the baby bust. The link between household spending and birth rates makes sense according to economic models of birth rates, as the household spending measure proxies for a household's income level and expectations about their economic situation. During the pandemic, it also captures the extent of consumer activity since the spending measure captures spending on both goods and services. Our empirical analysis further suggests that the rapid recovery of the labor market, along with a revival of household spending (driven in part by an unprecedented multitrillion-dollar government policy response that bolstered household balance sheets) statistically explains the rapid rebound in birth rates.

Early in the pandemic, states with relatively large COVID caseloads experienced the largest relative declines in births. Our empirical analysis finds that by the summer of 2020 and the remainder of that year, that relationship was much weaker. One possible explanation is that the psychology of the pandemic shifted over time. Perhaps people were less anxious after COVID had been circulating for a number of months and more open to getting pregnant then, despite caseload counts. The fact that states which instituted mask mandates had a smaller rebound in births suggests that those locations where COVID anxiety was still greatest continued to experience lower birth rates.

Looking beyond the analyses of this paper, we note that the size of the COVID baby bust as observed through September 2021 pales in comparison to the longer-term decline in US births (Kearney, Levine, and Pardue, 2022). Births have fallen by 20 percent over the last 15 years and show no signs of reversing. Births in the U.S. have now fallen well below replacement levels, a situation that has existed in other developed countries for the past few decades. Such low levels of fertility will affect economic growth, the solvency of public retirement systems, and other economic and social outcomes going forward. The attention that the potentially large COVID baby bust has garnered should be refocused on that more consequential, long-term decline.

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Appendix Table 1: National Trends in Births and Other Factors, by Month of Conception in 2020

2020 Month of Conception	Birth Rate	Unemploy-ment Rate	COVID Cases per 1,000 Pop.	Spending Relative to January	Percent with Mask Mandate (7/2020)	Percent with School-Open Mandate (7/2020)
1	5.22	3.8	0.0	0.5%		
2	4.83	4.1	0.0	-0.6%		
3	4.96	14.6	0.6	-10.8%		
4	4.73	13.0	2.6	-26.5%		
5	4.55	11.2	2.2	-15.3%		
6	5.17	10.2	2.7	-9.4%		
7	5.01	8.7	5.9	-7.0%	67.9%	38.3%
8	5.14	7.9	4.2	-4.9%	67.9%	38.3%
9	5.36	7.2	3.6	-3.4%	67.9%	38.3%
10	5.57	6.9	5.6	-2.4%	67.9%	38.3%
11	5.63	6.8	13.5	-3.6%	67.9%	38.3%
12	5.54	6.5	19.4	-3.2%	67.9%	38.3%
Total	5.14	8.4	5.0	-7.2%	67.9%	38.3%

Notes: all estimates reflect national means from state-level data weighted by the size of the female population between the ages of 15 and 44 (the appropriate weight for the birth rate). They may not exactly match national means weighted by the size of the full population.