The Great Recession's Baby-less Recovery: The Role of Unintended Births

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Abstract

The U.S. experienced an expected fertility decline during the Great Recession, but fertility continued to fall throughout the recovery period, reaching historic lows by 2019. The drop in fertility was more acute among young women and unmarried women, whose births are more likely to be unintended. In this paper, we use a combined-survey estimation strategy that exploits the relative strengths of the National Survey of Family Growth and the Natality Detail Files to estimate birth intention consistently over time. We find that between 2007 and 2019 intended births fell by just 8.5% while unintended births fell by 22%. We show that this decline in unintended births can largely be explained by changes in the demographic characteristics of women of childbearing age, reductions in sexual activity, and shifts to more effective methods of contraception.

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Data Availability Statement: Upon publication, all code used to produce this paper will be made available on the ICPSR's data repository. The NSFG data are public-use, so we will make these data available in the same location. The Natality Detail Files with geographic information used in this paper are restricted-use after 2004, so we will provide researchers with instructions for applying for access to the data from the National Center for Health Statistics.

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I. Introduction

The Great Recession that began in late 2007 was associated with a large decrease in fertility. This was not unexpected, as a great deal of research has shown fertility to be pro-cyclical over the business cycle.[1] What is surprising is that the United States (U.S.) birth rate continued to decline as the economy recovered, with birth rates falling an additional twelve percent between the end of the recession in 2009 and 2019 (see Figure 1). Today the U.S. birth rate is at an historic low; data for 2020 show a birth rate of 56 births per 1,000 women aged 15-44, and a total fertility rate of 1.641 births per woman—well below replacement rate (Osterman, et al. 2022).[2] This downward fertility trend has received significant attention in the popular press, with articles trying to understand both the underlying causes of this "baby-less" recovery and the implications for policy and economic growth (e.g. Belluz 2018; The Economist 2018; Emba 2018; Howard 2019; Miller 2018).

However, these aggregate trends in fertility mask substantial heterogeneity across different demographic groups. For example, the decline in birth rates between 2007 and 2019 was driven by women under age thirty; for women over thirty, birth rates actually increased over this period. Looking back further, birth rates for women over thirty have been steadily increasing since at least 1980, while the rate for younger women (and especially teens) peaked in the early 1990s. Trends in birth rates also differ by marital status; from 1980 to 2007, rates for married and unmarried women converged as the nonmarital childbearing rate rose. Since then, the rate for unmarried women has fallen by 27%, while that for married women has fluctuated but stayed near its 2007 level.[3] Importantly, these two groups—young women and unmarried women—are the groups that have historically been most likely to have *unintended* births. Definitions of intendedness vary, but generally a birth is considered to be unintended if either the pregnancy was unwanted or it occurred earlier than the mother would have liked.

Changes in unintended births over time could have significant policy implications. Over two-thirds of unintended births in 2010 were paid for by public insurance programs, costing the

[1] See Sobotka, Skirbekk, and Philipov (2011) for a review of this literature.
[2] The total fertility rate (TFR) "estimates the number of births that a hypothetical group of 1,000 women would have over their lifetimes, based on the age-specific birth rate in a given year" (Osterman, et al. 2022, p. 4).
[3] For detailed depictions of trends for different groups going back to 1980, see Buckles, Guldi, and Schmidt (2019).

government over $21 billion in that year (Sonfield & Kost 2015). Unwanted and mistimed births are associated with worse child health and development outcomes (Hummer et al. 2004; Lin et al. 2018), including lower levels of prenatal care, low birth weight, and costly complications (Kost & Lindberg 2015; Mohllajee et al. 2007). So, while a falling fertility rate presents challenges for (for example) the solvency of public pension programs,[4] there may be cost savings if the decline is coming from unintended births. Policy makers who are concerned about fertility declines may therefore want to focus on strategies for increasing *intended* births.

Furthermore, unintended births reflect barriers to women's ability to effectively plan their lives—barriers that might include a lack of information or access to reproductive care and contraception. Claudia Goldin and Larry Katz's (2002) seminal study on the effects of access to the birth control pill for young women in the late 1960s showed that women who did not have this access invested less in their careers, as they faced greater uncertainty about their fertility. More recently, research from the Turnaway Study, which offers some of the best causal evidence on unintended births, has shown that women turned away from abortion clinics experience worse physical and mental health as well as worse economic outcomes compared to women who received abortions (see, for example, Biggs et al. 2017; Foster et al. 2019; Gerdts et al. 2016; Miller et al. 2020; Ralph et al. 2019).[5] Reducing barriers to family planning and increasing the share of births that are intended are likely to improve maternal and family well-being, and are among the Office of Disease Prevention and Health Promotion's Healthy People 2030 objectives.[6]

In this paper, we document changes in unintended and intended births in the U.S. since 1989, with an emphasis on the period following the Great Recession. We begin by documenting heterogeneity in fertility trends across demographic groups, using data from the National Center

[4] As fertility drops, there will be fewer working age individuals to support the dependent population, which leads to quicker depletion of the Social Security Trust Fund. Nearly all of the increase in projected Social Security program costs from 2010 to 2030 is due to the increasing aged dependency ratio (Goss 2010). The recent fertility declines would put further strain on the system.

[5] Identification in these studies comes from comparing women who were denied abortions due to a gestational age just above the legal limit to those near but below the limit who were allowed to obtain abortions.

[6] https://health.gov/healthypeople/objectives-and-data/browse-objectives/family-planning

for Health Statistics' (NCHS) Natality Detail Files.[7] These data represent the near-universe of births in the U.S., but unfortunately do not include information about pregnancy or birth intention. A number of studies have used another NCHS data set, the National Survey of Family Growth (NSFG), to estimate trends in unintended pregnancies and births (for example, Mosher et al. 2012; Finer & Zolna 2011, 2014, 2016), but there are a number of reasons why these data are poorly suited for constructing consistent trends over time. In fact, the 2013-2015 NSFG User's Guide cautions users against "interpreting estimates from combined data files because the NSFG has not been conducted with a continuous nor annual survey design that would permit valid estimation and inference for the full span of years" (p. 7). We discuss these issues in more detail in Section III, and illustrate the difficulties of using the NSFG to create trends in even well-measured concepts such as average age and marital status of mothers giving birth.

Given these limitations, we use a combined-survey estimation strategy that takes advantage of the relative strengths of both the NSFG and the Natality Detail Files. Because the NSFG has excellent measures of birth intention, we use it to construct a model that predicts whether each birth in the Natality Detail Files (a census of births) was likely to have been unintended. The method we develop allows us to generate consistent annual estimates of the proportion of the roughly four million births in the U.S. that are unintended each year, and to provide specific estimates of both levels and changes over time. Because most other countries' birth registries also lack information on pregnancy intention, our method will likely be useful for researchers studying fertility in other contexts as well.

We focus our analysis on the period following the start of the Great Recession. Between 2007 and 2019, the number of births fell by 13.1%. Results from our preferred specification suggest that intended births fell by 8.5% while unintended births fell by 22.0%. Our estimates for the decline in unintended births are robust across many specification choices, including using alternative measures of unintended births or different NSFG cycles for the prediction model. The 22% decline between these two years translates to nearly 323,000 fewer unintended births, or 57% of the total fertility decline. Importantly, our results show that while both unintended and intended births fell during the Great Recession, unintended births continued to fall throughout

[7] The Natality Detail Files provide information obtained from each birth certificate issued in the United States. There is some variation across states and over time in the information that is available from the birth certificates; we discuss this below where it is relevant.

the recovery while intended births actually rebounded, at least until 2016. The baby-less recovery from the Great Recession has puzzled social scientists; our findings show that it was not baby-less for women who were likely to have *intended* births.

In Section V, we use the framework of Levine's (2001) "fertility decision tree" to explore *why* unintended births fell during this period. The tree begins with the choice of whether or not to have sexual intercourse and ends with a birth or no birth (including the decision to avert a birth using an abortion). Using data from the NSFG to explore mechanisms, we show that the decline cannot be explained by changes in fertility intentions or abortions. Rather, three factors seem to be driving the reduction in unintended births: changes in the composition of women of childbearing age, reductions in sexual activity, and large shifts towards the use of more effective methods of contraception. The latter is driven by increases in the use of long-acting reversible contraceptive methods (LARCs) among young women. These three factors can explain almost all of the decrease in unintended births for women with a high probability of this outcome between the 2006-10 and 2017-19 waves of the NSFG, with reductions in sexual frequency playing the largest role.

II. Trends in Fertility

Between 1900 and 2020, the U.S. general fertility rate fell by more than half (130 to 56 births per 1000 women aged 15 to 44). This decline has been non-monotonic; the rate fell to 76.3 in 1933 before rising to 122.9 in 1957 during the peak of the baby boom.[8] Figure 1 shows that fertility reached a peak in 1990 and again in 2007; the post-2007 decline has produced a total fertility rate that is at its lowest recorded level and well below replacement level.

As discussed in the introduction, these aggregate trends in fertility conceal big differences in how fertility is changing for women with different characteristics. An important

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[8] An extensive literature explores the root causes of the baby boom and subsequent bust (see Bailey, et al. 2014, and Bailey & Hershbein 2018 for reviews). Literature examining the post-1960 decline has suggested that the birth control pill (approved by the FDA for use as a contraceptive in 1960) and legal access to abortion (beginning in 1969) are key drivers of the post-1960 decline in births (Bailey 2006; Bailey 2010; Bailey et al. 2013 a,b; Goldin and Katz 2002; Guldi 2008; Levine et al. 1999; Myers 2017). Changes in medical technology (Albanesi and Olivetti 2014) and the Vietnam War (Bitler & Schmidt 2012) also played a role in declining birth rates over the 1960s. Since the early 1970s, the decline has been smoother and comparatively flat (Bailey et al. 2014).

example is age. There has been a widely-documented decline in the birth rate for teenagers in the U.S. since the early 1990s, which has been attributed to a variety of supply and demand factors including but not limited to: reduced sexual activity (Boonstra 2014); increased and more effective use of contraceptives (Boonstra 2014) either due to affordability via Medicaid (Kearney & Levine 2009, 2015a) or to access to more reliable long-acting and reversible methods of contraception like IUDs (Kelly et al. 2020, Lindo & Packham 2017); and the effect of new media (targeted television programming, social media, and the Internet) on teen fertility choices (Guldi & Herbst 2017; Kearney & Levine 2015b; Trudeau 2016).[9]

The decline in the fertility of younger women is evident in Figure 2A, which reports birth rates by five-year age groups from 1989 to 2019. To construct these rates, we use the Natality Detail Files from each year to construct the numerator, and age- and sex-specific population counts from the National Cancer Institute's Surveillance, Epidemiology, and End Results data (SEER) to construct the denominator. The teen birth rate fell from a peak of around 62 births per 1,000 women age 15 to 19 in 1991, to around 17 in 2019, for a remarkable 73% decline. The birth rate for women 20 to 24 also declined over this same period, with the decline accelerating in 2008. While this group had one of the highest birth rates through the mid-1990s, it now has a rate that is well below that for women 25 to 29 and even 30 to 34. Conversely, birth rates for women over 30 have increased since 1989, aided by delayed age at first marriage and first birth and infertility treatments that have facilitated births at later ages (Buckles 2007; Matthews & Hamilton 2009, 2016; Schmidt 2007; U.S. Census Bureau 2018). These shifts in births by age have accelerated post-2007: teen birth rates have dropped by 60% since that year. Furthermore, since 2016, women age 30 to 34 have been the group with the highest birth rate in the U.S.[10]

There have also been significant changes in the marital status of women giving birth from 1989 to 2019, as shown in Figure 2B.[11] The birth rate for married women fell throughout the

[9] While the literature primarily examines the effects of these factors on teen birth rates, many of them may also have affected fertility choices of older women. For example, Kearney and Levine (2009) show that the likelihood of birth declines for both teens and older women when access to publicly funded contraception increases.

[10] Although women 30 to 34 have had the highest birth rates since 2016, their birth rates, along with most other age groups, have been decreasing since that year as well, a point we return to in the conclusion.

[11] For these calculations, we use population estimates by marital status from the Current Population Survey Annual Social and Economic Supplement in the denominator (Flood et al.,

early 1990s, while that for unmarried women rose, so that by 1994 approximately one-third of births were to an unmarried mother (see also Curtin et al. 2014). The nonmarital rate stabilized for a few years after that, but began to increase again in the mid-2000s, reaching a peak in 2007. Since then, the nonmarital rate has declined steadily from 55 to 40 births per 1,000 unmarried women, while birth rates for married women have fluctuated between 84 and 91.

In Figure 2C, we show birth rates by the race and ethnicity of the mother. This figure points to a potentially important contributor to the fall in the U.S. birth rate—the decline in births among Hispanic women. Birth rates for this group fell by a third between 2007 and 2019, from 82 to 55 births per 1,000 women. Also apparent from this figure is that while births to Hispanic women are still higher than other race/ethnicity groups, they appear to be converging to these other groups in recent years. Cuellar (2020) documents changes for Hispanic births and suggests worsening economic conditions, changing immigration patterns, and shifts in birth intention could be driving these trends. In our analysis, we will examine the extent to which the demographic patterns in Figure 2 drive changes in our estimates of unintended births.

III. Unintended Births

The fact that birth rates for young and unmarried women have fallen since 2007 in the U.S. suggests that unintended births are also likely falling, as these women have historically been most likely to experience unintended pregnancies (Finer & Zolna 2014; Kost & Lindberg 2015). Indeed, Finer and Zolna (2016) identified a decrease in the unintended pregnancy rate between 2008 and 2011, driven by declines among young and poor women. They report that this was the first "substantial decline" since 1981. This decrease is also documented in Finer et al. (2018), using the same data but a prospective instead of retrospective measure of unintended pregnancies.

These studies rely on data from the NSFG, which provides carefully crafted questions about pregnancy wantedness and timing.[12] However, the NSFG is poorly suited for analyzing

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2021). We are not able to use the Natality Detail Files to calculate birth rates by marital status after 2016 because California no longer reports this information after 2016 due to statutory restrictions; for those years we use birth rates from the NCHS births data for 2019 (Martin et al., 2019; Martin et al., 2021).

[12] The NSFG underreports abortions, so Finer and Zolna (2014) and Finer and Zolna (2016) supplement the NSFG data with data from the Guttmancher Institute's periodic census of

detailed trends in these outcomes for a number of reasons. First, the sample size of pregnancies that result in live births is small, and fluctuates greatly across waves. For example, the data include 1,303 births for 2011-12 but only 461 for 2003-04. Second, dividing the responses from NSFG cycles into years for an annual-level analysis is not recommended; the NSFG documentation's answer to an FAQ asking "Can I analyze the data for just one year, or just one quarter?" is an unequivocal "No."[13] Third, questions about pregnancy intentions are asked retrospectively for the births in our sample, which may introduce recall bias in responses (Rosenzweig & Wolpin 1993). Since NSFG cycles are administered at irregular intervals as many as four years apart, the degree of this bias may not be constant over time. Finally, while we use standard weighting procedures described in the 2013-2015 NSFG User's Guide[14] to attempt to create a sample that is representative of the U.S. population over time, the guide itself cautions against using the NSFG for this purpose, as we note in the introduction.

To demonstrate the severity of these issues, we create trends for characteristics that are observable in both the NSFG and in the Natality Detail Files. The latter contain nearly 100% of births in the U.S., so we treat the statistics obtained from them as the true population values. Figure 3 shows that even for well-measured characteristics like age at birth (Panel A) and marital status (Panel B), the NSFG trends show much more variability than those from the Natality data. Even more problematic are inflection points implied by the NSFG data that do not correspond to inflection points in the true population values, which would lead to incorrect conclusions about the trends in those characteristics. In Figure 3C, we present trends in five different measures of unintended births from the NSFG (we discuss these different measures in more detail below). Across these measures, unintendedness appears to be decreasing until 2003-04, then rising in 2005-06, falling through 2013-14, and finally rising again by 2017-19. But given the appearance of inflection points in characteristics shown to be trending smoothly in Panels A and B, it is difficult to have confidence in the trends in unintendedness presented in Panel C.

To address these issues and create reliable trends in unintended births over time, we use a combined-survey estimation strategy that takes advantage of the relative strengths of both the

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abortion providers. These data are collected approximately once every six years (Finer et al. 2018).

[13] https://www.cdc.gov/nchs/data/nsfg/NSFG_2015-2017_UG_App6_FAQ.pdf

[14] Available at https://www.cdc.gov/nchs/data/nsfg/NSFG_2013-2015_UG_App2_ FileManipulations_rev.pdf

NSFG and the Natality Detail Files. We begin by estimating a model of unintended births in the NSFG for a specific cycle, using variables common to the NSFG and Natality data. We then use the coefficients from this model to predict the fraction and number of births in the Natality data that are likely unintended, based on the characteristics of mothers in that year.

Measures of intendedness vary with the survey used, whether the focus is solely on pregnancy intention or also birth intention, and whether the measure incorporates information about intended timing.[15] Guzzo (2017a), following earlier work by Pulley et al. (2002), uses questions on pregnancy wantedness and timing from the NSFG to classify births as 1) unwanted (individual did not want any births or any additional births); 2) seriously mistimed (wanted but occurring more than two years earlier than desired); 3) slightly mistimed (wanted but occurring less than two years earlier than desired); and 4) wanted and on-time. Guzzo et al. (2018) show that the two-year cutoff is a meaningful threshold for defining pregnancy intention.

For our primary analysis, we focus on unintended births, not pregnancies, and construct a measure of unintended births that is similar in spirit to that used in Pulley et al. (2002) and Guzzo (2017a) that combines responses to two questions in the NSFG Pregnancy Files. The first asks women, "if you had to rate how much you wanted or didn't want a pregnancy right before you got pregnant that time, how would you rate yourself?" Respondents are asked to use a 0 to 10 scale, where zero indicates that the woman wanted to avoid the pregnancy and 10 indicates that she wanted to get pregnant. We classify a birth as unwanted if the response was below five. The NSFG also asks whether the birth occurred sooner than the woman intended, and if so, by how much. We define a birth as mistimed if the woman says that it was wanted but was too soon by two years or more. For our main measure of birth intention, we classify a birth as unintended

[15] Rosenzweig and Wolpin (1993) find a great deal of ex-post rationalization in self-reports of wantedness based on post-birth outcomes. Campbell and Mosher (2000) and Klerman (2000) provide more historical background on measures of intendedness and the work looking into measurement issues; see also Mosher et al. (2012). In addition to Rosenzweig and Wolpin (1993), who use the 1979 National Longitudinal Survey, several authors have leveraged the same data (Joyce, Kaestner, and Korenman, 2000), the NSFG (Poole et al., 2000), and the National Longitudinal Survey of Adolescent Health (Guzzo and Hayford, 2014) and come to the same broad conclusion that reported pregnancy (birth) intention can change (from intended to unintended or vice versa). However, since individuals appear to change reported intention in both directions, and this does not appear to be related to other factors (beyond those we control for in our model), we do not think that the potential bias on our predicted measure of intendedness is a large concern in our analysis.

if it is *either* unwanted or mistimed; nearly 36% of births in our sample in 2005-06 were unintended by this definition.[16,17] We examine robustness to alternative measures, including looking separately at unwanted and mistimed births, as well as indicators for whether the mother was not trying to get pregnant, and whether she reported being unhappy to be pregnant. All four alternative measures are highly correlated with our primary measure of intention, with correlation coefficients of 0.88, 0.69, 0.67, and 0.58, respectively.

We use the NSFG to construct a model of pregnancy intention that we can use to predict the fraction of births in the Natality Detail Files that are likely to be unintended. We estimate the following model:

$$Unintended_i = \alpha + X_i \beta + \varepsilon_i \qquad (1)$$

$Unintended_i$ is a binary variable indicating that birth *i* was unintended using our preferred measure as defined above. X_i is a vector of the maternal characteristics that are common to both the NSFG and the Natality Detail Files: age, marital status, race and ethnicity, parity (birth order), and residence in a metropolitan area.[18] Previous work has shown that these characteristics are associated with pregnancy intention (Guzzo 2017b; Hayford and Guzzo 2016; Pulley et al. 2002). Our objective is to maximize the predictive power of our model, so the regression includes single-year-of-age dummies; separate dummies for each parity from one to nine-plus; four mutually exclusive race/ethnicity dummies (white non-Hispanic, Black non-Hispanic, Hispanic, and other); an indicator for being married at the time of the birth; an indicator for the mother living in a metropolitan area, and pairwise interactions of all of these variables. There are 233 independent variables in this model. We estimate the model separately for six NSFG cycles: 2002, 2006-2010, 2011-2013, 2013-2015, 2015-17 and 2017-19.

[16] This is very similar to the share of unintended births reported by Mosher et al. (2012). They use a slightly different sample constructed using the 2006-2010 NSFG and report that 37% of births are unintended.
[17] All analysis uses the NSFG final weights to produce a sample that is more representative of the U.S. population.
[18] We are not able to include maternal education as a covariate because the implementation of the standard birth certificate in 2003, and states' gradual adoption of it through 2016, mean that education is not measured consistently over our time period. This can be seen in Appendix Table 1 of Buckles, Guldi, and Schmidt (2019). We discuss potential implications of the birth certificate revision for race and ethnicity below.

We use the coefficients from the fully interacted model to predict the fraction of births that were unintended in each year, given the average characteristics of women giving birth that year (their *X*'s). This approach is similar to that developed by Baicker, Buckles, and Chandra (2006) to create a predicted probability of Caesarean birth, and used in Buckles and Guldi (2017) to understand the contribution of demographic changes to trends in preterm birth. For our preferred specification, we use the 2002 NSFG Cycle to estimate equation (1) and treat 2002 as our "base year." This combined-survey strategy captures the changes in UIB that are implied by changes in the demographic characteristics of mothers, keeping the "returns" to those characteristics constant. But, if the returns (the relationship between characteristics and the probability the birth is unintended) are changing over time, our estimates of UIB will be sensitive to the choice of the base year. To account for this, we test the robustness of our results to alternative choices of the base year. We also explore the sensitivity of our results to alternative measures of UIB, and to the use of a probit model rather than a linear probability model.

IV. Results

We begin by examining the relationship between maternal characteristics and unintendedness from the model of pregnancy intention, and how this relationship varies by survey year. To simplify the discussion we use a more parsimonious version of equation (1), with three mutually exclusive age group dummies (15-19, 20-29, over 30 (omitted)); an indicator for being unmarried at the time of the birth; our four mutually exclusive race/ethnicity dummies (white non-Hispanic omitted); a continuous measure of parity; and an indicator for residence in a metropolitan area. Table 1 provides these estimates. Each column presents the coefficients from a different cycle of NSFG data.

Conditional on the other variables in the model, the characteristics that most strongly predict that a birth was unintended across the six cycles are being a teenager and being unmarried at birth. For example, in 2002, women who were teenagers at the time of the birth were 39 percentage points more likely than women over 29 to say that the birth was unintended, ceteris paribus. Other characteristics that are consistently associated with an unintended birth are births at age 20 to 29, higher parity, and Black non-Hispanic race/ethnicity. The estimates are qualitatively similar across NSFG cycles, though the point estimates fluctuate for some of the independent variables, emphasizing the need to explore the sensitivity of the results to alternative choices for the base year. The R-squared values for the first five models range between 0.19 and 0.20, indicating that even a simple model can explain a substantial amount of the variation in birth intention. For the 2017-19 cycle, the R-squared is lower at 0.11, but the R-squared for the fully specified model in 2017-19 is comparable to that for other years (see Appendix Table 3).

For our main results in Figure 4, we use the fully-interacted model described in Section III and the characteristics in the NSFG to predict intendedness in the Natality Detail Files.[19] Figure 4A shows how the predicted proportion of births that are unintended (PPU) using this model evolved between 1989 and 2019. Because California (which accounts for about 12% of U.S. births each year) no longer includes marital status in its births data after 2016, predictions for these years take the fraction of nonmarital births in California from the NCHS reports referenced above, and interacted variables are assumed to have the same value that they had in 2016. The predictions for these years are represented as points disconnected from the main series to indicate that they are calculated in a modified way, and we refer this as our modified calculation.

We observe three distinct periods. First, the PPU was stable through the 1990s, at just under 33%. Second, the PPU declined a bit before beginning to increase again in 2004, reaching a peak in 2008 when we predict that 34% of births were unintended. Third, since 2008, the PPU has declined steadily, reaching 31.0% in 2016 (and 30.4% in 2019, using our modified calculation).

Figure 4A includes a 95% confidence interval for each year's predicted UIB rate.[20] The confidence interval for each prediction is roughly four percentage points wide, and almost all predictions fall within the interval for the other years. However, it is important to keep in mind that all of the uncertainty reflected in the confidence intervals comes from using the NSFG data and model to estimate the β in Equation (1). Because the average characteristics used to generate the PPU are calculated using the population of births from the Natality Detail File and therefore

[19] Appendix Table 2 shows the coefficients and standard errors for each of the 233 independent variables in the model. The R-squared for this model is 0.37.

[20] To calculate the standard errors for the confidence intervals, we use the "stdp" option for the "predict" command in Stata 15.0, which creates the sampling error of the prediction under the assumption that there is no uncertainty in the values of the characteristics (the X's) that are used to generate the prediction. Given that the X's are created using population-level data, we assume they represent the true population values.

represent their true values, there is no additional prediction error associated with those averages. Thus, while the confidence intervals tell us that the *level* of the actual trend line for UIB might be a little higher or lower than we predict, *changes* in the predicted UIB over time—which are our focus—are entirely driven by changes in mothers' actual characteristics and not by model uncertainty.

Figure 4B shows trends in the number of unintended births (on the left axis) and intended births (on the right axis). To generate these trends, we multiplied the number of births in each year by the PPU to get the number of UIB, and by (1-PPU) to get the number of intended births. Based on our primary specification, the number of unintended births fell by 16% between 2007 and 2016, resulting in nearly 237,000 fewer unintended births. This accounts for 64% of the decline in total births over this period. Using our modified calculation through 2019, we conclude that unintended births fell by 22% from 2007 to 2019, while unintended births fell by just 8.5%. There were 322,258 fewer unintended births in 2019 than in 2007, accounting for 57% of the overall decline.

Trends in unintended births tracked trends in intended births quite closely over most of the time period in Figure 4B, including during the Great Recession-induced decrease in fertility beginning in 2007. But strikingly, after the recession, the two series diverge. Unintended births continue to decline, while intended births rebound, suggesting that the baby-less recovery was driven entirely by births that were likely unintended. Our modified calculations do suggest that *intended* births started to fall again after 2016; we return to this most recent trend below.

Given the way the PPU is constructed, its fluctuations are driven by changes in the age, race, parity, metropolitan residence, and marital status of women giving birth each year. We can decompose the PPU into its component parts to understand better the relative contribution of each of these characteristics to changes in the trend. To do this, we again use the coefficients from the 2002 NSFG model and multiply by the average characteristics of mothers in each year from the Natality Detail Files, but for one set of characteristics at a time while setting the others at their 2002 levels. For example, to isolate the contribution of changes in the age distribution of women giving birth, we calculate the PPU for each year using the coefficients from the 2002 NSFG model and the average race, parity, metropolitan residence, and marital status from 2002, but allow the age profile to vary year-by-year. Thus, we are able to see how the PPU would have changed if only the age profile of women giving birth had changed, but all other characteristics and their returns had remained constant at 2002 levels.

The results are in Figure 5; the line with triangle markers shows the total change in PPU using this method.[21] We draw several conclusions from this figure. First, the decline in the PPU between 2008 and 2019 is almost entirely due to changes in the age distribution of women giving birth (recall from Figure 2A that this period saw large decreases in the birth rate for women under thirty). Changes in marital status contributed only slightly, as there was a small shift away from nonmarital childbearing (Figure 2B).[22] Meanwhile, the increase in the PPU between 2004 and 2008 is due entirely to increases in births to unmarried women. Continuing backward, the flat PPU of the 1990s and early 2000s is the result of offsetting increases in nonmarital childbearing and declining fertility rates for young women—especially those under 25.

Figure 5 also shows that when all characteristics except the mother's race/ethnicity are held constant, there is little movement in the PPU over time and virtually none after 2007. At first glance, this is surprising given the large decrease in births to Hispanic women that we observe in Figure 2C. The reason is that the likelihood that a birth is unintended is very similar for Hispanic and non-Hispanic women. That is, Hispanic ethnicity is not a strong predictor of an unintended birth—the coefficients on the indicator for Hispanic ethnicity in our prediction models in Table 1 are close to zero and not statistically significant. We conclude that while the decrease in births to Hispanic women is clearly an important contributor to the overall decline in births in the U.S. since 2007, it is *not* a key driver of the decline in unintended births that we document.[23]

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[21] Note that we are unable to include the interaction terms in the model when decomposing the PPU because it is not possible to hold one element of the interaction constant while changing the other given that the characteristics used for the predictions are population averages. Using a prediction model without interactions results in small differences in the estimated trend in the PPU as shown in Online Appendix Figure 12. A benefit of using a model without interactions is that it allows us to estimate a PPU for 2017-2019 using imputed values for average marital status in California from the NCHS annual reports. See Online Appendix Figure 12 for details; the figure shows that unintended births continued to fall through 2019.

[22] This suggests that changes in births to cohabitating couples are not likely to be an important explanation for the most recent decline.

[23] The 2003 birth certificate revision, which was adopted by states at different times between 2003 and 2016, allowed for the reporting of multiple racial categories. One concern is that this might drive some of the patterns we observe. However, as illustrated in Figure 2C and Figure 5, the very large changes in Hispanic birth rates after 2007 (and smaller but still substantial changes

As noted above, a potential drawback of our method of constructing the PPU is that if the "returns" to the characteristics that we use to predict unintended births change over time, our estimates could be sensitive to the choice of the NSFG cycle used to estimate the model coefficients. We explore this sensitivity in Figure 6, which replicates the approach used in Figure 5, but using different NSFG cycles to estimate the model. First, focusing on the predicted trend in unintended births if all characteristics are allowed to fluctuate (represented by the dark line with triangle markers), we see that the estimated *level* of unintended births changes across the panels. This is expected—if the level of unintended births changes over time, then models that use different NSFG cycles to predict unintended births will predict more or fewer of them. However, it is striking that the *trend* in the PPU is extremely similar regardless of which NSFG cycle is used.

Figure 6 also replicates the decomposition exercise in Figure 5. Because Figure 5 uses the 2002 NSFG cycle, the characteristics that are held constant are fixed at their 2002 levels. In Figure 6, we fix characteristics to a year that is at the midpoint of the relevant NSFG cycle, which changes the year in which the various estimates intersect. Because the intersection point is now in 2008 or later in each panel, our key takeaway from the decomposition exercise is even clearer—across the four panels, the decline in the PPU from 2008 to 2019 is almost entirely due to changes in the age distribution of women giving birth.

As a final exploration of the sensitivity of our results to our modeling choices, in Figure 7 we illustrate the percent change in the number of unintended births between 2007-2016 from sixty different specifications of our prediction model (six waves of the NSFG, five measures of unintendedness, and two functional forms—linear probability model and probit). We produce Figure 7 using 2016 as an endpoint because of the issue with unreported marital status in California after 2016.[24]

The results are reassuringly stable across specifications. The estimates range from 9% to 22% across all measures; our preferred estimate of 16% (represented by the solid triangle using

in birth rates for women in other race/ethnicity categories) have virtually no effect on our predicted UIB trend. Fluctuations in race/ethnicity caused by the gradual implementation of the 2003 revision across states would be much smaller and would be unlikely to change our results.

[24] For the LPM models we can use average population characteristics to create the predictions, and impute average marital status as described in the text, but this is not possible for the non-linear probit model.

the 2002 cycle) is exactly in the middle of this range. Every estimate in the figure is above 8.5%, which is the percent decline in *all* births between 2007 and 2016. Thus, all sixty estimates reach the same conclusion: unintended births declined more than births overall. The estimates using "too soon" as the measure of pregnancy intention yield slightly larger percent decreases, with estimates of the decline ranging around 20%. This implies that the decline in UIB is coming disproportionately from those who do want a birth at some point, suggesting that women may be finding it easier to correctly time their births.

Overall, our main result—that there was a decline in unintended births of around 16% over this period—is quite robust across specifications of the prediction model. When we use 2019 as the endpoint for our preferred (LPM) specification, we conclude that there was a 22% decline in unintended births between 2007 and 2019. Given that births declined 13% over this period, it appears that unintended births account for a disproportionate amount of the fertility decline through 2019 as well.

V. Explaining the Decline in Unintended Births

What explains the continued drop in births even after the economic recovery began, and what led to the divergence between unintended and intended births? To explore this, we borrow a framework from Levine (2001), in which he describes a "fertility decision tree." The tree begins with the choice of whether or not to have sexual intercourse and ends with a birth or no birth (including the decision to avert a birth using an abortion).[25] In applying the decision tree to our setting, we have in mind an individual who has an idea of how many children, if any, they would like to have over the course of their lifetime—their fertility intentions. This will influence decisions made at all nodes on the tree. The tree begins with the decision on whether and how often to have intercourse; if the decision is made to have intercourse, the woman then decides whether to use contraception. After having sex, women become pregnant with probability p_1 if they used contraception and p_2 if they did not; the choice of method affects p_1 while emergency contraception could be used to decrease both p_1 and p_2. Finally, if the woman does become pregnant, she faces the decision of whether to have an abortion. At each decision node, changes in the environment a woman is facing may alter the path taken.

[25] We include this figure as Appendix Figure 13.

We use the NSFG to identify the changes in women's behavior and intentions within the decision tree that could explain the large decline in unintended births since the Great Recession. In Figure 3 above, we documented that the NSFG is not well-suited for documenting detailed trends in the characteristics of women who have recently given birth, as one needs to combine cycles to obtain reasonable sample sizes of women giving birth each year, which the NSFG is not designed to do. But here, we can use the NSFG files as intended—as separate cycles, using each cycle's weights to produce nationally representative statistics for that period. This removes the need to re-weight the data to combine cycles. Furthermore, because we are interested in the behaviors of all women of childbearing age, we include all women in the NSFG Respondent Files in our sample. This yields much larger sample sizes, ranging from 5,554 in 2015-17 to 12,279 in 2006-10.

We document changes in women's behaviors and intentions for the full, nationally representative sample, and then separately for women who are most and least likely to have an unintended birth. To estimate a woman's propensity for an unintended birth, we return to our strategy of using a prediction model. Here, we are interested in predicting whether a woman of childbearing age has an unintended birth (as opposed to predicting whether a given birth was intended, as above). Thus, we include all women of childbearing age in the NSFG in our prediction models, and estimate the following:

$$UIB_i^k = \lambda + Z_i^k \boldsymbol{\gamma}^{\boldsymbol{k}} + \mu_i \qquad (2)$$

where UIB_i^k is an indicator for whether woman i in cycle k had an unintended birth within the last three years. We again use the 2002 cycle as the base year in our main specifications. Z_i^k is a vector of demographic and family background characteristics of woman i; details and parameter estimates are in Appendix Table 4. Note that here we are not restricted to covariates that are also available in the Natality Detail Files, and we avoid variables that are likely to be endogenously determined with unintended births (e.g. marital status).

The distribution of the predicted probabilities from this model is shown in Appendix Figure 14. Because this is a linear probability model, we predict negative probabilities of an unintended birth for some women. Meanwhile, women on the high end of the distribution are predicted to have an unintended birth with probability 0.2 or higher. We classify women in the top and bottom quartiles of this distribution as having a high and low probability of a UIB, respectively. Appendix Table 5 shows summary statistics for these two groups and for the full sample, in the 2002 NSFG. Importantly, those we predict to have a high Pr(UIB) are much more likely to have *actually* had a UIB—21.2% of women in the top quartile had a UIB, compared to only 1.8% for the bottom quartile.

Before we examine behaviors within the fertility tree, we note that trends in the predicted Pr(UIB) can shed light on the role of changing demographic and background characteristics of women of childbearing age. In Figure 8, we show how both the Pr(UIB) and the actual incidence of UIB have changed across NSFG cycles. For the remainder of this section, we focus on the changes after the 2006-10 cycle, which captures the period after unintended births peaked in Figure 4. In Panel A, we see that the predicted probability of a UIB declined slightly from 2006-10 to 2017-19, from 0.040 to 0.034. This suggests that changes in women's demographic and background characteristics alone would predict a small decline in UIB based on our model. However, the decline in *actual* UIB shown in Panel B is larger—the fraction of women with a recent UIB fell from 0.072 to 0.058 over this same period.[26] For those with a high Pr(UIB), the predicted probability of a UIB fell by 1.5 percentage points (pp), while actual UIB fell by 7 pp. Thus, while changes in women's characteristics contribute, most of the decline in UIB overall and for the high Pr(UIB) group is due to changes in women's behaviors.

We now turn to these behaviors, beginning at the last node of the decision tree—the decision to have an abortion conditional on a pregnancy. We note that over the period we consider, a number of abortion clinics closed, and state legislatures passed an increasing number of laws that restrict abortion access, which we expect would have resulted in fewer abortions and more births, *ceteris paribus*.[27] Indeed, the national trend in abortions, which has been falling over time, is at its lowest point since Roe v. Wade (Jones & Jerman 2014, 2017). The results in Figure 9A are consistent with this. For our high Pr(UIB) group, the fraction that have had an abortion within the last 12 months fell by nearly half between the 2006-10 and 2017-19 cycles (despite a small uptick in the last cycle). As the decrease in abortions would have worked to increase unintended births, it is clear that changes in abortions are not driving the decline in UIB.

[26] If we use these numbers to approximate the number of UIB in 2008 and 2018 (the midpoints of their respective NSFG cycles), we estimate that there would have been approximately 258,000 fewer UIB in 2018. This is consistent with our estimates in Figure 4, in which we predict 285,407 fewer UIB in 2018 than in 2008.

[27] See, for instance, Fischer et al. (2018), Lindo et al. (2020), Lu and Slusky (2019), Myers and Ladd (2020), and Packham (2017).

Having ruled out an increase in abortions as an explanation, we return to the beginning of the fertility decision tree—the decision to have sex (with a man) or not. Recent work by Ueda et al. (2020) using the General Social Survey suggests that sexual activity has declined modestly over the last decade for women ages 25 to 34. Additionally, analysis from the Centers for Disease Control and Prevention using Youth Risk Behavior Survey data indicate that since 1991 there has been a declining trend in teens who report ever having had sexual intercourse.[28]

We document the trend in sexual activity within the NSFG in Figure 9B, which presents the frequency of sexual intercourse with a man in the past 4 weeks. This measure includes zeroes for those women who did not have sex, so it captures movements in both abstinence and frequency. The figure shows that in the decade following the Great Recession, there has been a gradual decrease in women's reported sexual activity in the past 4 weeks. For those with a high Pr(UIB), the decrease is more dramatic, especially between the 2015-17 and 2017-19 waves. Between the 2006-10 and 2015-17 cycles, the frequency of sexual activity in the past 4 weeks fell by 9%, and it fell by an additional 20% between the 2015-17 and 2017-19 waves. We conclude that decreasing sexual activity was a contributing factor to the decline in UIB over this period, especially in the most recent years.

We now move to the next two nodes in the decision tree—whether to use a method of contraception, and which method to use. In Figure 9C, we show the fraction of women who are currently using any contraception, conditional on currently being sexually active with a man. In 2006-10, 64% of women in the full sample report using any method. This number is stable through the 2015-17 cycles, though it increases in 2017-19. For our high-risk group, the fraction using any method declines over the period, which would work to *increase* UIB. Again, we conclude that the decline in UIB over the 2007-2016 period is unlikely to be explained by changes in the number of women choosing to contracept at all.

Next, we consider whether there have been important changes in the method of contraception, conditional on using any method. There is some evidence that this has changed over this period—in particular, that more women are using highly effective forms of contraception, which include both long-acting reversible contraceptives (LARCs, Bailey and Lindo 2018) and sterilization. LARCs include intra-uterine devices (IUDs) and implants, and are

[28] https://www.cdc.gov/healthyyouth/data/yrbs/pdf/trends/2019_sexual_trend_yrbs.pdf

much more effective in practice than daily/single-use contraception and have been shown to reduce births to teens and young women (Kelly et al. 2020; Lindo and Packham 2017). Thus, a shift towards these highly effective contraceptive methods would decrease p_1 (the probability of a pregnancy when using birth control) in the fertility decision tree.

In Figure 10, we document trends in the choice of method among currently contracepting women, for all women and separately for those with high and low risk of a UIB. Panel A shows that the use of highly effective methods (LARCs plus sterilization) among all contracepting women increased between 2006-10 and 2015-17, while use of the Pill and condoms decreased. While women with a high probability of a UIB (shown in Panel B) are consistently less likely to use either a LARC or sterilization than women with a low probability of a UIB (shown in Panel C), by 2015-17, 41% of women in this group were using these highly effective methods, up 21% from the 2006-10 cycle. Between 2015-17 and 2017-19, usage of highly effective forms of contraception falls, in part due to changes in program rules affecting Title X clinics (Fowler et al. 2020; Bailey, Bart, & Lang 2022).

Figure 10 groups both sterilization and LARCs together as highly effective methods of contraception, and the NSFG questions do not allow us to directly observe whether an individual woman switched from choosing sterilization to choosing a LARC. However, an analysis of sterilization and LARC trends by age (Appendix Figure 15) suggest that this may have been happening for some women age 25 and older—sterilization rates fall for this group as a whole over the period, while LARC rates increase. On the other hand, sterilization has always been rare among women 15-24, but over a quarter of these women are using LARCs by 2017-19. It appears that young women were *not* simply switching from one highly effective method to another; rather, they are choosing LARCs instead of less effective methods.

What is behind this increase in the use of LARCs, especially among young women? We note two important developments during this period. First, there were changes in medical practice. In 2009, the American College of Obstetricians and Gynecologists (ACOG) recommended that LARCs be offered as a first-line contraceptive method and that they were appropriate for all women; prior to this, LARCs were primarily recommended for women who had already had a child. Then, in 2012, ACOG expanded this recommendation to include adolescents, and the American Pediatric Association recommended the use of LARCs for adolescents at higher risk of an unintended birth starting in 2014 (Bailey and Lindo, 2018).

Consistent with this, in Figure 9D we show that the fraction of women using a LARC as their *first* method of contraception increased over the period that the recommendations changed, especially for women with a high likelihood of a UIB. Again, Panel B of Appendix Figure 15 shows that these women would have been unlikely to choose sterilization as their first method, suggesting that many would have opted for a less effective method.

Second, beginning in 2010, the Affordable Care Act (ACA) increased access to contraception by mandating contraceptive coverage for private plans, and by expanding insurance coverage among young women through Medicaid expansions and the young adult provision (Bullinger and Simon 2019; Snyder et al. 2018). Prior work has shown that these components of the ACA led to increased LARC use (Becker 2018; Carlin, Fertig, and Dowd 2016) and a decrease in fertility for some women (Abramowitz 2018; Becker, 2018; Gangopadhyaya and Johnston, 2020). In Figure 11, we show changes in insurance coverage among women of childbearing age. The fraction of women who were uninsured fell from 0.27 in 2006-10 to 0.18 in 2017-19. Importantly, this change is more acute for women with a high probability of a UIB; the fraction of these women with no insurance coverage at all dropped from 0.45 in 2006-10 to 0.29 in 2017-19.

In addition to the increase in LARC use, there may have been changes in the use of emergency contraception (EC), which is taken soon after sexual intercourse and is intended to avert a pregnancy. Changes in EC use could decrease both *p1* and *p2* in the fertility decision tree. Before 1998, an individual could only obtain EC via a prescription, but by 2013, it was available over the counter for all ages.[29] Figure 9E shows that EC use did increase dramatically among sexually active women between 2006-10 and 2017-19. EC use is not common among women at low risk for a UIB throughout this period, but for those at higher risk, the fraction increased from 0.036 to 0.058. However, the expected effect of EC availability on unintended births is ambiguous, as it has unintended consequences: it increases sexual activity (Atkins, 2014; Mulligan, 2016), decreases the use of condoms (Atkins and Bradford, 2015), and increases sexually transmitted infections (Girma and Paton, 2011; Durrance, 2013). Indeed, Durrance

[29] Durrance (2013) and Atkins and Bradford (2015) detail the move to OTC access prior to the national level changes and also provide other information on EC. We draw on their discussion in how we describe EC.

(2013) and Mulligan (2016) find that EC access does not change birth rates. Given this evidence, we conclude that changes in EC use have not played a significant role in the decrease in UIB.

Finally, recall that each decision node on the tree is affected by a woman's desired fertility. In Figure 9F, we show trends in the number of (additional) children women report that they would like to have. For the full sample, this number is flat throughout the period, while for the high probability group, desired fertility is actually increasing. Thus, it does not appear that a stronger desire to avoid births is behind the decline in UIB that we observe.

Our analysis using the NSFG, combined with evidence from the previous literature, leads us to conclude that much of the decrease in unintended births can be explained by three factors. In the calculations that follow, we focus on those with a high Pr(UIB). First, we estimate that 1.48 pp, or 21% of the 7.02 pp decline in UIB for this group between the 2006-2010 and 2017-2019 cycles can be explained by changing demographic and family background characteristics. Second, the NSFG suggests that the usage of highly effective contraceptive methods like LARCs and sterilization rose by 6.9% between the 2006-10 and 2017-19 waves. If all of this increase came from women who were previously using pills or condoms, this shift would have increased typical use efficacy from approximately 86% to nearly 100%, and could therefore explain 4.8% of the decrease in UIBs.[30] Third, sexual frequency fell by 27.3% between 2006-10 and 2017-19. If we assume that translates to a reduction in UIBs of the same magnitude, the decrease in sexual activity would explain 70.7% of the decline in UIBs over this period. These three explanations (changes in characteristics, shifts to highly effective contraceptive methods, and reductions in sexual frequency) can therefore explain nearly all of the decrease in UIBs between 2006-10 and 2017-19 for the high Pr(UIB) group.

These calculations are affected by the choice of the end period, as there was a large drop in sexual frequency and a decrease in the fraction of women using a highly effective method between 2015-17 and 2017-19. For the 2006-10 to 2015-17 period, changes in demographic characteristics, contraceptive methods, and sexual activity can explain 18.6%, 21.3%, and 36.2%, respectively, of the overall reduction in UIB. While the relative importance of the three factors changes, together they are still able to account for most (76%) of the decline in UIB for women with a high probability of this outcome.

[30] We obtain typical use failure rates from www.cdc.gov/reproductivehealth/unintendedpregnancy/pdf/contraceptive_methods_508.pdf.

VI. Discussion and Conclusion

In the years following the start of the Great Recession, the U.S. experienced an expected fertility decline, followed by an unexpected "baby-less recovery." In this paper, we show that the aggregate trend masked diverging fertility patterns by both age and marital status, with the declines coming from those groups most likely to have unintended births. We combine data from the NSFG and the Natality Detail Files to create a consistent trend in unintended births over time. We first show that the number of births that were likely unintended declined by about 22% between 2007 and 2019, accounting for 57% of the total fertility decline over that period. Trends in unintended births tracked trends in intended births closely from 1989 through 2007 and throughout the fertility decline during the Great Recession. However, while unintended births continued to fall throughout the recovery period, intended births rose again, at least through 2016—revealing that that the recovery was not baby-less for all. These results are robust to a wide range of alternate specifications.

We use the NSFG to show that the decrease in unintended births is unlikely to be due to changes in fertility intentions, abortion rates, or large changes in the share of individuals using any contraception. Rather, our results suggest that the decrease in unintended births can be largely explained by three factors: changes in the demographic characteristics of those giving birth, a shift towards more effective methods of contraception, and reductions in sexual frequency. These three factors can explain almost all of the decrease in unintended births between the 2006-10 and 2017-19 waves of the NSFG for women with a high probability of this outcome, with reductions in sexual frequency playing the largest role. Further research is needed to identify the underlying causes of changes in these factors, including the potential role of health care policy, economic conditions, the political environment, dating and marriage markets, and behavioral responses to technologies like smart phones and broadband internet.

While our paper has focused on documenting and explaining the decline in unintended births during the 2007-2019 period, we believe our analysis can inform our understanding of fertility trends since then, and expectations about the future. We make three main points. First, our analysis suggests that *intended* births began to decline again over the 2017-2019 period. Using the 2017-19 NSFG cycle, we show sizable increases in sexual abstinence and in contraception even among those with a low probability of a UIB. This group also indicated a slight decline in their fertility intentions. Recent work has documented fertility declines within

Democratic counties (with little change among Republican counties) and among Hispanic women following the 2016 election (Dahl, Lu, and Mullins 2021), and an increase in LARC insertions in the immediate aftermath of that election (Pace et al. 2019). These studies suggest that growing political polarization in the U.S. may mean that fertility trends are increasingly influenced not only by economic cycles, but by political ones.

Second, demographers, social scientists, policy makers, and journalists have debated whether the fertility decline of the post-2007 period reflected births that were temporarily postponed or births that were permanently foregone, possibly due to shifts in the demand for children (e.g. Wong 2019; Kearney and Levine 2021b; Kearney, Levine, & Pardue 2022). Given that the fertility decline was driven by women in their teens and twenties, it seemed plausible that higher birth rates for these women in their thirties might result in completed fertility rates that were comparable to previous cohorts. However, our results in Figure 2A show that this has not happened. Women who were in their early twenties in 2007-10 would have been in their early thirties in 2017-20, and birth rates for women in this age group actually declined over those years. Thus, completed fertility for this cohort is likely to decline unless births are pushed to even later ages, which is possible but physiologically difficult. The COVID-19 pandemic has further suppressed fertility rates for all women (Kearney and Levine 2021a), making a catch-up in births at these later ages even less likely.

Third, the higher rates of unintended births historically seen in the U.S. could provide another explanation for the fact that fertility for U.S. women has remained higher than for their European counterparts, despite the fact that the U.S. lags behind many of those European countries in terms of family-friendly policies such as paid maternity leave or subsidized child care. Bearak et al. (2018) show that in 2011-2014, the rate of unintended pregnancies in the U.S. was almost twice as high as the rate in either Northern or Western Europe, areas where birth rates are low and use of effective contraception is high. If the reduction in unintended births we document is permanent, it could mean that U.S. fertility will align more closely with patterns in these other parts of the world in the future.

References

Abramowitz, J. (2018). Planning Parenthood: The Affordable Care Act Young Adult Provision and Pathways to Fertility. *Journal of Population Economics*, 31(4): 1097-1123.

Albanesi, S., & Olivetti, C. (2014). Maternal health and the baby boom. *Quantitative Economics*, *5*(2), 225-269.

Atkins, D.N. (2014). Association Between Increased Availability of Emergency Contraceptive Pills and the Sexual and Contraceptive Behaviors of Women. *Journal of Public Health Policy*. 35, 292–310.

Atkins, D. N. and Bradford, W.D. (2015). The Effect of Changes in State and Federal Policy for Nonprescription Access to Emergency Contraception on Youth Contraceptive Use: A Difference-in-Difference Analysis Across New England States. *Contemporary Economic Policy*. 33(3), 405-417.

Baicker, K., Buckles, K., & Chandra, A. (2006). Geographic variation in the appropriate use of cesarean delivery. H*ealth Affairs*, 25, w355–w367.

Bailey, M. J. (2010). Momma's Got the Pill: How Anthony Comstock and Griswold v. Connecticut Shaped U.S Childbearing. *American Economic Review*, 100(1), 98–129.

Bailey, M. J. (2006). More Power to the Pill: The Impact of Contraceptive Freedom on Women's Labor Supply. *Quarterly Journal of Economics*, 121(1), 289-320.

Bailey, M.J., Bart, L.J. & Lang, V.W. (2022). The Missing Baby Bust: The Consequences of the COVID-19 Pandemic for Contraceptive Use, Pregnancy, and Childbirth among Low-Income Women. *NBER Working Paper 29722* http://www.nber.org/papers/w29722.

Bailey, M. J. & Hershbein, B. J. (2018). US Fertility Rates and Childbearing in American Economic History, 1800–2010. In Cain, L.P., Fishback, P.V., and Rhode, P.W. (Eds.) *The Oxford Handbook of American Economic History, Vol. 1* (pp. 75-100). New York: Oxford.

Bailey, M. J., Guldi, M. & Hershbein, B. J. (2013a). Recent Evidence on the Broad Benefits of Reproductive Health Policy. *Journal of Policy Analysis and Management*, 32(4), 888-896.

-----. (2013b). Further Evidence on the Internal Validity of the Early Legal Access Research Design. *Journal of Policy Analysis and Management*, 32(4), 899-904.

-----. (2014). Is There a Case for a 'Second Demographic Transition'? Three Distinctive Features of the Post-1960 U.S. Fertility Decline. In Leah P. Boustan, Carola Frydman, and Robert A. Margo (Eds.) *Human Capital in History: The American Record in honor of Claudia Goldin* (pp. 273-312). Chicago: University of Chicago Press. http://press.uchicago.edu/ucp/books/book/chicago/H/bo18411047.html

Bailey, M.J. and J. Lindo (2018). Access and Use of Contraception and Its Effects on Women's Outcomes in the United States. In Susan L. Averett, Laura M. Argys, and Saul D. Hoffman (Eds.) *The Oxford Handbook of Women and the Economy*. Oxford: Oxford University Press.

Bearak, J., Popinchalk, A., Alkema, L., and Sedgh, G. (2018). Global, Regional, and Subregional Trends in Unintended Pregnancy and its Outcomes from 1990 to 2014: Estimates from a Bayesian Hierarchial Model. L*ancet Global Health* 6(4), E380-E389.

Becker, N. V. (2018). The Impact of Insurance Coverage on Utilization of Prescription Contraceptives: Evidence from the Affordable Care Act. *Journal of Policy Analysis and Management*, *37*(3), 571-601.

Belluz, J. (2018). The Historically Low Birthrate, eExplained in 3 Charts. Retrieved from: https://www.vox.com/science-and-health/2018/5/22/17376536/fertility-rate-united-states-births-women

Biggs, M. A., U. D. Upadhyay, C. E. McCulloch, and D. G. Foster (2017). Women's Mental Health and Well-being 5 Years After Receiving or Being Denied an Abortion: A Prospective, Longitudinal Cohort Study. *JAMA Psychiatry* 74(2), 169–178

Bitler, M. & Schmidt, L. (2012). Birth Rates and the Vietnam Draft. A*merican Economic Review Papers and Proceedings*, 102(3): 566-69.

Boonstra, H. (2014). What Is Behind the Declines in Teen Pregnancy Rates? G*uttmacher Policy Review* 19(3).

Buckles, K. (2007). Stopping the Biological Clock: Infertility Treatments and the Career-Family Tradeoff. *Unpublished manuscript*.

Buckles, K. & Guldi, M. (2017). Worth the Wait? The Effect of Early Term Birth on Maternal and Infant Health. J*ournal of Policy Analysis and Management,* 36(4), 739-974.

Buckles, K., Guldi, M. E., & Schmidt, L. (2019). *Fertility Trends in the United States, 1980-2017: The Role of Unintended Births* (No. w25521). National Bureau of Economic Research.

Bullinger, L. R., and Simon, K. (2019). Prescription Contraceptive Sale Following the Affordable Care Act. *Maternal and Child Health Journal*, 23, 657–666.

Campbell, A. A., & Mosher, W. D. (2000). A History of the Measurement of Unintended Pregnancies and Births. *Maternal and Child Health Journal*, 4(3), 163-169.

Carlin, C. S., Fertig, A. R., & Dowd, B. E. (2016). Affordable Care Act's Mandate Eliminating Contraceptive Cost Sharing Influenced Choices of Women with Employer Coverage. *Health Affairs*, *35*(9), 1608-1615.

Cuellar, M.H. (2020) The US Great Recession: A Hispanic Baby Bust? US Hispanic Fertility Since the Great Recession, 2006-2015. https://jscholarship.library.jhu.edu/bitstream/handle/1774.2/63509/CUELLAR-DISSERTATION-2020.pdf?sequence=1

Curtin, S. C., Ventura, S. & Martinez, G. M. (2014). Recent Declines in Nonmarital Childbearing in the United States. *National Center for Health Statistics Data Brief* #162.

Dahl, G., Lu, R., & Mullins, W. (2021). Partisan Fertility and Presidential Elections. Unpublished manuscript, University of California San Diego.

Durrance, C.P. (2013). The Effects of Increased Access to Emergency Contraception on Sexually Transmitted Disease and Abortion Rates. Economic Inquiry. 51(3), 1682–1695.

Economist. (2018). What explains America's mysterious baby bust? November 24, 2018. Retrieved from https://amp.economist.com/united-states/2018/11/24/what-explains-americas-mysterious-baby-bust?

Emba, Christine. (2018). The Recession is Long-Gone. Where are the Babies? *Washington Post* May 23.

Finer, L. B., Lindberg, L. D. & Desai, S. (2018). A Prospective Measure of Unintended Pregnancy in the United States. *Contraception*, 98(6), 522-527.

Finer, L. B. & Zolna, M. R. (2016). Declines in Unintended Pregnancy in the United States, 2008–2011. T*he New England Journal of Medicine*, 374(9), 843-52.

-----. (2014). Shifts in Intended and Unintended Pregnancies in the United States, 2001–2008. *American Journal of Public Health*, 104(S1), S43-S48.

-----. (2011). Unintended Pregnancies in the United States: Incidence and Disparities, 2006. *Contraception*, 84(5), 478-485.

Fischer, S., Royer, H., and White, C. (2018). The Impacts of Reduced Access to Abortion and Family Planning Services on Abortions, Births, and Contraceptive Purchases. *Journal of Public Economics*, 167, 43-68.

Flood, S., King, M., Rodgers, R., Ruggles, S., Warren, J.W., and Westberry, M. (2021). Integrated Public Use Microdata Series, Current Population Survey: Version 9.0 [dataset]. Minneapolis, MN: IPUMS. https://doi.org/10.18128/D030.V9.0"

Foster, D. G., S. E. Raifman, J. D. Gipson, C. H. Rocca, and M. A. Biggs (2019). Effects of Carrying an Unwanted Pregnancy to Term on Women's Existing Children. *The Journal of Pediatrics* 205, 183–189.e1.

Fowler, C, Gable, J., Lasater, B., & Asman, K. (2020). *Title X family planning annual report: 2019 national summary*. Retrieved from https://opa.hhs.gov/research-evaluation/title-x-services-research/family-planning-annual-report/family-planning-0.

Gangopadhyaya, A. and E.M. Johnston (2020). The Impact of ACA Medicaid Expansions on Fertility, School Enrollment, and Labor Supply of Women of Reproductive Age. Urban Institute unpublished manuscript.

Gerdts, C., L. Dobkin, D. G. Foster, and E. B. Schwarz (2016). Side Effects, Physical Health Consequences, and Mortality Associated with Abortion and Birth after an Unwanted Pregnancy. *Women's Health Issues* 26(1), 55–59.

Girma, S. and Paton, D. (2011). The Impact of Emergency Birth Control on Teen Pregnancy and STIs. *Journal of Health Economics*. 30, 373-380.

Goldin, C. & Katz, L. F. (2002). The power of the pill: Oral contraceptives and women's career and marriage decisions. J*ournal of Political Economy*, 110(4), 730-770.

Goss, S. C. (2010). The Future Financial Status of the Social Security Program. S*ocial Security Bulletin*, 70(3), 111-125.

Guldi, M. (2008). Fertility Effects of Abortion and Pill Access for Minors. *Demography*, 45(4), 817-827.

Guldi, M. & Herbst, C. M. (2017). Offline effects of online connecting: the impact of broadband diffusion on teen fertility decisions. *Journal of Population Economics,* 30(1), 69-91.

Guzzo, K. B. (2017a). A quarter century of change in unintended births. *Family Profiles*, FP-17-08. Bowling Green, OH: National Center for Family and Marriage Research. Retrieved from https://www.bgsu.edu/ncfmr/resources/data/family-profiles/guzzo-quarter-century-change-unintended-births-fp-17-08.html

-----. (2017b). Unintended Births: Variation Across Social and Demographic Characteristics. *Family Profiles*, FP-17-09. Bowling Green, OH: National Center for Family and Marriage Research. Retrieved from https://www.bgsu.edu/ncfmr/resources/data/family-profiles/guzzo-unintended-births-variation-social-dem-char-fp-17-09.html

Guzzo, K. B., Eickmeyer, K. & Hayford, S. R. (2018). Does Postpartum Contraceptive Use Vary by Birth Intendedness? *Perspectives on Sexual and Reproductive Health*, 50(3), 129-138.

Guzzo, K.B., Hayford, S.R. (2014). Revisiting Retrospective Reporting of First-Birth Intendedness. *Maternal and Child Health Journal* 18, 2141–2147.

Hayford, S.R. & Guzzo, K.B. (2016). Fifty Years of Unintended Births: Education Gradients in Unintended Fertility in the U.S., 1960-2010. P*opulation and Development Review*, 42(2), 313-341.

Howard, J. 2019. US fertility rate is below level needed to replace population, study says. Retrieved from https://www.cnn.com/2019/01/10/health/us-fertility-rate-replacement-cdc-study/index.html.

Hummer, R. A., Hack, K. A. & Raley, R. K. (2004). Retrospective reports of pregnancy wantedness and child well-being in the United States. J*ournal of Family Issues*, *25*(3), 404-428.

Jones, R. K. & Jerman, J. (2014). Abortion Incidence and Service Availability In the United States, 2011. P*erspectives on Sexual and Reproductive Health*. Retrieved from https://www.guttmacher.org/sites/default/files/article_files/abortion_incidence_in_the_united_states_2011.pdf

-----. (2017). Abortion Incidence and Service Availability In the United States, 2014. P*erspectives on Sexual and Reproductive Health.* Retrieved from https://doi.org/10.1363/psrh.12015

Joyce, T. J., Kaestner, R., & Korenman, S. (2000). The stability of pregnancy intentions and pregnancy-related behavior. *Maternal and Child Health Journal* 4, 171–179.

Kearney, M. & Levine, P. B. (2009). Subsidized Contraception, Fertility, and Sexual Behavior. T*he Review of Economics and Statistics*, 91(1), 137–151.

-----. (2015a). Investigating Recent Trends in the U.S. Teen Birth Rates. *Journal of Health Economics,* 41, 15-29.

-----. (2015b). Media Influences on Social Outcomes: The Impact of MTV's 16 and Pregnant on Teen Childbearing. *The American Economic Review,* 105(12), 3597-3632.

-----. (2021a). The Coming COVID-19 Baby Bust is Here. Brookings Up Front Blog, May 5, 2021.

-----. (2021b). Will Births in the US Rebound? Probably Not. Brookings Up Front Blog, May 24, 2021.

Kearney, M.S., Levine, P.B, Pardue, L. (2022). The Puzzle of Falling US Birth Rates since the Great Recession. *Journal of Economic Perspectives* 36(1), 151-176.

Kelly, A, Lindo, J.M., & Packham, A. (2020) The Power of the IUD: Effects of Expanding Access to Contraception through Title X Clinics. *Journal of Public Economics* 192.

Klerman, L. K. (2000). The intendedness of pregnancy: A concept in transition. *Maternal and Child Health Journal* 4, 155–162.

Kost, K., & Lindberg, L. (2015). Pregnancy Intentions, Maternal Behaviors, and Infant Health: Investigating Relationships With New Measures and Propensity Score Analysis. *Demography,* 52(1), 52: 83.

Levine, P. B. (2001). The Sexual Activity and Birth-Control Use of American Teenagers. *NBER Chapters*, 167-218.

Levine, P. B., Staiger, D., Kane, T. J., Zimmerman, D. J. (1999). Roe v. Wade and American Fertility. *American Journal of Public Health*, 89(2): 199-203.

Lin, W., Pantano, J. & Sun, S. (2018). Birth Order and Unwanted Fertility. *Unpublished manuscript*.

Lindo, J. M., Myers, C., Schlosser, A., and Cunningham, S. (2020). How Far is Too Far? New Evidence on Abortion Clinic Closures, Access, and Abortions. J*ournal of Human Resources* 55, 1137-1160.

Lindo, J. M. & Packham, A. (2017). How Much Can Expanding Access to Long-Acting Reversible Contraceptives Reduce Teen Birth Rates? *American Economic Journal: Economic Policy*, 9(3), 348-376.

Lu, Y. and Slusky, D. (2019). The Impact of Women's Health Clinic Closures on Fertility. *American Journal of Health Economics*, 5(3), 334–359.

Martin, J. A., Hamilton, B. E., Osterman, M. J. K., & Driscoll, A. K. (2019). Births: Final Data for 2018. N*ational Vital Statistics Reports,* 68(13). Hyattsville, MD: National Center for Health Statistics.

Martin, J. A., Hamilton, B. E., Osterman, M. J. K., & Driscoll, A. K. (2021). Births: Final Data for 2019. N*ational Vital Statistics Reports,* 70(2). Hyattsville, MD: National Center for Health Statistics.

Mathews, T. J., & Hamilton, B. E. (2009). Delayed Childbearing: More Women Are Having Their First Child Later in Life, *NCHS Data Brief* No. 21.

-----. (2016). Mean Age of Mothers is on the Rise: United States, 2000–2014, *NCHS Data Brief* No. 232.

Miller, C. C. (2018). Americans Are Having Fewer Babies. They Told Us Why. New York Times, July 5, 2018. Retrieved from https://www.nytimes.com/2018/07/05/upshot/americans-are-having-fewer-babies-they-told-us-why.html

Miller, S, Wherry, L.A., Foster, D.G. (2020). *The Economic Consequences of Being Denied an Abortion.* (No. w26662). National Bureau of Economic Research.

Mohllajee, A P., Curtis, K. M., Morrow, B., & Marchbanks, P A. (2007). Pregnancy Intention and its Relationship to Birth and Maternal Outcomes. *Obstetrics and Gynecology,* 109(3), 678-686.

Mosher, W. D., Jones, J., & Abma, J. C. (2012). Intended and Unintended Births in the United States: 1982-2010. *National Health Statistics Reports,* no. 55.

Mulligan, K. (2016). Access to Emergency Contraception and its Impact on Fertility and Sexual Behavior. *Health Economics*. 25, 455–469.

Myers, C. K. (2017). The Power of Abortion Policy: Reexamining the Effects of Young Women's Access to Reproductive Control. *Journal of Political Economy*, 125(6), 2178-2224.

Myers, C. and Ladd, D. (2020). Did Parental Involvement Laws Grow Teeth? The Effects of State Restrictions on Minors' Access to Abortion. J*ournal of Health Economics* 71.

National Cancer Institute, DCCPS, Surveillance Research Program (2021). Surveillance, Epidemiology, and End Results (SEER) Program Populations (1969-2019) [dataset]. http://www.seer.cancer.gov/popdata.

National Center for Health Statistics. Natality Detail File, 1980-2019. Public-use data file and documentation. Https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm

National Center for Health Statistics. National Survey of Family Growth, 2002; 2006-2010; 2011-2013; 2013-2015; 2017-2019. Public-use data file and documentation. Https://www.cdc.gov/nchs/nsfg/index.htm

Office of Disease Prevention and Health Promotion. Accessed October 16, 2020. https://health.gov/healthypeople/objectives-and-data/browse-objectives/family-planning

Osterman, M.J.K., Hamilton, B.E., Martin, J.A., Driscoll, A.K., Valenzuela, C.P. (2022). Births: Final Data for 2020. *National Vital Statistics Reports,* 70(17) Hyattsville, MD: U.S. National Center for Health Statistics. Available from https://dx.doi.org/10.15620/cdc:112078.

Pace, L.E., Dusetzina, S.B. Murray Horowitz, M.E, & Keating, N.L. (2019). Utilization of Long-Acting Reversible Contraceptives in the United States After vs Before the 2016 Presidential Election. *JAMA Internal Medicine* 179(3), 444-446.

Packham, A. (2017). Family Planning Funding Cuts and Teen Childbearing. *Journal of Health Economics* 55(1), 168-185.

Poole, V.L., Flowers, J.S., Goldenberg, R.L. et al. (2000). Changes in Intendedness During Pregnancy in a High-Risk Multiparous Population. *Maternal and Child Health Journal* 4, 179–182.

Pulley, L., Klerman L.V., Tang H., Baker B.A. (2002). The extent of pregnancy mistiming and its association with maternal characteristics and behaviors and pregnancy outcomes. *Perspectives on Sexual and Reproductive Health*, 34(4), 206-11.

Ralph, L. J.,Schwarz, E.B., Grossman, D., and Foster, D.G. (2019). Self-reported Physical Health of Women Who Did and Did Not Terminate Pregnancy After Seeking Abortion Services: A Cohort Study. *Annals of Internal Medicine*.

Rosenzweig, M. R., & Wolpin, K. I. (1993). Maternal Expectations and Ex Post Rationalizations: The Usefulness of Survey Information on the Wantedness of Children. *Journal of Human Resources*, 28(2), 205.

Schmidt, L. (2007). Effects of Infertility Insurance Mandates on Fertility *Journal of Health Economics,* 26(3), 431-446.

Sobotka, T., Skirbekk, V., & Philipov, D. (2011). Economic Recession and Fertility in the Developed World. *Population and Development Review* 37(2), 267-306

Snyder, A. H., Weisman, C. S., Liu, G., Leslie, D., & Chuang, C. H. (2018). The Impact of the Affordable Care Act on Contraceptive Use and Costs among Privately Insured Women. *Women's Health Issues,* 28(3), 219–223.

Sonfield, A. & Kost, K. (2015). Public Costs from Unintended Pregnancies and the Role of Public Insurance Programs in Paying for Pregnancy-Related Care National and State Estimates for 2010, *Guttmacher Report*, February 2015. Retrieved from https://www.guttmacher.org/report/public-costs-unintended-pregnancies-and-role-public-insurance-programs-paying-pregnancy.

Trudeau, J. (2016). The role of new media on teen sexual behaviors and fertility outcomes—the case of 16 and Pregnant. *Southern Economic Journal,* 82(3), 975-1003.

Ueda, P., Mercer, C. H., Ghaznavi, C., & Herbenick, D. (2020). Trends in frequency of sexual activity and number of sexual partners among adults aged 18 to 44 years in the US, 2000-2018. *JAMA network open*, *3*(6), e203833-e203833.

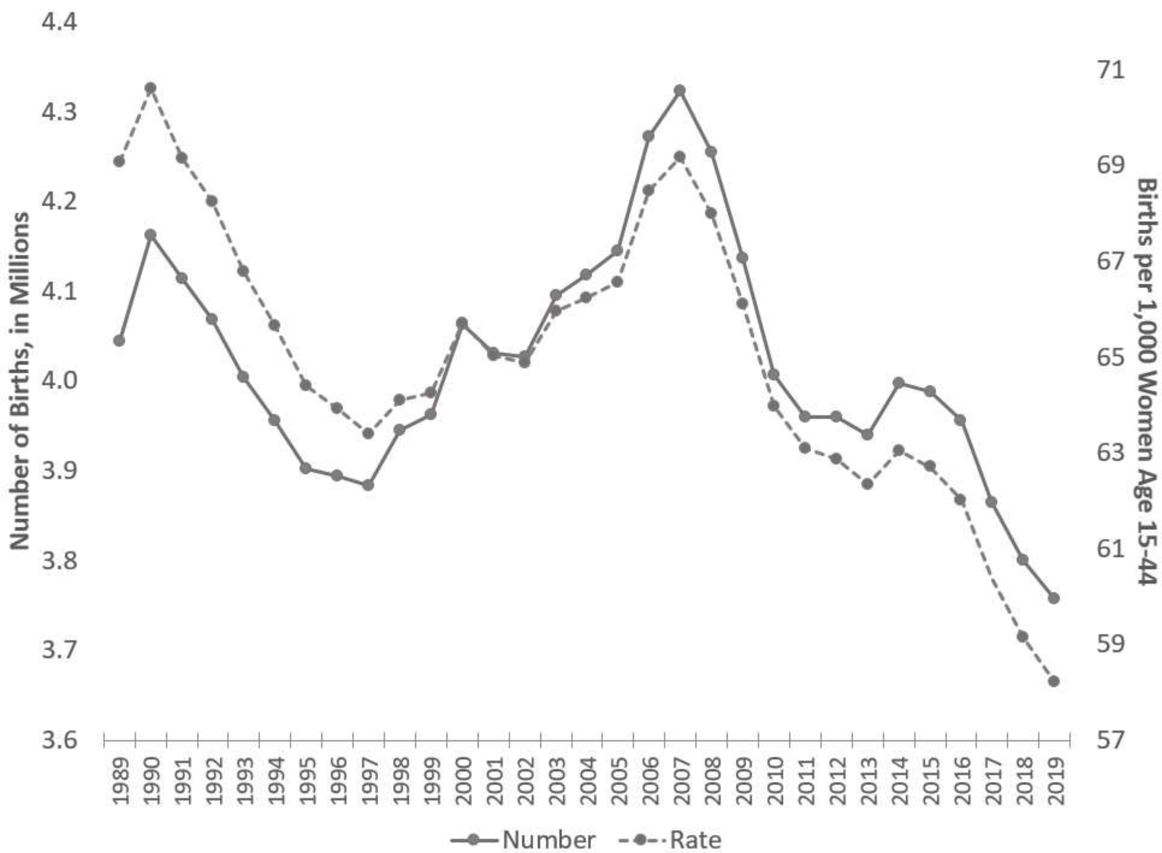
U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. 2016. Morbidity and Mortality Weekly Report: Youth Risk Behavior Surveillance--United States, 2015. Surveillance Summaries. Vol. 65 No. 6 June 10, 2016. https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2015/ss6506_updated.pdf

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. 2020. Morbidity and Mortality Weekly Report: Youth Risk Behavior Surveillance--United States, 2019. Surveillance Summaries. Vol. 69 No. 1 August 21, 2020. https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/su6901-H.pdf

U.S. Census Bureau, 2018. Historical Marital Status Tables. Retrieved from https://www.census.gov/data/tables/time-series/demo/families/marital.html

Wong, A. (2019). The Misplaced Fears About the United States' Declining Fertility Rate." *The Atlantic*, May 17, 2019.

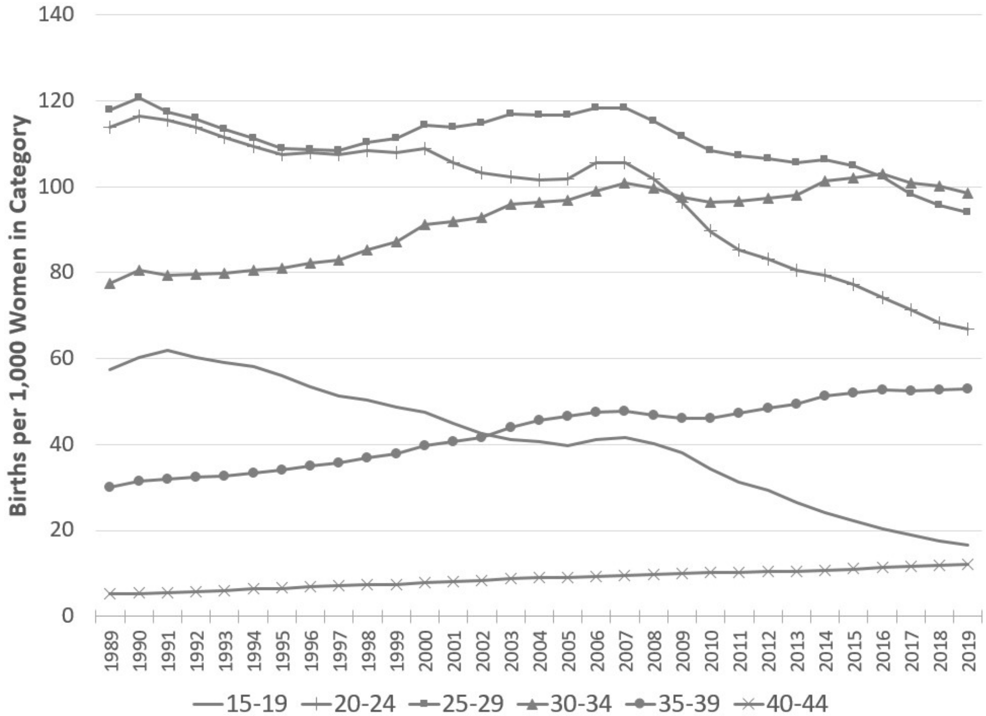
Figure 1: Total Number of Births and Birth Rates in the United States, 1989-2019



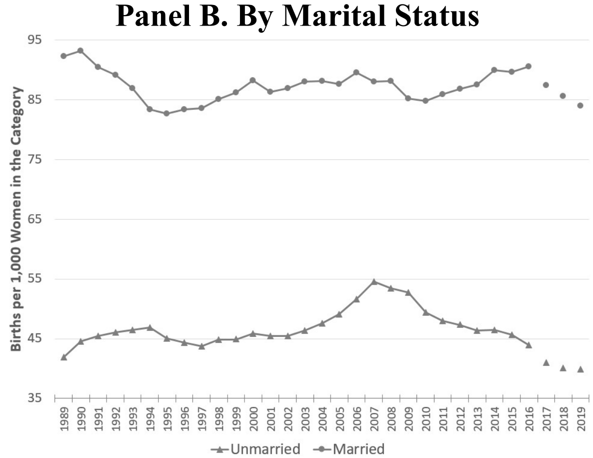
Notes: Birth rates are calculated as the number of births per 1,000 women in the category. Age- and sex-specific population counts used in the denominators are from the National Cancer Institute's Surveillance, Epidemiology, and End Results data (SEER).

Figure 2: Birth Rates by Age, Marital Status, and Race/Ethnicity in the United States, 1989-2019

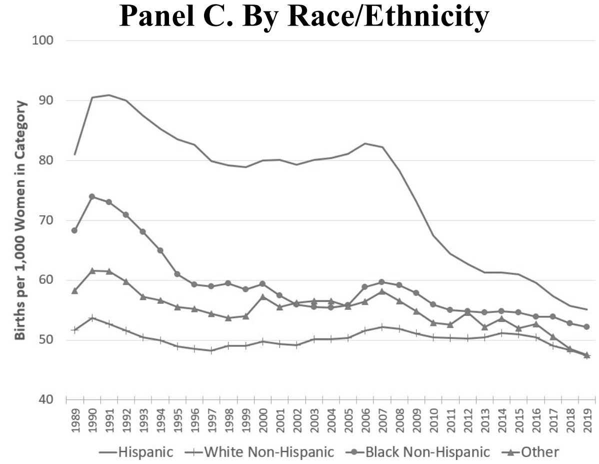
Panel A. By Five-Year Age Categories



Panel B. By Marital Status



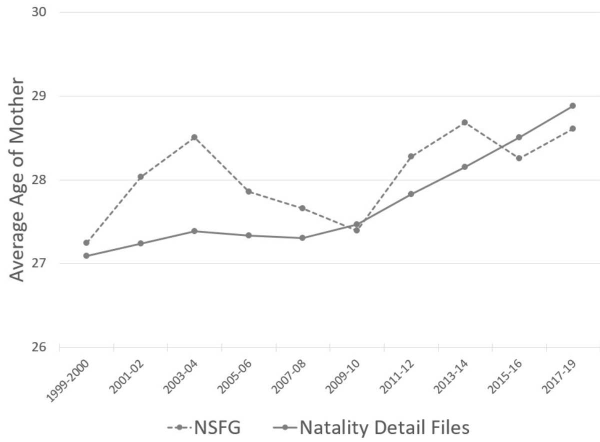
Panel C. By Race/Ethnicity



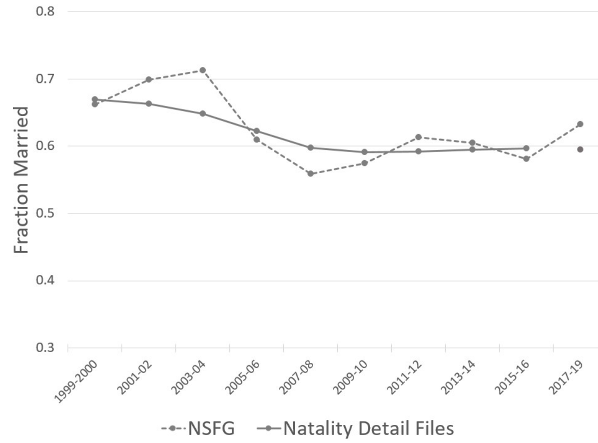
Notes: Birth rates are calculated as the number of births per 1,000 women in the category. Age-, race/ethnicity, and sex-specific population counts used in the denominators for Panels A and C are from SEER; population counts by marital status used in the denominators for Panel B are calculated from the Current Population Survey Annual Social and Economic Supplement. Marital status is not available in the restricted use Natality Files for California after 2016, so data points for those years are from Martin et al. (2019) and Martin et al. (2021) (indicated by data points disconnected from the main series).

Figure 3: Trends in Characteristics of Births, NSFG Data

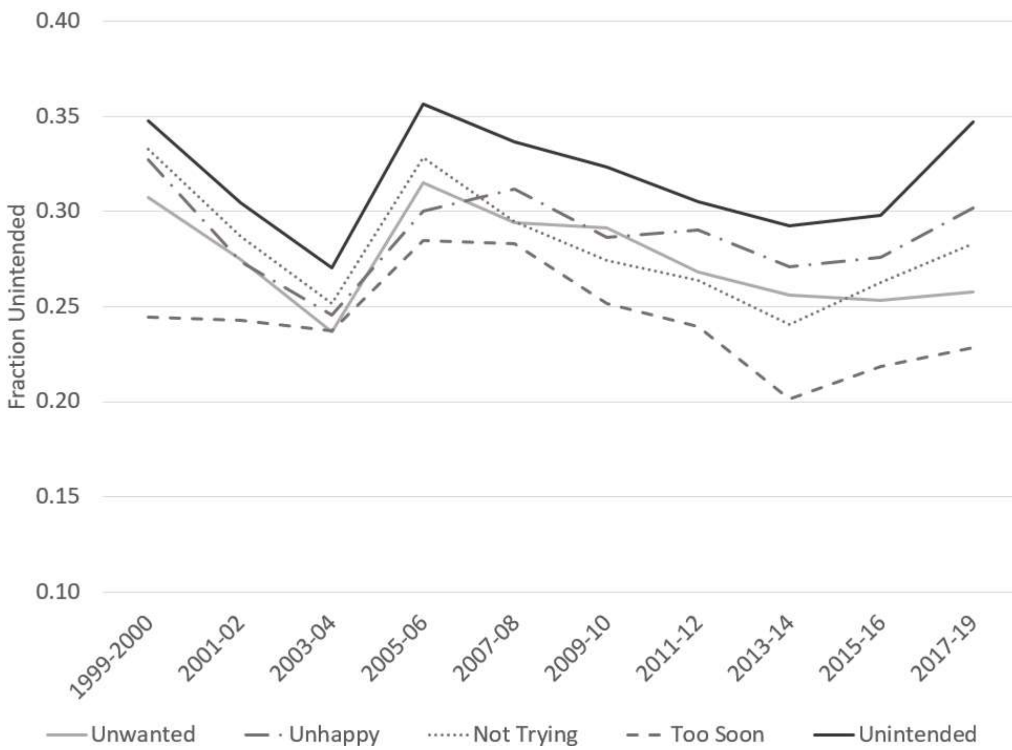
Panel A: Average Age of Mother in NSFG and Natality Detail Files



Panel B: Fraction Married in NSFG and Natality Detail Files



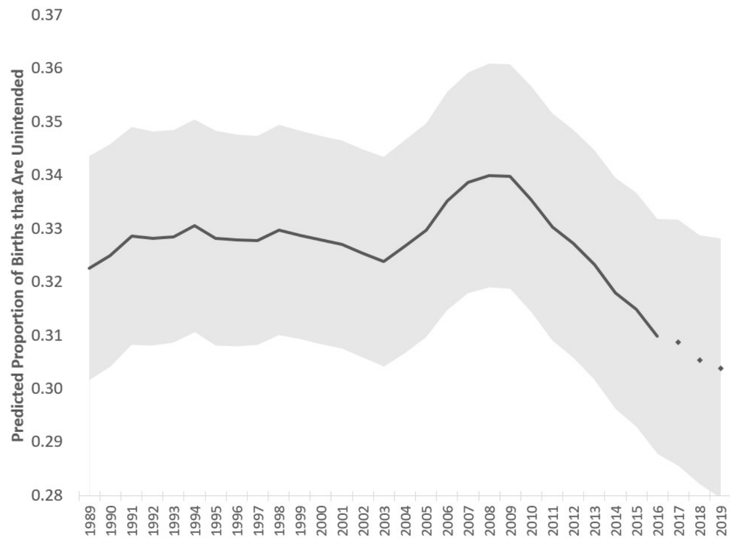
Panel C: Fraction Unintended Births in NSFG



Notes: Figures show the trends in the indicated characteristic in the NSFG data. Figures 3A and 3B also show the trends in the indicated characteristic in the Natality Detail Files (see Figure 2 notes regarding marital status in 2017-2019). Birth years are collapsed into two-year bins (or three in the case of 2015-17) to increase the number of observations in each data point. Results are weighted using the 2011-19 combined weights for birth years 2009-2019, the 2006-2010 cycle weights for birth years 2003-2008, and the 2002 cycle weights for birth years 1999-2002.

Figure 4: Trends in Intended and Unintended Births, 1989-2019

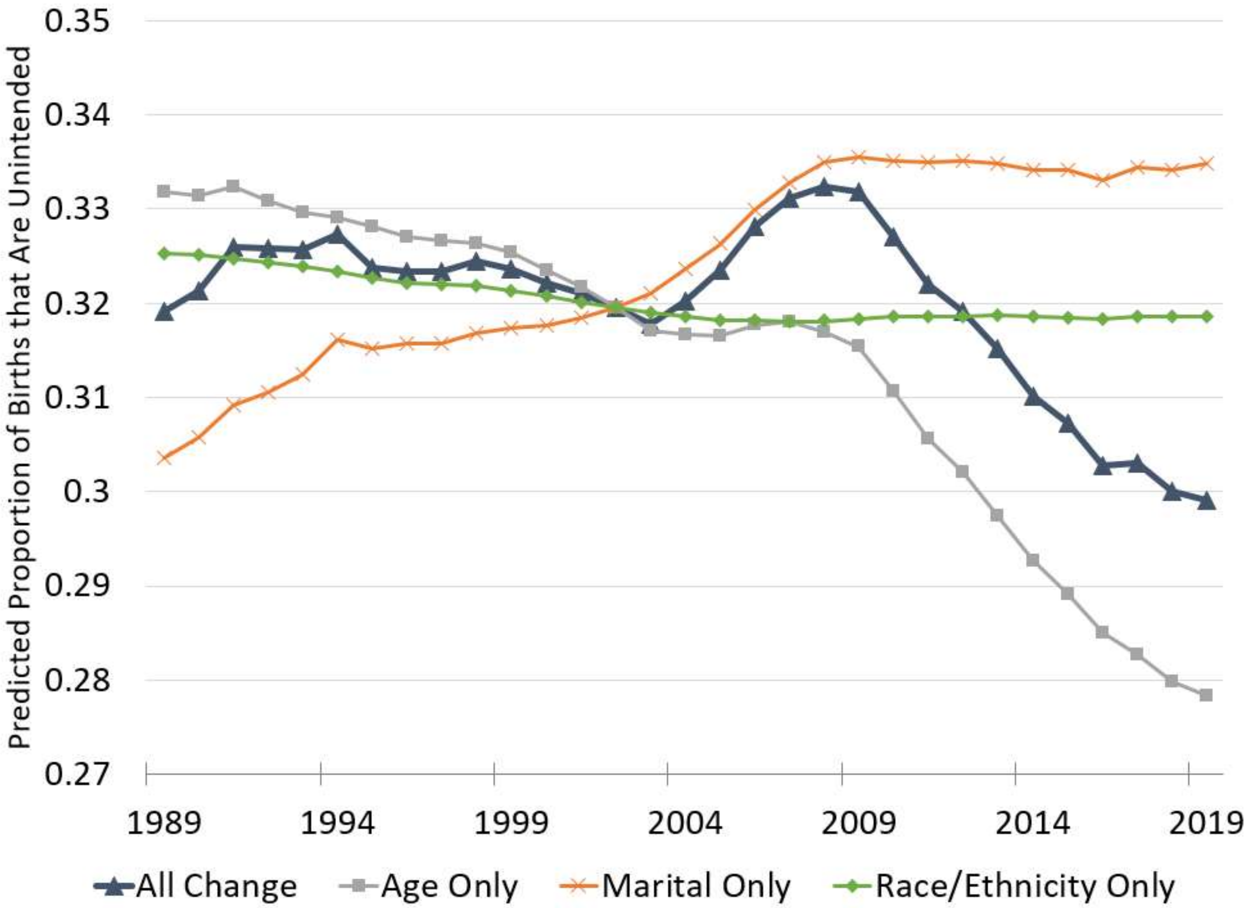
Panel A: The Predicted Proportion of Births that Are Unintended



Panel B: The Predicted Number of Unintended and Intended Births

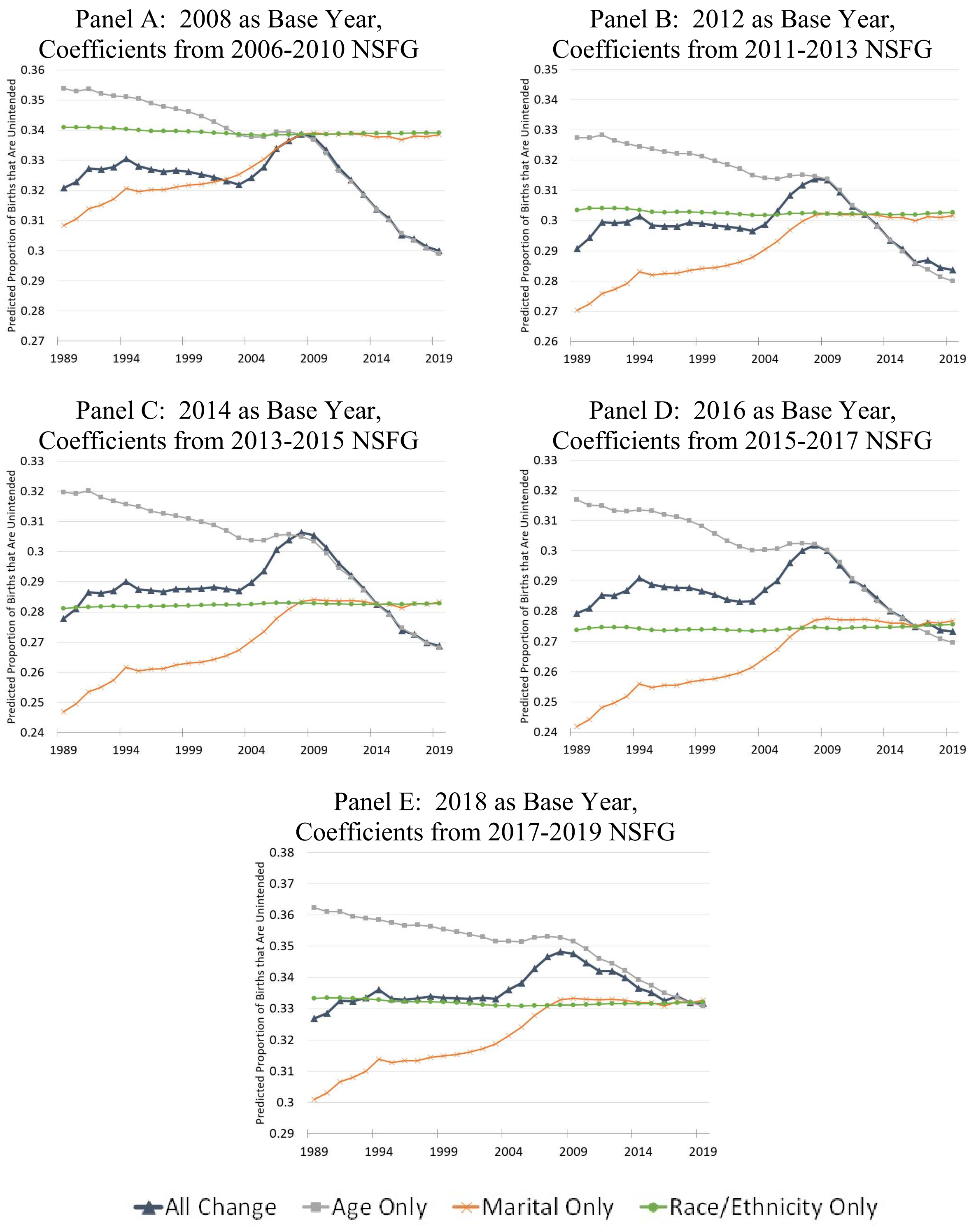
Notes: The predicted proportion of unintended births in each year is estimated using the characteristics of women giving birth in the Natality Detail Files and holding the "returns" to each characteristic constant at the level estimated using the 2002 NSFG. Here, unintended is defined as a birth in which the pregnancy was unwanted or occurred two years or more before intended. The shaded areas in Panel A represent 95% confidence intervals for the prediction. In Panel B, we multiply the number of births in each year by the PPU to get the number of UIB, and by (1-PPU) to get the number of intended births. Marital status is not available in the Natality Files for California after 2016, so predictions for those years rely on marital status statistics from Martin, et al. (2019) and Martin, et al. (2021) (indicated by data points disconnected from the main series).

Figure 5: Decomposition of Changes in the Predicted Proportion of Births that Are Unintended, 1989-2019



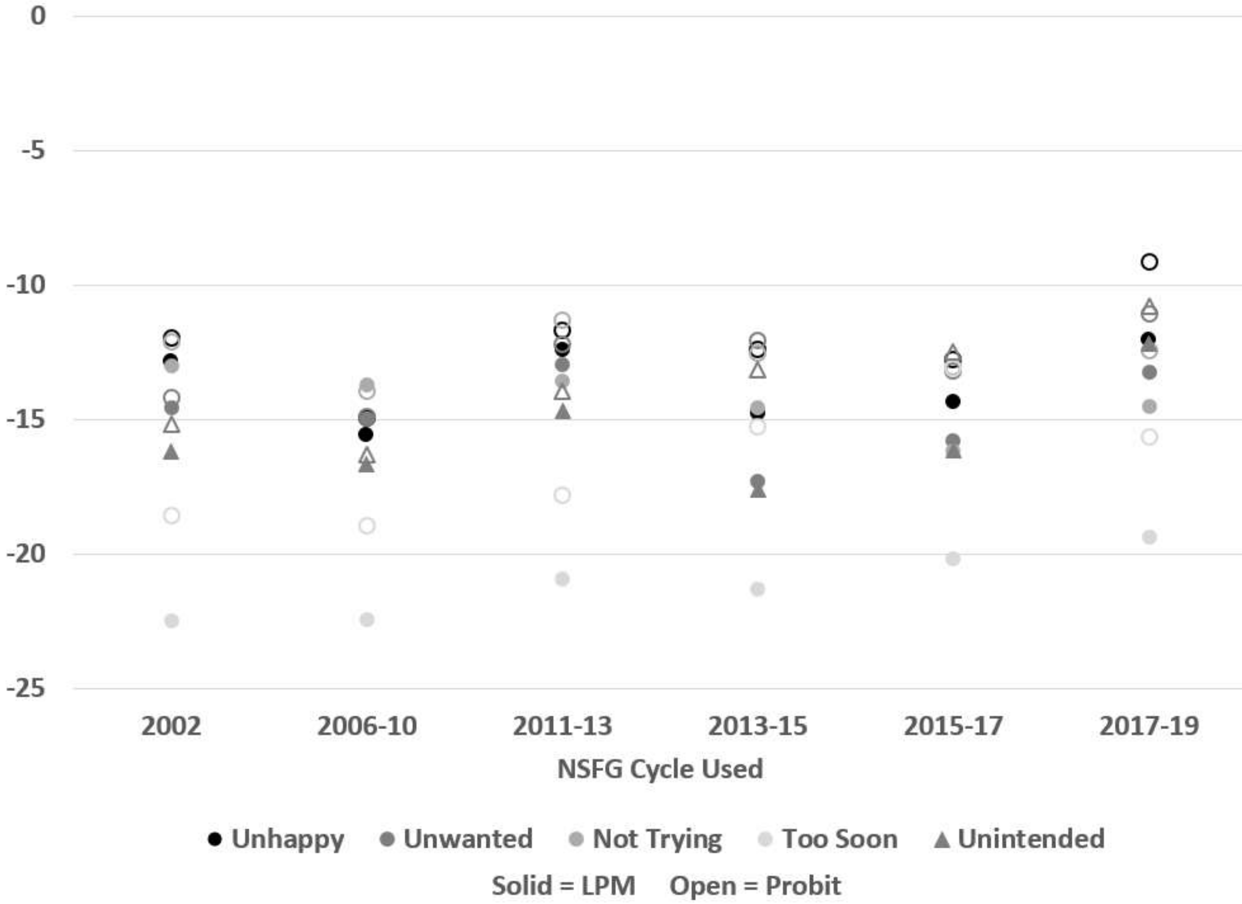
Notes: Figure shows the predicted fraction of births that were unintended in each year, based on the characteristics of women giving birth in that year in the Natality Detail Files and holding the "returns" to each characteristic constant at the level estimated using the 2002 NSFG. For the "All Change" estimate, all characteristics are allowed to fluctuate across years. For each of the other estimates, only one of the characteristics (age, marital status, or race/ethnicity) is allowed to fluctuate while the others are held constant at their 2002 levels. See Figure 4 notes for other details.

Figure 6: Decomposition of Changes in the Predicted Proportion of Births that Are Unintended, 1980-2019, Using Alternative Reference Years



Notes: Figures are created as described in Figure 5, but with the base year changed to the indicated year, rather than 2002.

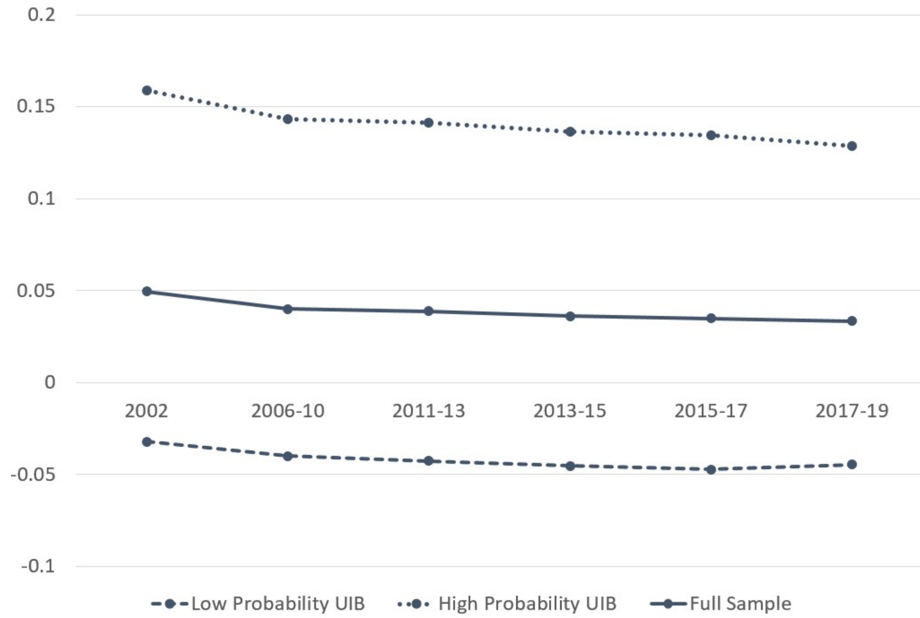
Figure 7: Percent Change in Unintended Births from 2007-2016, Under Sixty Different Specifications of the Prediction Model



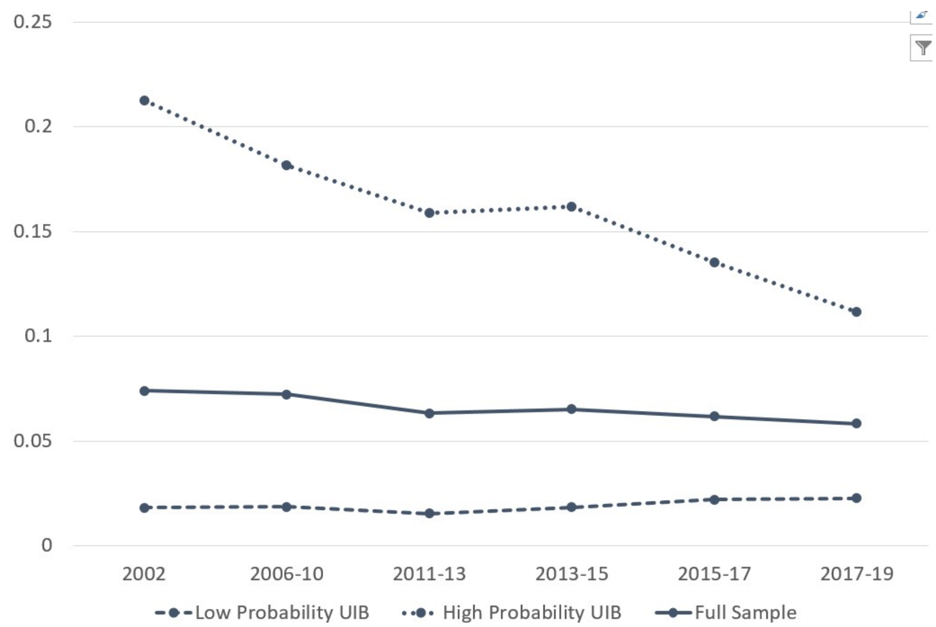
Notes: Figure shows the percent change in the predicted number of unintended births between 2007 and 2016, using different specifications of the prediction model. There are sixty different specifications in total—five definitions of pregnancy intendedness x six different NSFG cycles x two model choices (linear probability or probit). Throughout the paper, our preferred specification uses the 2002 NSFG to estimate a linear probability model, where a birth is defined as unintended if it was unwanted or the pregnancy occurred at least two years sooner than desired; this specification is represented by a solid triangle. See Appendix Table 3 for the R-squared or Pseudo R-squared for each model.

Figure 8: Trends in Unintended Births, by Predicted (UIB) Quartile

Panel A: Predicted Probability of UIB

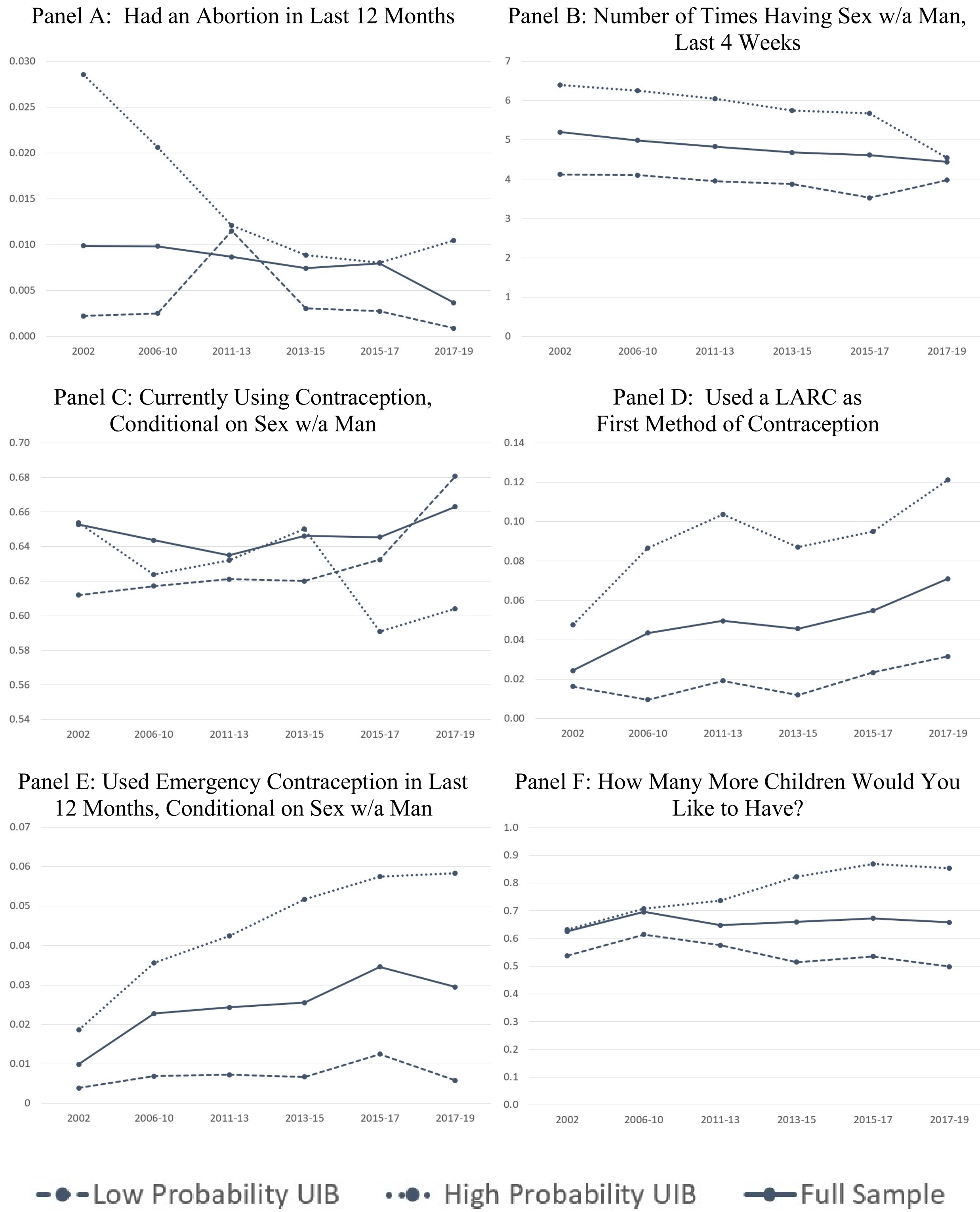


Panel B: Fraction with an Unintended Birth



Notes: Data are from the indicated NSFG Cycle. The low and high probability UIB samples are in the bottom and top quartiles, respectively, of the distribution shown in Appendix Figure 14.

Figure 9: Trends in Fertility-Related Behaviors, by Predicted (UIB) Quartile



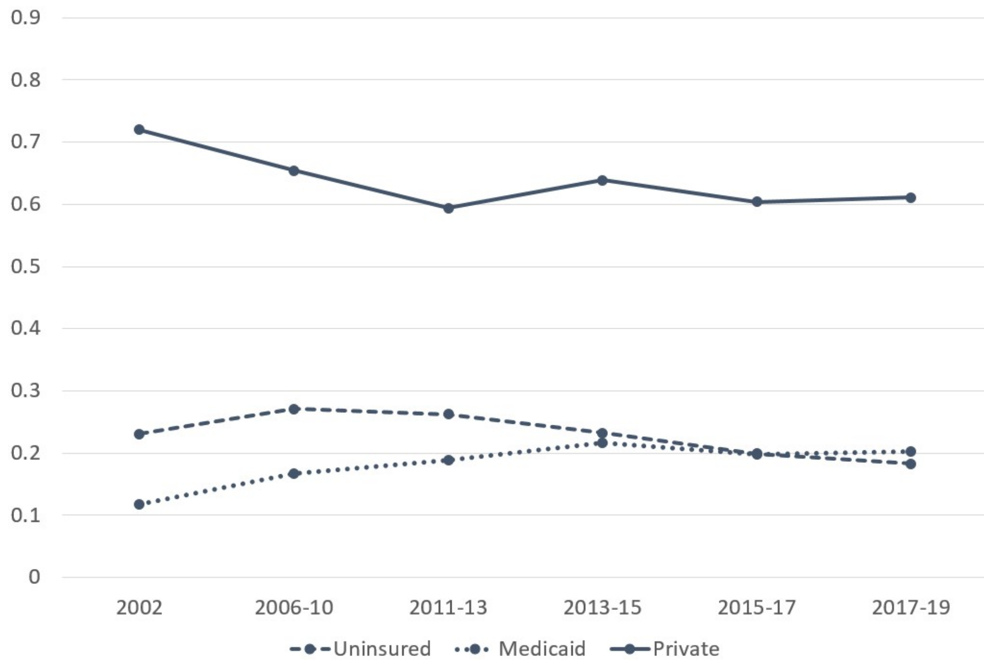
Notes: Data are from the indicated NSFG Cycle. The low and high probability UIB samples are in the bottom and top quartiles, respectively, of the distribution shown in Appendix Figure 14.

Figure 10: Trends in Method of Contraception, for Women Currently Using Any Method

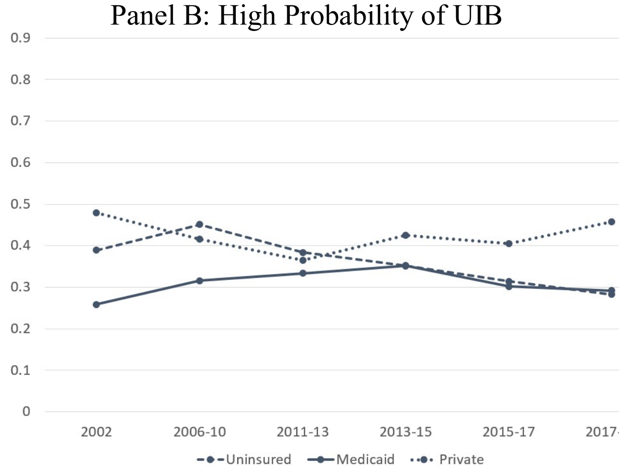
Notes: Data are from the indicated NSFG Cycle. The low and high probability UIB samples are in the bottom and top quartiles, respectively, of the distribution shown in Appendix Figure 14. Long-acting reversible contraceptives (LARCs) and sterilization are grouped together, as both are highly effective methods of birth control.

**Figure 11: Trends in Insurance Coverage,
for Women with a High Probability of an Unintended Birth**

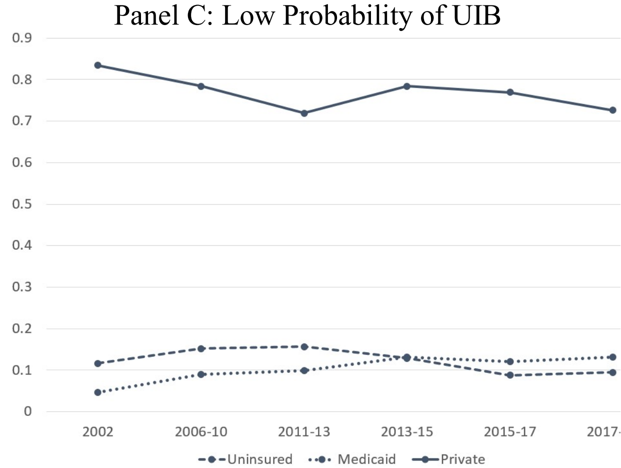
Panel A: Full Sample



Panel B: High Probability of UIB



Panel C: Low Probability of UIB



Notes: Data are from the indicated NSFG Cycle. The low and high probability UIB samples are in the bottom and top quartiles, respectively, of the distribution shown in Appendix Figure 14.

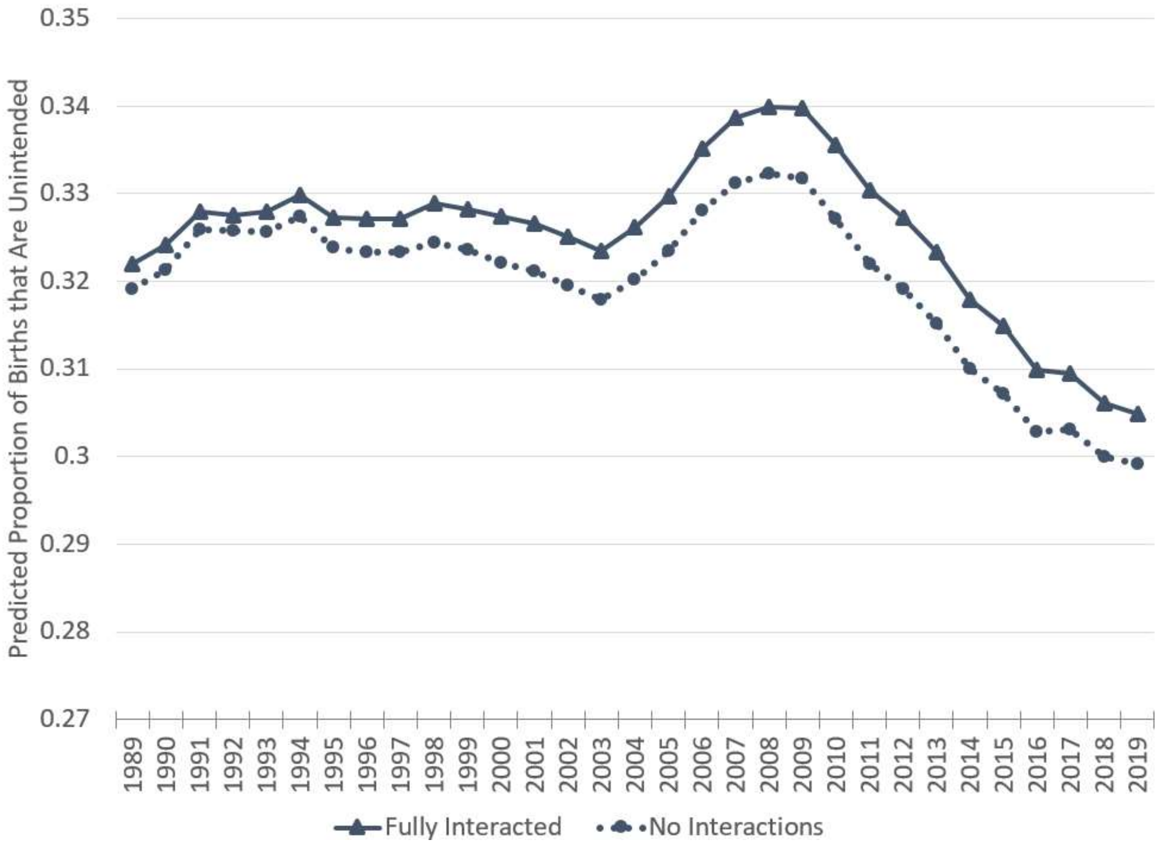
Table 1: Linear Probability Models of Likelihood that the Birth was Unintended, Using Variables Common to NSFG and Natality Detail Files

	NSFG Cycle					
	2002	2006-10	2011-13	2013-15	2015-17	2017-19
Age 15-19	0.3903***	0.3625***	0.3207***	0.2840***	0.3751***	0.2097**
	(0.0417)	(0.0394)	(0.0651)	(0.0732)	(0.0787)	(0.1047)
Age 20-29	0.0807***	0.0866***	0.0918***	0.1153***	0.1369***	0.0786*
	(0.0237)	(0.0229)	(0.0325)	(0.0293)	(0.0384)	(0.0416)
Unmarried	0.2668***	0.2658***	0.2657***	0.3042***	0.2759***	0.2431***
	(0.0307)	(0.0275)	(0.0365)	(0.0363)	(0.0438)	(0.0426)
Black	0.0683*	0.0547*	0.1336***	0.0292	0.1031*	0.0553
	(0.0361)	(0.0309)	(0.0438)	(0.0439)	(0.0539)	(0.0530)
Hispanic	-0.0424	0.0047	0.0158	0.0377	0.0005	-0.0161
	(0.0295)	(0.0296)	(0.0447)	(0.0373)	(0.0433)	(0.0459)
Other Non-White	-0.0305	0.0081	-0.0426	-0.0282	0.0044	0.0053
	(0.0474)	(0.0468)	(0.0475)	(0.0413)	(0.0734)	(0.0692)
Parity	0.0610***	0.0449***	0.0542***	0.0392***	0.0380**	0.0408***
	(0.0129)	(0.0095)	(0.0141)	(0.0121)	(0.0160)	(0.0143)
Metro	0.0104	0.0018	0.0099	0.023	0.0326	0.0136
	(0.0333)	(0.0282)	(0.0410)	(0.0364)	(0.0482)	(0.0439)
Constant	0.0158	0.0341	-0.0259	-0.0268	-0.0552	0.0869
	(0.0403)	(0.0352)	(0.0530)	(0.0447)	(0.0580)	(0.0546)
Frac. Unintended	0.3256	0.3426	0.3162	0.2918	0.2747	0.3419
Observations	2,047	3,134	1,387	1,390	1,213	1,171
R-squared	0.1986	0.1893	0.1950	0.1976	0.1897	0.1086

Notes: Coefficients are from OLS regressions using data from six cycles of the NSFG. For all regressions, the dependent variable is a binary variable indicating that the pregnancy was either unwanted or occurred two years or more before the woman intended. The sample is limited to pregnancies ending in a live birth. Results are weighted by the NSFG final weights. Robust standard errors are in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels.

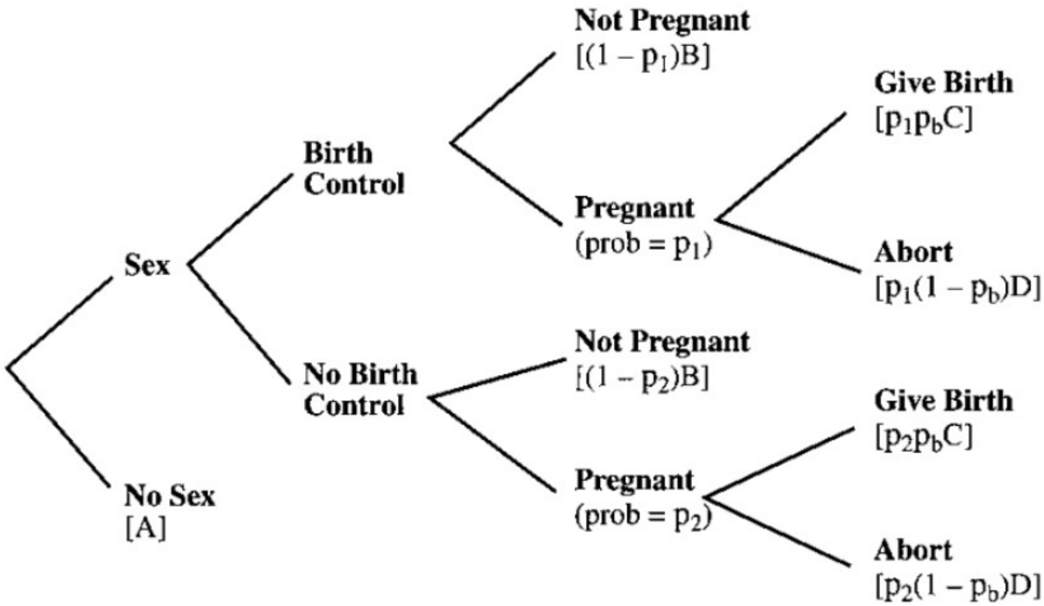
Online Appendix

Appendix Figure 12: Predicted Births that are Unintended, 1989-2019



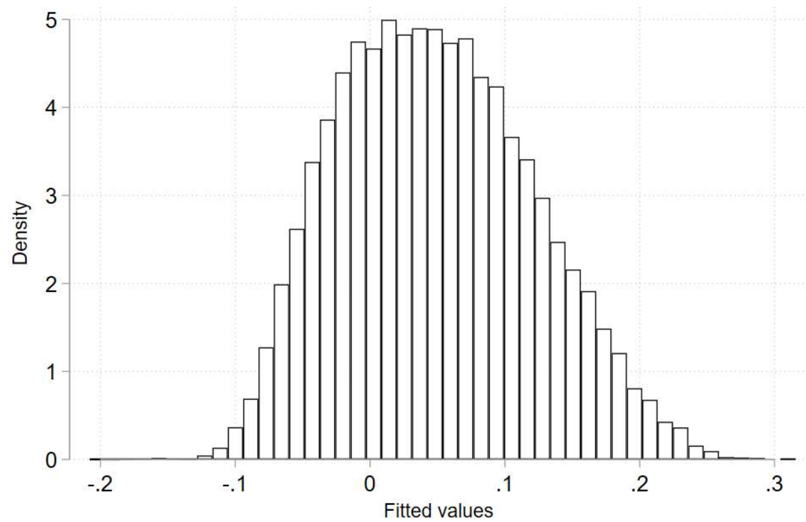
Notes: The predicted fraction and number of unintended births in each year are estimated using the characteristics of women giving birth in that year in the Natality Detail Files and holding the "returns" to each characteristic constant at the level estimated using the 2002 NSFG. This figure is analogous to Figure 4A, but allows a PPU to be constructed for 2017-2019 by using the National Center for Vital Statistics' estimates of the percent of births that are married in these years.

Appendix Figure 13: Fertility Decision Tree



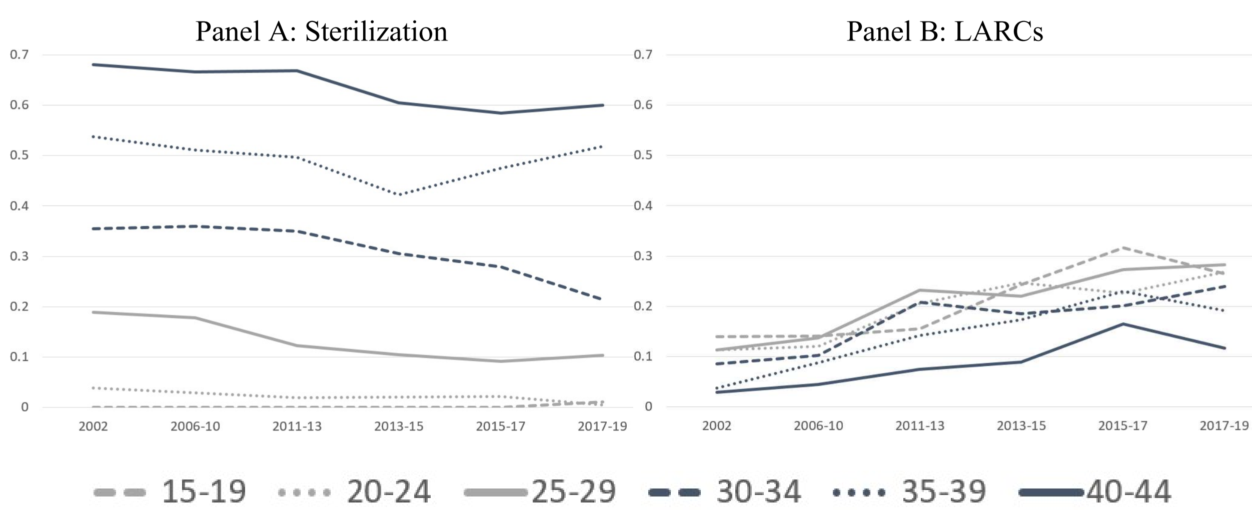
Notes: Figure 4.9 from Levine (2001).

Appendix Figure 14: Distribution of Predicted Probability of Unintended Births



Notes: Figure shows distribution of predicted values from estimating Equation (2), using the 2002 to 2017-19 Cycles of the NSFG. There are 40,822 observations in the sample.

Appendix Figure 15: Fraction of Women Using Highly Effective Methods of Contraception, by Age



Notes: Data are from the indicated NSFG Cycle. Sample is limited to women currently using a method of contraception.

Appendix Table 2:
Model Used to Predict Whether a Birth Was Unintended in Main Specification

	Coefficient	Standard Error	Significance
Age			
16	-0.29630762	(0.329)	
17	0.14861973	(0.147)	
18	-0.01904884	(0.196)	
19	0.16013741	(0.182)	
20	-0.30439553	(0.176)	*
21	-0.25500390	(0.200)	
22	-0.34625518	(0.209)	*
23	-0.22749132	(0.208)	
24	-0.57283258	(0.229)	**
25	-0.67663801	(0.203)	***
26	-0.63630593	(0.189)	***
27	-0.26852053	(0.213)	
28	-0.09141662	(0.221)	
29	-0.35330534	(0.204)	*
30	-0.16574039	(0.242)	
31	-0.73559332	(0.175)	***
32	-0.12424993	(0.303)	
33	-0.42765811	(0.299)	
34	-0.06159627	(0.255)	
35	-0.57073045	(0.261)	**
36	-0.42729795	(0.340)	
37	-0.03850709	(0.399)	
38	-0.60266221	(0.420)	
39	-0.65244031	(0.221)	***
40	0.00217201	(0.308)	
41	0.20488353	(0.318)	
42	-0.14479572	(0.335)	
43	0.12480457	(0.252)	
Married	-0.25334057	(0.343)	
Black Non-Hispanic	0.61917406	(0.345)	*
Hispanic	-0.66416013	(0.258)	**
Other	0.10646714	(0.120)	
Metro Area	-0.74180824	(0.210)	***
Parity			
2	-0.84041768	(0.106)	***
3	0.10429513	(0.284)	

4	0.16031113	(0.286)	
5	0.28643727	(0.285)	
6	0.36196315	(0.319)	
7	-0.20291086	(0.356)	
8	0.18700753	(0.388)	
9	0.12308785	(0.436)	
Married x Age Category			
16	0.00395051	(0.610)	
17	-0.38122368	(0.359)	
18	0.16616821	(0.373)	
19	-0.24074981	(0.350)	
20	-0.31742933	(0.343)	
21	-0.28200641	(0.344)	
22	-0.28094202	(0.347)	
23	-0.44437924	(0.342)	
24	-0.36257449	(0.351)	
25	0.04054082	(0.343)	
26	-0.04095369	(0.341)	
27	-0.40064850	(0.348)	
28	-0.52229470	(0.348)	
29	-0.28995714	(0.353)	
30	-0.53757149	(0.358)	
31	-0.09862825	(0.348)	
32	-0.56043929	(0.369)	
33	-0.17978761	(0.367)	
34	-0.39833340	(0.378)	
35	-0.14622593	(0.374)	
36	-0.41789252	(0.420)	
37	-0.07188244	(0.361)	
38	0.12291488	(0.470)	
39	-0.15497345	(0.349)	
40	-		
Married x Parity			
2	0.05451738	(0.070)	
3	0.34739649	(0.079)	***
Black x Age Category			
16	-0.18531182	(0.396)	
17	-0.85481548	(0.359)	**
18	-0.41484419	(0.354)	
19	-0.78826046	(0.359)	**
20	-0.76821738	(0.359)	**

21	-0.40569216	(0.354)	
22	-0.38258624	(0.364)	
23	-0.73352242	(0.356)	**
24	-0.46263224	(0.371)	
25	-0.01612565	(0.359)	
26	-0.36531913	(0.363)	
27	-0.28317708	(0.358)	
28	-0.46885222	(0.373)	
29	-0.54224360	(0.368)	
30	-0.35460675	(0.380)	
31	-0.22094247	(0.366)	
32	-0.50026762	(0.360)	
33	-0.43034956	(0.380)	
34	-0.69826961	(0.382)	*
35	-0.40676463	(0.429)	
36	-0.59051263	(0.419)	
37	-0.31595424	(0.385)	
38	0.38199532	(0.369)	
39	-0.18841070	(0.404)	
40	-0.85156912	(0.443)	*
Black x Parity			
2	0.05101810	(0.084)	
3	-0.02367523	(0.089)	
Hispanic x Age Category			
16	0.67691422	(0.375)	*
17	0.24383561	(0.292)	
18	0.43273330	(0.312)	
19	0.31279859	(0.294)	
20	0.44384992	(0.294)	
21	0.48341662	(0.302)	
22	0.51917946	(0.304)	*
23	0.32702839	(0.289)	
24	0.56398958	(0.299)	*
25	0.60362327	(0.290)	**
26	0.43912965	(0.296)	
27	0.16760634	(0.297)	
28	0.39331031	(0.295)	
29	0.58219457	(0.298)	*
30	0.53174508	(0.320)	*
31	0.50745833	(0.282)	*
32	0.52178377	(0.303)	*

33	0.48775864	(0.328)	
34	0.57937741	(0.318)	*
35	0.79652542	(0.338)	**
36	0.23609507	(0.309)	
37	0.80513835	(0.340)	**
38	0.93561512	(0.380)	**
39	0.41129428	(0.298)	
40	0.68632829	(0.372)	*
Hispanic x Parity			
2	0.16079697	(0.070)	**
3	0.08834905	(0.078)	
Other x Age Category			
16	-0.29576561	(0.401)	
17			
18	-0.29343960	(0.261)	
19	-0.56038791	(0.325)	*
20	-0.36173436	(0.254)	
21	-0.07241481	(0.232)	
22	0.06641641	(0.265)	
23	0.09758026	(0.441)	
24	0.43110564	(0.298)	
25	0.28853130	(0.276)	
26	-0.27619016	(0.233)	
27	-0.07029783	(0.201)	
28	-0.03175689	(0.228)	
29	0.10445122	(0.225)	
30	0.11261244	(0.204)	
31	0.18278016	(0.264)	
32	0.01816838	(0.262)	
33	-0.19292492	(0.251)	
34	-0.25533050	(0.267)	
35	0.11939384	(0.220)	
36	0.19916449	(0.349)	
37			
38			
39	0.14896376	(0.235)	
40	0.05122471	(0.289)	
Other x Parity			
2	-0.15958233	(0.106)	
3	-0.09863383	(0.122)	
Metro x Age Category			

16	0.79957682	(0.364)	**
17	0.76019365	(0.244)	***
18	0.71219206	(0.251)	***
19	0.69446689	(0.257)	***
20	0.93930656	(0.248)	***
21	0.84459662	(0.254)	***
22	0.84603983	(0.259)	***
23	0.82423180	(0.256)	***
24	0.76454711	(0.256)	***
25	0.75602984	(0.240)	***
26	0.73513025	(0.243)	***
27	0.63712770	(0.237)	***
28	0.63631064	(0.265)	**
29	0.67529488	(0.232)	***
30	0.56643885	(0.249)	**
31	0.76137006	(0.229)	***
32	0.56783497	(0.321)	*
33	0.52636057	(0.291)	*
34	0.27513370	(0.246)	
35	0.58646137	(0.243)	**
36	0.86436272	(0.269)	***
37	0.04779081	(0.437)	
38	0.35915959	(0.282)	
39	0.63860607	(0.240)	***
40	-0.22592646	(0.421)	
Metro x Parity			
2	-0.16077363	(0.063)	**
3	-0.06310333	(0.077)	
Parity 2 x Age Category			
16	1.06795156	(0.576)	*
17	0.97513992	(0.214)	***
18	0.76980227	(0.185)	***
19	0.84921926	(0.169)	***
20	0.84671366	(0.155)	***
21	0.86145908	(0.157)	***
22	0.84744072	(0.171)	***
23	1.00931406	(0.154)	***
24	1.20499623	(0.169)	***
25	0.82661080	(0.157)	***
26	0.94872701	(0.155)	***
27	1.00891793	(0.145)	***

28	0.88472813	(0.143)	***
29	0.81607264	(0.161)	***
30	1.05839276	(0.137)	***
31	0.93021250	(0.138)	***
32	1.00926733	(0.157)	***
33	0.90385413	(0.148)	***
34	1.25753558	(0.171)	***
35	0.96777076	(0.131)	***
36	1.14582419	(0.191)	***
37	0.89443219	(0.155)	***
38	0.75351280	(0.190)	***
39	1.01346087	(0.142)	***
40	1.21627414	(0.274)	***
Parity 3 x Age Category			
16	-0.40165541	(0.496)	
17	0.05042136	(0.279)	
18	-0.09037544	(0.290)	
19	-0.68308491	(0.357)	*
20	0.03695840	(0.312)	
21	-0.01006975	(0.288)	
22	-0.10854153	(0.301)	
23	-0.25340998	(0.289)	
24	0.01813391	(0.300)	
25	-0.13384181	(0.293)	
26	-0.16874014	(0.293)	
27	0.04065979	(0.281)	
28	-0.24604352	(0.279)	
29	-0.39475378	(0.278)	
30	-0.02111073	(0.281)	
31	-0.16004947	(0.277)	
32	-0.02298241	(0.287)	
33	-0.06358178	(0.285)	
34	0.10897955	(0.276)	
35	-0.30107972	(0.269)	
36	-0.07972424	(0.310)	
37	-0.18809687	(0.303)	
38	-0.26949221	(0.278)	
39	-0.28447014	(0.266)	
40			
Married x Black	-0.03868573	(0.077)	
Married x Hispanic	0.07538962	(0.071)	

Married x Other	-0.22705242	(0.130)	*
Married x Metro	0.20273784	(0.078)	***
Metro x Black	-0.09445468	(0.103)	
Metro x Hispanic	0.02144015	(0.085)	
Metro x Other	0.13210271	(0.109)	
Constant	0.89353287	(0.120)	***
Observations	2047		
R-squared	0.3711		

Notes: Table shows coefficients used to create the predicted fraction unintended in Figure 4A. Coefficients are from an OLS regression using data from the 2002 NSFG. The dependent variable is a binary indicator indicating that the pregnancy was either unwanted or occurred two years or more before the woman intended. The sample is limited to pregnancies ending in a live birth. Results are weighted by the NSFG final weights for the 2002 cycle. Standard errors are robust to heteroskedasticity. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels.

Appendix Table 3:
R-Squareds and Pseudo R-Squareds for Models in Figure 7

	NSFG Cycle					
	2002	2006-10	2011-13	2013-15	2015-17	2017-19
Unhappy	0.2969	0.2647	0.3359	0.3234	0.4289	0.3713
Unwanted	0.3211	0.2689	0.3712	0.3597	0.4012	0.3795
Not Trying	0.3023	0.2630	0.3509	0.3142	0.3935	0.3665
Too Soon	0.3562	0.3073	0.3852	0.4241	0.4693	0.3649
Unintended	0.3711	0.3144	0.4022	0.3904	0.4435	0.3465

	NSFG Cycle					
	2002	2006-10	2011-13	2013-15	2015-17	2017-19
Unhappy	0.2221	0.1668	0.2291	0.2160	0.2778	0.2186
Unwanted	0.2545	0.1671	0.2432	0.2397	0.2424	0.2582
Not Trying	0.2258	0.1552	0.2317	0.2140	0.2215	0.2402
Too Soon	0.2652	0.2101	0.2753	0.2848	0.2551	0.2462
Unintended	0.2818	0.2067	0.2790	0.2573	0.2517	0.2136

Notes: Table shows the R-squared or pseudo R-squared for sixty different models used to predicted birth intendedness in the NSFG—five definitions of pregnancy intendedness x six different NSFG cycles x two model choices (linear probability or probit). These models are used to produce the results in Figure 7.

Appendix Table 4:
Model Used to Predict Whether a Woman Has Had an Unintended Birth

	Coefficient	Standard Error	Significance
Age			
16	0.0060	(0.0162)	
17	0.0266	(0.0209)	
18	0.0898	(0.0246)	***
19	0.1646	(0.0299)	***
20	0.1685	(0.0264)	***
21	0.2223	(0.0308)	***
22	0.1898	(0.0248)	***
23	0.2305	(0.0286)	***
24	0.2060	(0.0280)	***
25	0.2279	(0.0321)	***
26	0.1863	(0.0358)	***
27	0.1211	(0.0205)	***
28	0.1769	(0.0330)	***
29	0.1439	(0.0250)	***
30	0.1304	(0.0245)	***
31	0.1335	(0.0230)	***
32	0.1235	(0.0221)	***
33	0.1373	(0.0259)	***
34	0.0912	(0.0198)	***
35	0.0825	(0.0205)	***
36	0.0958	(0.0231)	***
37	0.0758	(0.0178)	***
38	0.1109	(0.0286)	***
39	0.0700	(0.0153)	***
40	0.0453	(0.0142)	***
41	0.0609	(0.0151)	***
42	0.0647	(0.0239)	***
43	0.0457	(0.0145)	***
44	0.0575	(0.0166)	***
Years of Education			
10	0.0298	(0.0207)	
11	0.0038	(0.0233)	
12	-0.0181	(0.0163)	

13	-0.0473	(0.0183)	***
14	-0.0519	(0.0177)	***
15	-0.0947	(0.0185)	***
16	-0.0769	(0.0163)	***
17	-0.0861	(0.0191)	***
18	-0.0677	(0.0219)	***
19+	-0.0486	(0.0207)	**
Born Outside the U.S.	0.0293	(0.0109)	***
Mother's Education			
High School	-0.0098	(0.0111)	
Some College	-0.0047	(0.0134)	
College Degree+	-0.0056	(0.0132)	
Mother's Work Status			
Part Time	-0.0051	(0.0093)	
Both Full and Part Time	-0.0126	(0.0177)	
No Work for Pay	0.0061	(0.0085)	
Missing	-0.0267	(0.0564)	
Mother's Age at First Birth			
18-19	-0.0212	(0.0135)	
20-24	-0.0224	(0.0121)	*
25-29	-0.0374	(0.0134)	***
30+	-0.0268	(0.0176)	
Missing	-0.0034	(0.0269)	
Intact Home at 18	0.0243	(0.0088)	***
Race/Ethnicity			
Non-Hispanic White	-0.0082	(0.0125)	
Non-Hispanic Black	0.0305	(0.0149)	**
Other	0.0077	(0.0195)	
Parents Married at Birth			
No	-0.0089	(0.0124)	
Missing	-0.0655	(0.0231)	***
Age at Menarche			
10	-0.0184	(0.0288)	
11	-0.0093	(0.0271)	
12	-0.0069	(0.0267)	
13	-0.0091	(0.0268)	
14	-0.0016	(0.0278)	
15	-0.0048	(0.0300)	
16	-0.0003	(0.0377)	

17	0.0633	(0.0738)	
18	-0.0401	(0.0492)	
19	-0.0924	(0.0345)	***
21	0.0010	(0.0369)	
22	-0.0990	(0.0441)	**
Periods Not Yet Begun	-0.1227	(0.0468)	***
Missing	-0.0164	(0.0557)	
Religion Raised In			
Catholic	0.0198	(0.0131)	
Baptist	0.0115	(0.0141)	
Meth/Luth/Pres/Episc	0.0060	(0.0133)	
Fundamentalist	0.0284	(0.0211)	
Other Protestant Denom.	0.0280	(0.0223)	
Protestant, No Denom.	-0.0132	(0.0209)	
Other Non-Christian	-0.0087	(0.0151)	
Missing	0.0558	(0.0801)	
Constant	-0.0158	(0.0303)	
Observations	7483		
R-squared	0.0776		

Notes: Table shows coefficients used to create the predicted probability that a woman has had an unintended birth within the last 3 years, used in Figures 8-11. Coefficients are from an OLS regression using data from the 2002 NSFG Respondent file. The dependent variable is a binary indicator indicating that the woman had a birth within the last three years *and* that she described the birth as either unwanted or occurring two years or more before the woman intended. Results are weighted by the NSFG final weights for the 2002 cycle. Standard errors are robust to heteroskedasticity. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels.

Appendix Table 5: Characteristics of NSFG Respondents in Top and Bottom Quartiles of the Predicted Probability of an Unintended Birth

	Full Sample	Bottom Quartile	Top Quartile
Pr(UIB)	0.050	-0.032	0.159
UIB	0.075	0.018	0.212
Age	29.97	33.74	24.86
>HS Educ	0.507	0.679	0.263
Born Outside U.S.	0.143	0.099	0.199
Mom >HS	0.401	0.446	0.319
Mom Teen Birth	0.340	0.218	0.517
Intact Home at 18	0.653	0.821	0.471
Age at Menarche	12.570	12.588	12.510
Non-Hispanic White	0.657	0.832	0.421
Non-Hispanic Black	0.139	0.045	0.257
Non-Hispanic Other	0.056	0.051	0.057

Notes: Table shows summary statistics for women in the 2002 NSFG, for the full sample (n=7,643) and for those in the bottom (n=1,870) and top (n=1,871) quartiles of the distribution shown in Appendix Figure 14. “UIB” is an acronym for “unintended birth.”