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The Demand for Season of Birth

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Abstract

We study the determinants of season of birth, for white married women aged 20-45 in the US, using birth certificate and Census data. We also elicit the willingness to pay for season of birth through discrete choice experiments implemented on the Amazon Mechanical Turk platform. We document that the probability of a spring first birth is significantly related to mother's age, education, smoking status during pregnancy, and the mother working in "education, training, and library" occupations, whereas a summer first birth does not depend on socio-demographic characteristics. We find consistent but stronger correlates when focusing on second births, while all our findings are muted among unmarried women. We estimate the average willingness to pay for a spring birth to be 600 USD, which is about 18% of the most valued birth in our Amazon Mechanical Turk experimental sample or 15% of the mean charges for a normal birth in 2013 according to the Agency for Healthcare Research and Quality.

JEL Classification Codes: I10, J01, J13.
Keywords: quarter of birth, fertility timing, willingness to pay, NVSS, ACS-IPUMS, Amazon Mechanical Turk, discrete choice experiments.

1 Introduction

Motivation. While the relevance of season of birth has been acknowledged at least since Huntington's 1938 book "Season of Birth: Its Relation to Human Abilities", it was not until recently that season of birth became prominent in biology, economics and social sciences more generally. There is now a well-established literature illustrating a variety of aspects that are significantly correlated with season of birth, including birth weight, education, earnings, height, life expectancy, schizophrenia, etc. Although understanding the channels through which season of birth affects these outcomes still represents a scientific challenge, in the US, winter months are associated with lower birth weight, education, and earnings, while spring and summer are found to be "good" seasons (e.g., Buckles and Hungerman, 2013; Currie and Schwandt, 2013).

This paper. Using birth certificate and Census data we provide new evidence on season of birth patterns and correlates with demographic and socioeconomic characteristics among white married women, which are absent among unmarried women and those using assisted reproductive technology (ART) procedures. We argue that these can be explained by season of birth being a choice variable subject to economic and biological constraints, for those who may plan fertility. The plausibility of a demand for season of birth is also suggested by the positive willingness to pay for season of birth (and in particular, spring), which we estimate using discrete choice experiments in the online Amazon Mechanical Turk platform.

Using US Vital Statistics data from 2005 to 2013 on all first singleton births to white married women aged 20-45, we show that the prevalence of spring births is related to mother's age in a humped-shaped fashion, positively related to education, and negatively related to smoking and receiving food benefits during pregnancy, conditional on gestation week, state and year fixed effects. However, maternal characteristics do not correlate with the probability of having a baby in summer. Interestingly, we find stronger spring correlates when focusing on second births, which is consistent with season of birth being a matter of choice: Learning—if mothers become better at either understanding the benefits (costs) of spring (non-spring) births, or at targeting season over time—and/or biological effects—if mothers who have already had a first birth are less likely to be biologically constrained (i.e., they are more likely to conceive when they would like).

We then examine the interaction of a first singleton child's season of birth with her mother's occupation using data from the American Community Survey for 2005-2014. Our findings reveal that in professions allowing more flexibility in taking time off work and those that have summer breaks (e.g., among teachers), mothers are additionally more likely to choose spring births but *not* summer births, and this holds conditional on age, education, being Hispanic, and state and year fixed effects. Finally, we focus on the placebo group of unmarried women: All our seasonal patterns are muted among them, consistent with the idea that unmarried women are much less likely to plan fertility and conceptions, and thus to choose season of birth. Indeed, in the US, unmarried women are reported to be more than twice as likely to have unwanted pregnancies than married women (Finer and Zolna, 2016; Mosher et al., 2012).

Inspired by Buckles and Hungerman (2013), who recognize that a thorough investigation of preferences for birth timing is an open and fertile challenge for future work, we devised and ran a series of discrete choice experiments in the Amazon Mechanical Turk market place in September 2016, to elicit the willingness to pay for season of birth. We estimate the average willingness to pay for a spring birth to be 600 USD, which is about 18% of the most valued birth in our Amazon Mechanical Turk sample or 15% of the mean charges for a normal birth in 2013 according to the Agency for Healthcare Research and Quality. This is a non-negligible magnitude which supports our contention that there is indeed a demand for season of birth.

Both our correlates and the estimated value of season of birth are consistent with the prominence of fertility planning in balancing people's work and family life. Far from assuming that the average woman is aware that both birth and long-term outcomes are affected by season of birth, it is sufficient to consider that the average woman has a sense that, on one hand, winter months may be tougher birth months because of cold weather and higher disease prevalence,[1] so that a spring birth maximizes the time a baby spends developing and strengthening before her first winter arrives. On the other hand, work commitments and summer work breaks may make it much easier to maximize time home with the child with a spring birth, for instance, among teachers.[2] Summer is the most popular birth season in the US (almost 2 pp higher than spring) but apparently this is the result of the peak conception times of November and December, the holiday season in the US (Thanksgiving and Christmas). Indeed, the prevalence of summer births does not depend on mothers' observable characteristics and is not explicitly preferred to spring in terms of experimentally elicited willingness to pay.

Economic significance. Our estimated seasonality gaps, between 0.7 pp (smoking during pregnancy gap) and 0.9 pp (received food benefits during pregnancy) in the NVSS, and 4.6 pp by occupation in the ACS, are sizable. Buckles and Hungerman (2013) report a 1 pp difference in teenage mothers and a 2 pp difference in unmarried or non-white mothers between January births and May births, and they interpret these gaps as "strikingly large" compared to the estimated effects of welfare benefits on non-marital childbearing (Rosenzweig, 1999) or unemployment on fertility (Dehejia and Lleras-Muney, 2004). More recently, Raute (2015) assesses the effects of changes in financial incentives on fertility arising from a reform in parental leave benefits in Germany, and she finds that a €1,000 increase in parental benefits raises the probability of having a child in the four years post-reform by (at least) 1.2%.

[1] According to the CDC (2014), from 1982-83 through 2013-14, the "peak month of flu activity" (the month with the highest percentage of respiratory specimens testing positive for influenza virus infection), has been February (14 seasons), followed by December (6 seasons) and January and March (5 seasons each): http://www.cdc.gov/flu/about/season/flu-season.htm.

[2] The report on Fertility, Family Planning, and Women's Health (CDC, 1997) notes that some women do not take maternity leave due to the timing of birth relative to their job schedules.

Statistical significance. In this paper we use large and very large samples, in particular when using birth certificate and Census data. As noted by Leamer (1978), in very large samples almost any hypothesis of the sort $\beta = 0$ is rejected. Deaton (1997) notes that classical statistical procedures for hypothesis testing set the critical value in such a way that the probability of rejecting the null when it is correct, the probability of Type I error, or the size of the test, is fixed at some pre-assigned level (5 or 1 percent). However, these procedures take no explicit account of the power of the test, the probability that the null hypothesis will be rejected when it is false, or its complement, the Type II error, the probability of not rejecting the null when it is false. As elegantly discussed by Leamer (1978), meaningful hypothesis testing requires the significance level to be a decreasing function of sample size: Classical hypothesis testing at a fixed level of significance increasingly distorts the interpretation of the data against a null hypothesis as the sample size grows. By raising the critical values of test statistics with the sample size, the benefits of increased precision are more equally allocated between reduction in Type I and Type II errors (Deaton, 1997). Leamer's suggestion is to adjust the critical value for t tests as follows: Instead of using the standard tabulated values, the null hypothesis is rejected when the calculated t value exceeds the square root of the logarithm of the sample size, that is, reject $H_0 : \beta = 0$ if and only if $t_{act} > \sqrt{\log(N)}$.[3] This paper follows such an approach for all confidence intervals, statistical significance thresholds and hypothesis testing.

Related literature. Recent work by Barreca et al. (2015) suggests that individuals may make short-term shifts in conception month in response to very hot days, with resulting declines and rebounds in the following months. However, it is not clear how and why these short-term shifts would impact the seasonal distribution of births between seasons (or quarters) of birth. Currie and Schwandt (2013) explain the first quarter of birth disadvantage

[3]The actual derivation in Leamer is formulated in terms of F tests. Leamer (1978, 114-115) shows that the critical value for an F test is $\left[\frac{N-K}{P}\right]\left(N^{\frac{P}{N}} - 1\right)$ where P is the number of restrictions and K is the number of parameters. Moreover, this critical value can be approximated by $\log(N)$. In this paper we use the exact rather than approximate values when conducting tests.

through the negative impact of the disease environment on birth weight and gestational weeks in cold months (influenza at birth drives seasonality in gestational length), whereas Buckles and Hungerman (2013) emphasize the role of maternal characteristics in shaping the later socioeconomic disadvantage of winter-borns, showing that their mothers are less educated, less likely to be married or white, and more likely to be teenagers.[4] They also show that seasonality appears to be driven by wanted births—there is no seasonality in maternal characteristics among unwanted births, as revealed by the data from the National Survey of Family Growth. In France, Régnier-Loilier (2010) finds that "the primary school teachers' April peak is almost entirely due to seasonal birth strategies", although his data, the French registry of live births, do not report mother's occupation for 40% of the births, and primary school teachers represent a small selected group of women working in the educational sector.

Régnier-Loilier (2010) in France and Buckles and Hungerman (2013) in the US are the only socioeconomic analyses for non-agricultural societies that are consistent with season of birth being a choice variable. However, none of these studies runs any maternal characteristics analysis for spring and summer separately, or among married and unmarried women, illustrating differences due to planning and birth order. In addition, none of these studies is able to elicit the willingness to pay for season of birth. We are the first to provide strong and non-speculative evidence that there is indeed a demand for season of birth.

There is also a literature on "exact" birth timing that analyzes the joint decision of parents and physicians to alter the delivery of an already existing pregnancy (in response to non-medical incentives). Shigeoka (2015), focusing on the distribution of births between December and January, finds that in Japan many births are shifted one week forward around the school entry cutoff date. In the US, instead, birth timing does not happen systematically before school-eligibility cutoff dates (Dickert-Conlin and Elder, 2010). Dickert-Conlin and Chandra (1999) and LaLumia et al. (2015) report that in the US parents may move expected January births backwards to December to gain tax benefits, while Gans and Leigh

[4] Alba and Cáceres-Delpiano (2014) describe similar findings for Chile and Spain.

(2009) estimate that parents moved forward June deliveries to become eligible for a newly introduced "baby bonus" in Australia. Fewer births are documented on holidays (Rindfuss et al., 1979) and weekends (Gould et al., 2003), medical professional meeting dates (Gans et al., 2007), and less auspicious dates (Almond et al., 2015). This body of evidence clearly shows that parents may be willing and able to manipulate birth timing, but this represents a choice made well *after* conception occurs. Our analysis departs from this literature too, since we study a choice made *before* conception occurs.

Structure of the paper. Section 2 describes the data sources. Section 3 presents the analysis of the correlates of season of birth using birth certificate and census data. Section 4 provides the analysis of willingness to pay for season of birth. Section 5 concludes the paper.

2 Data Sources

2.1 Birth Certificate Data

Data on all births occurring each year in the US are collected from birth certificate records, and are publicly released as the National Vital Statistics System (NVSS) by the National Center of Health Statistics. These data are available for all years between 1968 and 2013, with all registered births in all states and the District of Columbia reported from 1984 onwards.[5] In total, more than 99% of births occurring in the country are registered (Martin et al., 2015). The birth certificate data record important information on births and their mothers. For the mother, this includes age, race, ethnicity, marital status, education, smoking status during pregnancy, and, since 2009, ART use, whether the mother received WIC (Women, Infants & Children) food benefits during pregnancy, height and pre-pregnancy

[5] Prior to 1984, a 50% sample was released for those states that did not submit their birth records on electronic, machine readable tape (Martin et al., 2015).

weight.[6] We use height and pre-pregnancy weight to construct pre-pregnancy BMI and the standard BMI categories: Underweight (BMI < 18.5), Normal Weight ($18.5 \leq$ BMI < 25), Overweight ($25 \leq$ BMI < 30) and Obese (BMI ≥ 30).[7] For the newborn, in addition to place and time of birth, measures include birth parity, singleton or multiple births status, gestational length (in weeks), birth weight, and one- and five-minute APGAR scores.[8]

Our main estimation sample consists of the years 2005-2013, and we retain all singleton first-births to white married mothers aged 20-45 who are issued an updated birth certificate with available education, smoking status and gestational length: 3,470,644 births, 3,468,715 of which have gestation length recorded, that is, for whom conception month is known. Season of birth is defined as the *expected* (intended) season of birth, which we compute combining information on the month of birth and gestational length. In practice, and following Currie and Schwandt (2013), month of conception is calculated by subtracting the rounded number of gestation months (gestation in weeks $\times$ 7/30.5) from month of birth. Hence, we focus on the *planning* of season of birth, i.e., the decision to conceive.[9]

While our main sample focuses on first births, we also investigate birth patterns and correlates among singleton second births occurring to white married mothers aged 20-45 (3,503,846 and 3,501,874).[10] Then, for both first- and second-births, we focus on the placebo group of unmarried women, based on the logic that women in this group are much less likely to plan fertility and conceptions, and thus to choose season of birth. We focus on white unmarried mothers aged 20-45 (first births: 1,843,016 and 1,841,119 births; second births:

[6] The question on WIC benefits is: "Did you receive WIC food for yourself because you were pregnant with this child?"

[7] When using pre-pregnancy BMI, we restrict our sample to mothers with a BMI between 16 and 40. Hence, we exclude the severely underweight (BMI < 16) and obese class III (BMI ≥ 40), following the BMI classification from the WHO.

[8] Birth certificates have gone through two important revisions in the variables reported: one in 1989 and the other in 2003. These revisions (described fully in NCHS, 2000) were implemented by states at different points in time. Prior to 2005, all states had fully incorporated the 1989 revision. In the most recent wave of birth certificate data (2013), 41 states, containing 90.2% of all births, had switched to the more recent 2003 revision. Importantly, the revised data include a different measure of education, a wider range of birth outcomes, and various new measures such as ART and WIC usage discussed above.

[9] Using *actual* or *expected* season of birth is immaterial for our findings.

[10] Descriptive statistics for these women and their births are provided in online appendix tables A1 and A2.

1,401,849 and 1,400,225 births).[11]

2.2 Census Data

The US birth certificate data do *not* contain information on mother's occupation. In order to investigate the role of mother's occupation in explaining season of birth, we supplement our analysis of NVSS data with the American Community Survey (ACS) conducted by the United States Census Bureau on a representative 1% of the US population every year (Ruggles et al., 2015). Along with demographic and socioeconomic characteristics of women, we observe their labor market outcomes, and specifically occupation which is coded using the standard Census occupation codes and defined as the individual's primary occupation for those who had worked within the previous five years.

We use data from 2005 to 2014, the most recent available survey, and focus on white married women aged 20-45 who are either the head of the household or spouse of the head of the household, and have a first singleton child who is *at most* one year old.[12] Given that Census data do not provide gestational length, season of birth is defined as the *actual* quarter of birth, not the *expected* one.

The ACS data allow us to study the relationship between the season of birth of the first-born and mother's occupation. To that end, we retain only women who had worked within the previous five years in non-military occupations where each occupation must have at least 500 women over the entire range of survey years.[13]

2.3 Amazon Mechanical Turk Data

We collect data on preferences for season of birth, alongside respondents' demographic and socioeconomic characteristics, devising and running a series of discrete choice experi-

[11] Descriptive statistics for unmarried mothers and their first births are provided in online appendix tables A3 and A4.

[12] We exclude women who are in the military, in a farm household, or currently in school.

[13] The very small number of observations of households containing two women have been excluded.

ments to elicit the willingness to pay for season of birth. All this information was obtained through a survey designed using Qualtrics and administered on the Amazon Mechanical Turk platform, which is an online labor market with hundreds of thousands of "workers". Mechanical Turk "workers" have been found to be more representative of the US population than in-person convenience samples, standard internet samples, typical college student samples, or other surveys, and are increasingly relied upon in cutting-edge economic research, well beyond experimental economics (Berinsky et al., 2012; Kuziemko et al., 2015; Francis-Tan and Mialon, 2015).

We published a "HIT" (Human Intelligence Task) request for 2,000 "workers" to complete a short survey, about 6-minutes long, and paid $1.10 (which corresponds to a pay rate of about $10 per hour), on a Monday in September 2016. We devised the following requirements to ensure the validity of our data. We restricted eligibility to those with approval rates above 95% and with more than 100 tasks already completed, while including an attention-check question and asking for the education level at the beginning and end of the survey to check for consistency. We also dropped those who finished the survey in less than 2 minutes and those who had an IP address which suggested that they were based outside of the US (5.05% of respondents were dropped with all these checks, mainly because their geographic IP was outside of the US, 3.7%). In addition, the survey was designed in such a way that respondents need to answer each and every question to be able to move to the following screen and thus to complete the survey. Respondents were clearly instructed that payment was contingent on submitting a numerical code visible only at completion. All "workers" need to have a US social security number to be able to register in the Mechanical Turk platform as "workers" since 2009, however, we took the additional precaution of launching the survey at 9.00 am East Coast time, to increase the likelihood that respondents were actually residing in the US rather than in Asia, for instance, since all our analysis is based on US data. By 2.13 pm, 2,000 respondents had completed our task.[14]

[14]We had run a pilot a few months before, and we prevented the same participants to take our survey in September to avoid priming effects.

3 Season of Birth Correlates

3.1 Main sample: White married mothers

Tables 1 and 2 display summary statistics for white married mothers aged 20-45 and their first singleton births born between 2005 and 2013, respectively. The average mother's age in our group is 28, 18% are Hispanic, 62% have at least some college and 4% report having smoked during pregnancy. In addition, for births occurring after 2009, we have information on whether those were conceived through the use of assisted reproductive technology (1%), whether the mother received food benefits during pregnancy (19%), and her pre-pregnancy body mass index (the average mother being nearly overweight, 24.96). The highest prevalence of first births is concentrated in the summer (0.27), and the lowest in winter (0.23). The average baby is born weighing 3.3 kg (7lbs 5oz) and has a gestational length of 39 weeks; 6% of babies are born with low-birth weight (<2.5 kg, 5lbs 8oz); and 8% are born prematurely (< 37 weeks).

[Table 1 about here]

[Table 2 about here]

Figure 1 displays the fraction of first births by month of birth during the period 2005-2013 for white married mothers aged 20-45. The figure mimics the findings reported in Table 2. We can see that the season with the highest prevalence is summer (July, August, September: 0.27), followed by spring (April, May, June: 0.25), fall (October, November, December: 0.25) and winter (January, February, March: 0.23). If we compare Figure 1 with that emerging from the second-birth sample (Figure 2), we observe an increase in the prevalence of spring births at birth two, from 0.25 to 0.26.

[Figure 1 about here]

[Figure 2 about here]

In Figure 3, panel a, we can see that "younger" (28-31) mothers are more likely to expect to have their first birth in summer and spring than "older" (40-45) mothers, while the former are less likely to expect to have their first birth in winter and fall than the latter. If "younger" and "older" mothers have the same preferences for season of birth, this pattern may reveal that "older" mothers are more biologically constrained than "younger" mothers. Of course, this biological pattern may be reinforced by different preferences, i.e., if "older" mothers are less concerned about the season of birth and more about getting pregnant than "younger" mothers. Interestingly these differences are much more pronounced among second births (Figure 4, panel a), which is consistent with season of birth being a matter of choice: Learning—if mothers become better at either understanding the benefits (costs) of spring (non-spring) births, or at targeting season over time—and/or biological effects—if mothers who have already had a first birth are less likely to be biologically constrained (i.e., they are more likely to conceive when they would like).

[Figure 3 about here]

[Figure 4 about here]

If women undergoing ART procedures to achieve their first birth cannot and do *not* choose season of birth, we should expect to find no seasonality gap in their births: That is exactly what the patterns in Figure 3, panel b, show. The previous discrepancy between "younger" (28-39) and "older" (40-45) mothers does not exist for births achieved through the use of ART procedures. Women relying on ART are likely to be biologically constrained, so that the season of birth prevalence is unrelated to their age.[15] Moreover, there is a drop in conceptions in December. This is in line with the seasonality of treatment availability in ART clinics, which in many cases do not offer complex fertility treatments such as IVF (in vitro fertilization) or embryo transfers in December due to Christmas closure and the daily attention and last minute changes that these treatments require.[16] These patterns

[15]The majority of women undergoing ART are older than 35.

[16]This is supported by anecdotal evidence on fertility clinics operations.

are very similar if we focus on second births (Figure 4, panel b). This evidence indicates that when women can and want to choose season of birth, its patterns are different to those when choice is restricted.

We now investigate the relationship between the proportions of first births in summer and spring and mother's characteristics, starting with age in Figure 5. Two interesting stylized facts emerge from this Figure. First, if anything, there is a weak negative relationship between the prevalence of summer first births and mother's age; second, there seems to be a humped-shaped relationship between the prevalence of spring first births and mother's age: This non-monotonicity is consistent with selection and biological effects, a point that we will discuss further below. Figure 6 shows a stronger humped-shaped relationship when focusing on second births.

[**Figure 5 about here**]

[**Figure 6 about here**]

In Table 3 we investigate the determinants of the probability of having a first birth in spring. In column (1) we simply regress a dummy variable of spring (=1 if first birth in spring, =0 otherwise) against mother's age and its square, and confirm the quadratic relationship described in Figure 5. In column (2) we can see that the relationship is robust to controlling for year and state fixed effects. Column (3) includes education (=1 if the mother has at least some college, =0 otherwise), smoking during pregnancy (=1 if the mother smoked during pregnancy, =0 otherwise), Hispanic (=1 if the mother is Hispanic, =0 otherwise), and gestation week fixed effects. The non-monotonic relationship is still present conditional on all these controls. We also observe that women with at least some college are 0.8 percentage points more likely to have their first birth in spring than their less educated counterparts; and women who smoked during pregnancy and Hispanic women are, respectively, 1 and 0.8 percentage points less likely to have their first birth in spring than their respective counterparts.

Restricting our analysis to the births that occurred between 2009 and 2013, column (4), does not affect our results. Finally, in column (5), we include information that is only available from 2009 onwards, namely, whether the mother received food benefits in pregnancy, mother's pre-pregnancy body mass index, and whether the birth was achieved through ART. The magnitudes on the coefficients of the variables included in previous columns are quite similar, albeit slightly smaller. In addition, we find that women who received food benefits in pregnancy are 0.9 pp less likely to have their first birth in spring than their counterparts, and those who were obese in the pre-pregnancy period were 0.4 pp less likely to have their first birth in spring. Controlling for state-specific linear trends and unemployment rate at season of conception is immaterial for our findings (see Table A5 in the online appendix).[17] Table 4 shows qualitatively similar but quantitatively larger correlates when focusing on second births.

[**Table 3 about here**]

[**Table 4 about here**]

In Table 5 we conduct exactly the same analysis but for summer, so that the dependent variable now equals 1 if the birth happens in summer, and 0 otherwise. Interestingly, with the exception of the Hispanic dummy and ART usage, none of the factors under consideration is statistically significant or robustly correlated with the dependent variable.[18] The ART usage finding is driven by the drop in December conceptions documented in Figure 3, panel b: Once we exclude these conceptions, neither Hispanic nor ART usage matter (see Table A8 in the online appendix). In addition, dropping the age squared term results in a statistically significant coefficient for age, but with a very small magnitude -0.0003 (see Table A9 in the online appendix), consistent with the weak negative relationship described in Figure 5. Once again, controlling for state-specific linear trends and unemployment rate

[17]Table A6 in the online appendix estimates a logit rather than a linear regression: results are virtually the same.

[18]Table A7 in the online appendix estimates a logit rather than a linear regression: results are virtually the same.

at season of conception does not change our findings (see A10 in the online appendix). Table 6 shows similar correlates when focusing on second births.

[Table 5 about here]

[Table 6 about here]

The findings in Table 3 seem to confirm that the humped-shaped relationship between the prevalence of spring first births and mother's age is due to selection and biological effects. On one hand, "older" mothers tend to be positively selected (in terms of socioeconomic characteristics), so that they are more likely to target spring (a good season); on the other hand, "older" mothers are more likely to be biologically constrained. Interestingly, the "optimal age"—the turning point of the mother's age quadratic—for having a spring baby moves from about 30 in columns (1) and (2) to about 26 in column (5), where socioeconomic selection into pregnancy is accounted for, in addition to year and state fixed effects. Once this is taken into account, we observe that the "optimal age" to have the first child decreases: Younger women are less biologically constrained, and hence, the "optimal age" decreases.

Moreover, a clear asymmetry arises between the findings in Tables 3 and 5: Observable maternal factors cannot explain the probability that a first birth occurs in summer, but do partially explain the probability that a first birth occurs in spring. This suggests that while first births in spring cannot be taken as being "as good as" randomly assigned, consistent with being the result of parental choices, the occurrence of summer births is unrelated to observable maternal characteristics. In other words, conceptions in the holiday season of Thanksgiving and Christmas seem to be popular regardless of maternal characteristics.

While the analyses in Tables 3 and 5 contain several maternal characteristics, they remain silent about the role of maternal occupation in explaining season of birth. If season of birth is a choice variable, then we may expect it to be also related to mother's occupation, if only because certain jobs allow more flexibility in taking time off work in certain seasons or have summer breaks. This is particularly relevant in the US, given the very limited maternity leave provisions available. While the NVSS (2005-2013) has no information on occupation, we use the ACS data (2005-2014) to shed light on the relationship between season of birth and mother's occupation.[19]

In Table 7 we investigate the importance of occupation—we include the 2-digit occupational dummy variables from the Census classification[20]—in explaining the probability of having a first birth in spring, column (1), and summer, column (2). Our findings reveal that women in "education, training and library" occupations are 4.6 pp more likely to have their first birth in spring than women in "Arts, Design, Entertainment, Sports and Media" occupations. We do not find any other statistically significant relationship between mother's occupation and season of birth. Moreover, and consistent with our findings from Table 5, mother's occupation does not play any role in explaining summer first births.[21] It seems that women in "education, training and library" occupations are much more likely to time their birth in the spring to have maternity leave before the beginning of their summer break, thus maximizing their time home with the baby as well as the time the baby spends developing and growing before her first winter comes.

[Table 7 about here]

Our estimated seasonality gaps, between 0.7 pp (smoking during pregnancy gap) and 0.9 pp (received food benefits during pregnancy) in the NVSS, and 4.6 pp by occupation in the ACS, are sizable. Buckles and Hungerman (2013) report a 1 pp difference in teenage mothers and a 2 pp difference in unmarried or non-white mothers between January births and May births, and they interpret these gaps as "strikingly large" compared to the estimated effects of welfare benefits on non-marital childbearing (Rosenzweig, 1999) or unemployment on fertility (Dehejia and Lleras-Muney, 2004). More recently, Raute (2015) assesses the effects of changes in financial incentives on fertility arising from a reform in parental leave

[19] Table A11 in the online appendix contains the descriptive statistics for the ACS sample.

[20] All occupation codes refer to IPUMS `occ2010` codes, which are available at: https://usa.ipums.org/usa/volii/acs_occtooccsoc.shtml

[21] Table A12 in the online appendix estimates a logit rather than a linear regression: results are virtually the same.

benefits in Germany, and she finds that a €1,000 increase in parental benefits raises the probability to have a child in the four years post-reform by (at least) 1.2%. Given that our seasonality gaps are obtained within a much more homogeneous group of mothers (white, married, non-teenage) and *not* in response to generous monetary benefits, our estimated gaps are definitely large. Moreover, these seasonality gaps may represent lower bounds of the actual relationship of mothers' characteristics and birth seasonality, if we take into account that women on average take several (about 6) months to get pregnant after they stop contracepting. Indeed, birth seasonality has been found to be consistent with the seasonality at which women stop contracepting (Rodgers and Udry, 1988) but not with marriage seasonality timing (Lam et al., 1994), which excludes honeymoon effects.

3.2 Placebo sample: White unmarried mothers

If season of birth were a choice variable, then we would expect it to be driven by the group of mothers who are more likely to plan fertility, have wanted pregnancies, and time their births. Unmarried women in the US are reported to be more than twice as likely to have unwanted pregnancies than married women (Finer and Zolna, 2016; Mosher et al., 2012). In this section we replicate our main analysis for unmarried mothers: We expect this group to exhibit no seasonality birth patterns if these patterns are driven by a demand for season of birth.

[Figure 7 about here]

We first plot the prevalence of first births among unmarried mothers. Figure 7 shows that births tend to be concentrated in the second part of the year, first summer (0.27) and then fall (0.26). This pattern is very different than the one obtained among married mothers (Figure 1). In Figure 8 we investigate differences by mother's age in seasonality of births. Interestingly, we do not find any differences between "younger" and "older" women as instead we found among married women (Figure 3), suggesting that among this group of women season of birth is not a choice variable.

[Figure 8 about here]

Figure 9 plots the fraction of births in spring and summer by mother's age. The patterns that we found among married women (Figure 5) are no longer observed: There is neither a humped-shaped relationship between spring prevalence and mother's age nor a negative relationship between summer prevalence and mother's age. If unmarried women are not choosing season of birth, the distribution of births by quarters will be the same for "younger" and "older" women, even if older women are less likely to conceive.

[Figure 9 about here]

Tables 8 and 9 explore the correlates of the probability of having a first birth in spring and summer, respectively. None of the variables under analysis, except for food benefits in the case of spring births, explains season of birth. If anything, both being born in spring or summer is "as good as" randomly assigned among unmarried women, and summer births are the most popular, suggesting a mechanical holiday effect for *all* women. Once again this pattern is consistent with season of birth not being chosen by this group of women, which is the group less likely to plan fertility or pregnancies.

Figures 10-12 and Tables 10-11 investigate the same patterns for second births among unmarried women. We find no seasonal pattern for second births either. This is evidence that unmarried women do not choose season of birth, since learning, information and/or biology cannot affect second births' seasonal patterns if these mothers are not making a choice. The absence of these patterns among second births of unmarried women is in stark contrast with the stronger patterns among second births of married women. This, again, supports our contention that there is a demand for season of birth when births are planned.

Finally, Table 12 shows that occupation cannot explain season of birth patterns among unmarried women. Given the strong positive correlation between "teachers" and spring births among married women, this evidence suggests that season of birth is a choice variable. Only for the group of women most likely to plan their pregnancies (the married), we observe that spring births are significantly related to their occupation and socioeconomic characteristics.

These findings have observable implications in the population of mothers who give birth at different seasons of the year. Spring is the season in which unmarried women make up the lowest proportion of all births, while it is the season in which married women make up the largest proportion of births among all births. There is thus a relative shortfall of unmarried mothers in the population of spring births compared to what would be expected if births were evenly spaced throughout the year, and a relative glut in all other seasons. Married mothers, on the other hand, have a relative glut among spring and summer, and a shortfall among winter and fall (all calculations available upon request).

[Table 8 about here]

[Table 9 about here]

[Figure 10 about here]

[Figure 11 about here]

[Figure 12 about here]

[Table 10 about here]

[Table 11 about here]

[Table 12 about here]

If unmarried mothers did not plan season of birth, we would expect to find a uniform distribution of births over the year (except for summer, which presumably captures Thanksgiving and Christmas holiday and may affect everyone). However, Figure 7 shows that births tend to be concentrated in the second part of the year, first summer (0.27) and then fall (0.26). How can we account for that discrepancy, that is, the high fraction of births in the fall? We explore the possibility that selective survival among those live births occurring to unmarried women depends on the month of conception. In particular, unmarried women have less resources to cushion (ameliorate) the negative effects of cold weather on their health and that of their babies in the womb. If this were the case, we should observe more babies born in summer and fall because they are more likely to survive than those due to be born in winter and spring. A differential selective survival pattern by marital status can be observed in Figure 13, where we plot the evolution of fetal deaths by month of occurrence.[22] While the number of fetal deaths is more or less constant over the year among married mothers, this is lower in the second half of the year among unmarried women.

[**Figure 13 about here**]

4 Willingness to Pay for Season of Birth

If there is a demand for season of birth, there must be a willingness to pay (WTP) for season of birth, that is, a maximum amount of money an individual would be prepared to pay for having a baby born in a particular season. In this section we describe the methodology we use to elicit the WTP for season of birth, and then present our estimates of the average willingness to pay for season of birth.

4.1 Measuring Willingness to Pay for Season of Birth

In general, there are two paths that can be followed to estimate WTP: One is based on stated preferences (i.e., directly asking people); the other is based on revealed preferences (i.e., observing people's behavior). Economists prefer to infer WTP from actual behavior,

[22]Deaths occurring at 20 weeks of gestation or more. Data are available from the NVSS, whereas miscarriages are not recorded.

although recently, health economists have increasingly moved towards the direct alternative of interviewing people, thus relying on stated preferences. Both methods have their specific pros and cons. Within the stated preferences methods, we can distinguish between contingent valuation and discrete choice experiments.

In this paper we will estimate the willingness to pay for season of birth using a discrete choice experiment (DCE) approach, which is a variant of conjoint analysis (CA). This method attempts to explain and predict consumers' behavior on the basis of their preferences for the attributes of a good (Lancaster, 1966). CA methods are particularly useful for quantifying preferences for non-market goods, and have been applied successfully to measure preferences for a diverse range of health applications (Bridges et al., 2011): From asthma medication (King et al., 2007) to depression (Wittink et al., 2010), to estimating the monetary value of reducing time spent on waiting lists (Propper, 1990, 1995) or to measure women's preference for surgical versus medical management of miscarriage (Ryan and Hughes, 1997). We can think of season of birth as one of the attributes associated with a birth, so that the DCE approach offers a natural procedure to measure the value of season of birth.

Before starting a DCE, the attributes characterizing the alternatives/scenarios need to be defined. In the case of a birth, we use the following attributes (the order in which these attributes are shown is randomized across respondents):

- season of birth
- out of pocket expenses
- gender
- birth weight or day of birth (randomly allocated to two groups of respondents)

Once the attributes are defined, the levels of each attribute must be decided. In the case of season of birth and gender, the levels are straightforward, namely [winter, spring, summer, fall] for the former, and [girl, boy] for the latter. The chosen values for out of pocket expenses (in USD) and birth weight were [250, 750, 1000, 2000, 3000, 4000, 5000, 6000, 7500, 10000] and [5lbs 8oz, 5lbs 13oz, 6lbs 3oz, 6lbs 8oz, 6lbs 13oz, 7lbs 3oz, 7lbs 8oz, 7lbs 13oz, 8lbs 3oz, 8lbs 8oz, 8lbs 13oz], respectively. Finally, for day of birth, we defined the values as [weekday, weekend]. As noted by Ryan and Farrar (2000), the levels must be plausible and actionable, then encouraging the respondents to take the exercise seriously. Following Bridges et al. (2011), in defining the values for birth weight and out of pocket expenses, we avoid the use of extreme values that may cause a grounding effect, and to avoid the use of heuristics by the respondents, we reduce the complexity of the task by providing a limited number of attributes over which choices must be made.

We use a main-effects design, which is orthogonal (all attribute levels vary independently) and balanced (each level of an attribute occurs the same number of times). In particular, the attributes are combined to form various (hypothetical) birth scenarios, all about a hospital birth of the first child with *no* complications.[23] Highlighting that the birth is with no complications is important. As discussed by Bridges et al. (2011), in the US health care market, insurance coverage and out-of-pocket medical expenses for procedures are routine for many patients. Cost may be perceived as correlated with improvements in medical outcomes or with access to advanced intervention. By noting that the birth has no complications, we avoid associating a higher cost with complications. Every birth is therefore characterized by a vector of four parameter values, each randomly assigned to each scenario, and the order of the four characteristics is randomized across respondents. Respondents are asked

[23]Specifically, we instruct respondents:

> *Imagine you and your partner are planning to have a baby or, if you have children already, think back to the time before the birth of your first child. You will have hopes and fears for how the birth will go.*
>
> *On the next screens we will show you pairs of possible birth scenarios, all about hospital births with no complications. The birth scenarios will differ in some respects/features.*
>
> *Please indicate on each screen which of the two scenarios you would prefer to happen for your child's birth (or if you already have children, which scenario you would have preferred to have happened for the birth of your first child).*

sequentially whether they prefer Scenario 1 or Scenario 2, facing two birth scenarios in each round and playing for seven rounds, so that a DCE amounts to tracing out an indifference curve in the attribute space.[24] Health care research studies typically use between 8 and 16 tasks.[25] The screen shot of a round with a choice between two scenarios is presented in the online appendix as Figure A1.

We present the theory behind the estimation of WTP using a discrete choice experiment borrowing from Zweifel et al. (2009, p.60): Each alternative j is characterized by its price p_j (out-of-pocket expenses) and a vector of characteristics $b_j = (b_{1j}, ..., b_{zj})$, while y_i denotes the income of individual i. The indirect utility function can thus be written as

$$V_{ij} = v(p_j, b_j, y_i, \epsilon_{ij}) \tag{1}$$

where ϵ_{ij} denotes an error term (random component) which stands for those determinants of choice not captured by p_j, b_j, y_i and that cannot be observed by the econometrician/experimenter. The individual i will choose alternative/scenario j over alternative/scenario l if and only if

$$V_{ij} \geq V_{il} \Leftrightarrow v(p_j, b_j, y_i, \epsilon_{ij}) \geq v(p_l, b_l, y_i, \epsilon_{il}) \quad \forall j \neq l. \tag{2}$$

We can then define the probability of individual i choosing j as

$$P_{ij} = Prob[V_{ij} \geq V_{il}] = Prob[v(p_j, b_j, y_i, \epsilon_{ij}) \geq v(p_l, b_l, y_i, \epsilon_{il})] \quad \forall j \neq l. \tag{3}$$

One can then calculate the marginal rate of substitution (MRS) between any two attributes

[24]The assumptions embedded in the behavioral model underlying these choices are (i) the existence of a representative consumer (which can be relaxed using a mixed-logit), and (ii) the functional form of the utility function – typically linear (this can be relaxed to allow for a quadratic functional form, though is still restrictive).

[25]The evidence from the transportation literature indicates that individuals can manage between 9 and 16 pairwise comparison before they become tired or bored (Pearmain et al., 1991).

k and m as

$$MRS_{k,m} = \frac{\frac{\partial v(p_j, b_j, y_i, \epsilon_{ij})}{\partial b_{kj}}}{\frac{\partial v(p_j, b_j, y_i, \epsilon_{ij})}{\partial b_{mj}}}. \tag{4}$$

Specifically, the MRS between attributes b_{kj} and price p_j captures the amount of disposable income (i.e., the negative of price) that a person is willing to pay in order to receive one more unit of the attribute k. This gives us precisely the WTP for attribute k,

$$WTP_k = -\frac{\frac{\partial v(p_j, b_j, y_i, \epsilon_{ij})}{\partial b_{kj}}}{\frac{\partial v(p_j, b_j, y_i, \epsilon_{ij})}{\partial p_j}}. \tag{5}$$

In order to estimate the WTP for attribute k, we need to use an econometric model for P_{ij}. Assuming that (i) ϵ_{ij} and ϵ_{il} follow a logistic distribution and that (ii) $v(\cdot)$ is linear, this gives us the following logit model

$$P_{ij} = \Lambda\left(\beta_0 + \sum_{k=1}^{K} \beta_k b_{kj} + \gamma p_j + \theta_r + \theta_o\right) \tag{6}$$

where Λ is the *cdf* of the logistic distribution, θ_r is a vector of round fixed effects and θ_o is a vector of question order fixed effects. The model is estimated clustering standard errors at the respondent level. The WTP for attribute k is then

$$WTP_k = -\frac{\beta_k}{\gamma}. \tag{7}$$

Note that given a linear utility function, WTPs are constant. Results obtained by Bryan et al. (2000) , Ryan et al. (1998), Telser and Zweifel (2002), and Zweifel et al. (2006) indicate that DCE may be a valid and reliable approach to WTP measurement in the case of health, however it is important to keep in mind that while interviewing people is the most direct and transparent method to find out preferences, participants may not understand questions, or fail to take them seriously (as the situations are only hypothetical). Our estimates must be assessed in light of such caveats.

4.2 Estimating Willingness to Pay for Season of Birth

We start with a description of the average characteristics of the participants in our online survey, as well as its geographic coverage. Table 13 displays the descriptive statistics on the characteristics reported by our sample of 1,899 valid Amazon Mechanical Turk respondents, that is, excluding those with an IP address suggesting that they were located outside of the US at the time of the survey, those who failed to pass a consistency check in survey questions, and respondents who completed the survey in under two minutes.[26] 56% of respondents are women; on average respondents are 36 years old; 89% of them have at least some college; 51% of them are parents; 8% of them are black; 84% are white; 5% are Hispanic; 46% are married; 69% are employed; 10% work in “education, library, and training” occupations; and their average family income is about 58,000 USD. According to Figure 14, the geographical coverage of our Amazon Mechanical Turk survey, map (a), broadly reflects the distribution of the US population recorded by the Census Bureau, map (b).

[Table 13 about here]

[Figure 14 about here]

In Table 14 we report the findings from our discrete choice experiments. Each column reports the average marginal effects corresponding to a logit regression where the dependent variable is to choose (or not) a given birth scenario based on the randomly assigned attributes of the birth, namely season of birth, out-of-pocket expenses, gender of the child, birth weight or day of the week. In column (1) we present the results for the full sample. Columns (2)

[26] In terms of sample size, our study does very well. The mean sample size for CA studies in health care research published between 2005 and 2008 was 259, with nearly 40% of the sample sizes in the range of 100 to 300 respondents (Marshall et al., 2010).

and (3) report the results for the samples using either birth weight (BW, column 2) or day of birth (DoB, column 3) as one of the attributes.[27] Our findings show that respondents are about 4 pp more likely to choose a birth scenario for their first birth if that scenario happens in the spring. Moreover, for each additional 1,000 USD of out-of-pocket expenses they are 7 pp less likely to choose a birth scenario. The finding on the cost-variable is consistent with our *a priori* expectation: The larger the costs of the birth scenario, the less likely is that such a birth scenario is chosen. This gives credibility to our design. Our estimate of the WTP for their first birth occurring in spring, which can be obtained as the negative of the ratio of the (average) marginal effect of spring divided by the (average) marginal effect on out-of-pocket expenses (multiplied by 1,000), is about 600 USD, which is statistically significant even based on the demanding Leamer criterion.

[Table 14 about here]

Is this a sizable magnitude? To answer this question we have calculated the value of a birth by adding the valuation of each characteristic in our regression. As all our valuations are relative (e.g., willingness to pay for spring compared with winter), all of these valuations must be taken as with respect to a baseline category, which in our case is a male, born in winter, during the week, and with the minimum birth weight in the range provided (i.e., 5lbs 8oz, or 2,500g). We made all these computations for the set of values in our discrete choice experiments, obtaining that the largest relative estimate is that of the willingness to pay for a girl, born in spring, during the weekend, and with a birth weight of 7lbs, 8oz: 3,354.644 USD. This means that the estimated WTP for spring is, at the very least, about 18% of the value of a birth based on these characteristics. We can also compare our estimate of the WTP for spring with the mean charges for a normal birth. According to AHRQ (2013),[28]

[27] We have 1,899 participants, facing 2 scenarios in each round, and playing for 7 rounds, which corresponds to 26,586 participant-scenario-round observations. The full sample regression is run adding indicators for missing birth weight (BW) and day of birth (DoB), since half of the respondents were randomly offered birth weight and the other half were offered day of birth as one of the attributes. In the end, we use $BW = BW$ if available and $BW = 0$ if missing, and $DoB = DoB$ if available and $DoB = 0$ if missing.

[28] http://hcupnet.ahrq.gov

in the US in 2013 these charges were about 3,848 USD. Hence, our WTP estimate would be about 15% of the mean charges for a normal birth, a substantial magnitude. No matter which benchmark of the value of a normal birth we use, we obtain that the value of season of birth is sizable.

5 Conclusions

We study the determinants of season of birth for white married women aged 20-45 in the US, using birth certificate and Census data. We document that the probability of having a baby in spring is significantly related to mother's age, education, smoking status during pregnancy and the mother working in "education, training, and library" occupations, whereas the probability of having a baby in summer is not related to any of these observable characteristics. We find consistent and stronger correlates when focusing on second births, whereas all our findings are muted among unmarried women. We also elicit the willingness to pay for season of birth through discrete choice experiments implemented on the Amazon Mechanical Turk platform. We estimate the average willingness to pay for a spring birth to be 600 USD, which is about 18% of the most valued birth in our Amazon Mechanical Turk sample or 15% of the mean charges for a normal birth in 2013 according to the Agency for Healthcare Research and Quality.

Our analysis combining both observational administrative data with experimental online survey data provides the first systematic study showing that there is a demand for season of birth: Season of birth is a choice variable for those who plan fertility, and does not mechanically follow biological constraints for all women. In particular, second births exhibit stronger seasonality among married women, and no seasonality among unmarried ones. While it seems that spring is positively valued as revealed by our willingness to pay analysis, the fact that different types of mothers exhibit different seasonality patterns suggest that women face different constraints, and/or have different preferences: Mothers who plan fertility (e.g., married), who have more flexibility (e.g., teachers), who have greater access to health information (e.g., more educated mothers), or are able to (e.g., younger) are more likely to have their babies in spring than their counterparts. When you plan a pregnancy, and your body and job allows it, or when you have greater information on the inputs to infant health, you target a spring birth to maximize time off work and/or the time that the baby has to grow and strengthen before she faces her first winter.

Our study may help policy-makers to better assess and design policies targeting job flexibility, parenthood and child health and development. This is particularly important in the US, where maternity leave provisions are very limited, since we show that it is jobs in the education sector that are most strongly related to spring births. These are occupations that are not highly-paid on average, but that traditionally provide time off in the summer and more flexibility in taking maternity leave around the break without job loss. Most jobs in the US do not have any maternity leave in place, so that the default may be a summer birth, a season in which it is easier to take time off from work. However, if the consideration of the baby's health is boosted by jobs with summer breaks and more flexible leave ("education, training, and library" occupations) and/or by actual planning (married or positively selected mothers), spring is the chosen season.

If all women shared a common preference to have spring births, but only those working in occupations with favorable conditions or who have partners who can economically support maternal leave could fulfill these preferences, a generous maternal leave policy would improve the ability that individuals have to optimally target births in a year. It would allow those with less flexibility to shift their births to their desired season, resulting in large changes in observed birth timing within the country across the year, utility gains associated with shifting individuals towards their preferred season, and not least of all, with increased child health at the population level (Currie and Schwandt, 2013).

References

Alba, A. and J. Cáceres-Delpiano (2014): "Season of birth and mother and child characteristics : evidence from Spain and Chile," Economics Working Papers we1423, Universidad Carlos III, Departamento de Economía.

Almond, D., C. P. Chee, M. M. Sviatschi, and N. Zhong (2015): "Auspicious birth dates among Chinese in California," *Economics & Human Biology*, 18, 153–159.

Barreca, A., O. Deschenes, and M. Guldi (2015): "Maybe Next Month? Temperature Shocks, Climate Change, and Dynamic Adjustments in Birth Rates," NBER Working Papers 21681, National Bureau of Economic Research, Inc.

Berinsky, A. J., G. A. Huber, and G. S. Lenz (2012): "Evaluating Online Labor Markets for Experimental Research: Amazon.com's Mechanical Turk," *Political Analysis*, 20, 351–368.

Bridges, J. F., A. B. Hauber, D. Marshall, A. Lloyd, L. A. Prosser, D. A. Regier, F. R. Johnson, J. Mauskopf, M. Ryan, and S. Farrar (2011): "Conjoint Analysis Applications in Health—a Checklist: A Report of the ISPOR Good Research Practices for Conjoint Analysis Task Force," *Value in Health*, 14, 403–413.

Bryan, S., L. Gold, R. Sheldon, and M. Buxton (2000): "Preference measurement using conjoint methods: an empirical investigation of reliability," *Health Economics*, 9, 385–395.

Buckles, K. S. and D. M. Hungerman (2013): "Season of Birth and Later Outcomes: Old Questions, New Answers," *The Review of Economics & Statistics*, 95, 711–724.

CDC (1997): "Fertility, Family Planning, and Women's Health: New Data from the 1995 National Survey of Family Growth," Vital and Health Statistics Series 23, No 19, Centers for Disease Control and Prevention.

——— (2014): "The Flu Season," Last accessed: September 15, 2015.

Currie, J. and H. Schwandt (2013): "Within-mother analysis of seasonal patterns in health at birth," *Proceedings of the National Academy of Sciences*, 110, 12265–12270.

Deaton, A. (1997): *The Analysis of Household Surveys – A Microeconometric Approach to Development Policy*, The Johns Hopkins University Press.

Dehejia, R. and A. Lleras-Muney (2004): "Booms, Busts and Babies' Health," *Quarterly Journal of Economics*, 119, 1091–1130.

Dickert-Conlin, S. and A. Chandra (1999): "Taxes and the Timing of Birth," *Journal of Political Economy*, 107, 161–177.

Dickert-Conlin, S. and T. Elder (2010): "Suburban legend: School cutoff dates and the timing of births," *Economics of Education Review*, 29, 826–841.

Finer, L. B. and M. R. Zolna (2016): "Declines in the Unintended Pregnancy in the United States, 2008-2011," *New England Journal of Medicine*, 374, 843–852.

Francis-Tan, A. and H. M. Mialon (2015): ""A Diamond Is Forever" And Other Fairy Tales: The Relationship Between Wedding Expenses And Marriage Duration," *Economic Inquiry*, 53, 1919–1930.

Gans, J. S. and A. Leigh (2009): "Born on the first of July: An (un)natural experiment in birth timing," *Journal of Public Economics*, 93, 246–263.

Gans, J. S., A. Leigh, and E. Varganova (2007): "Minding the shop: The case of obstetrics conferences," *Social Science & Medicine*, 65, 1458–1465.

Gould, J. B., C. Qin, A. R. Marks, and G. Chavez (2003): "Neonatal Mortality in Weekend vs Weekday Births," *Journal of the American Medical Association*, 289, 2958–62.

HUNTINGTON, E. (1938): *Season of Birth: Its Relation to Human Abilities*, New York: John Wiley & Sons, Inc.

KING, M. T., J. HALL, E. LANCSAR, D. FIEBIG, I. HOSSAIN, J. LOUVIERE, H. K. REDDEL, AND C. R. JENKINS (2007): "Patient preferences for managing asthma: results from a discrete choice experiment," *Health Economics*, 16, 703–717.

KUZIEMKO, I., M. I. NORTON, E. SAEZ, AND S. STANTCHEVA (2015): "How Elastic Are Preferences for Redistribution? Evidence from Randomized Survey Experiments," *American Economic Review*, 105, 1478–1508.

LALUMIA, S., J. M. SALLEE, AND N. TURNER (2015): "New Evidence on Taxes and the Timing of Birth," *American Economic Journal: Economic Policy*, 7, 258–93.

LAM, D. A., J. MIRON, AND A. RILEY (1994): "Modeling seasonality in fecundability, conceptions, and births," *Demography*, 31, 321–346.

LANCASTER, K. J. (1966): "A New Approach to Consumer Theory," *Journal of Political Economy*, 74, 132–157.

LEAMER, E. E. (1978): *Specification Searches – Ad Hoc Inference with Nonexperimental Data*, John Wiley & Sons, Inc.

MARSHALL, D., J. F. P. BRIDGES, B. HAUBER, R. CAMERON, L. DONNALLEY, K. FYIE, AND F. REED JOHNSON (2010): "Conjoint Analysis Applications in Health — How are Studies being Designed and Reported?" *The Patient: Patient-Centered Outcomes Research*, 3, 249–256.

MARTIN, J. A., B. E. HAMILTON, M. J. OSTERMAN, S. C. CURTIN, AND T. MATHEWS (2015): "Births: Final Data for 2013," National Vital Statistics Report Vol 64, No 1, National Vital Statistics, Division of Vital Statistics.

Mosher, W. D., J. Jones, and J. C. Abma (2012): "Intended and Unintended Births in the United States: 1982-2010," National Health Statistics Report No 55, National Center for Health Statistics.

NCHS (2000): "Report of the Panel to Evaluate the U.S. Standard Certificates," Tech. rep., Division of Vital Statistics National Center for Health Statistics.

Pearmain, D., J. Swanson, M. Bradley, and E. Kroes (1991): *Stated Preference Techniques: A Guide to Practice*, Steer Davies Gleave and Hague Consulting Group, 2 ed.

Propper, C. (1990): "Contingent valuation of time spent on NHS waiting list," *Economic Journal*, 100, 193–199.

——— (1995): "The Disutility of Time Spent on the United Kingdom's National Health Service Waiting Lists," *Journal of Human Resources*, 30, 677–700.

Raute, A. (2015): "Can financial incentives reduce the baby gap?- Evidence from a reform in maternity leave benefits," *University of Mannheim, mimeo.*

Régnier-Loilier, A. (2010): "La planification des naissances dans l'année : une réalité peu visible en France," *Population*, 65, 191–206.

Rindfuss, R., J. Ladinsky, E. Coppock, V. Marshall, and A. Macpherson (1979): "Convenience and the occurrence of births: induction of labor in the United States and Canada," *International Journal of Health Services*, 9, 439–460.

Rodgers, J. L. and J. Udry (1988): "The season-of-birth paradox," *Social Biology*, 35, 171–185.

Rosenzweig, M. R. (1999): "Welfare, Marital Prospects, and Nonmarital Childbearing," *Journal of Political Economy*, 107, S3–S32.

Ruggles, S., K. Genadek, R. Goeken, J. Grover, and M. Sobek (2015): *Integrated Public Use Microdata Series: Version 6.0 [Machine-readable database]*, Minneapolis: University of Minnesota.

Ryan, M. and S. Farrar (2000): "Using conjoint analysis to elicit preferences for health care," *British Medical Journal*, 320, 1530–1533.

Ryan, M. and J. Hughes (1997): "Using Conjoint Analysis to Assess Women's Preferences for Miscarriage Management," *Health Economics*, 6, 261–273.

Ryan, M., E. McIntosh, and P. Shackley (1998): "Methodological issues in the application of conjoint analysis in health care," *Health Economics*, 7, 373–378.

Shigeoka, H. (2015): "School Entry Cutoff Date and the Timing of Births," NBER Working Papers 21402, National Bureau of Economic Research, Inc.

Telser, H. and P. Zweifel (2002): "Measuring willingness-to-pay for risk reduction: an application of conjoint analysis," *Health Economics*, 11, 129–139.

Wittink, M. N., M. Cary, T. Tenhave, J. Baron, and J. J. Gallo (2010): "Towards Patient-Centered Care for Depression," *The Patient: Patient-Centered Outcomes Research*, 3, 145–157.

Zweifel, P., F. Breyer, and M. Kifmann (2009): *Health Economics*, Springer.

Zweifel, P., H. Telser, and S. Vaterlaus (2006): "Consumer Resistance Against Regulation: The Case of Health Care," *Journal of Regulatory Economics*, 29, 319–332.

Figures and Tables

Table 1: Descriptive Statistics for Mothers (White Married Mothers, 20–45)

	N	Mean	Std. Dev.	Min.	Max.
Mother's Age (years)	3468715	28.409	4.88	20	45
Hispanic	3468715	0.181	0.38	0	1
Aged 20-24	3468715	0.231	0.42	0	1
Aged 25-27	3468715	0.219	0.41	0	1
Aged 28-31	3468715	0.298	0.46	0	1
Aged 32-39	3468715	0.232	0.42	0	1
Aged 40-45	3468715	0.020	0.14	0	1
Some College +	3468715	0.616	0.49	0	1
Years of Education	3468715	14.836	2.32	4	17
Smoked in Pregnancy	3468715	0.041	0.20	0	1
Used ART[a]	2365647	0.010	0.10	0	1
Received WIC food in Pregnancy[a]	2343866	0.185	0.39	0	1
Pre-pregnancy BMI[a]	2235522	24.964	4.85	16	40
Pre-pregnancy Underweight (BMI $<$ 18.5)[a]	2235522	0.033	0.18	0	1
Pre-pregnancy Normal Weight (18.5 $\leq$ BMI $<$ 25)[a]	2235522	0.566	0.50	0	1
Pre-pregnancy Overweight (25 $\leq$ BMI $<$ 30)[a]	2235522	0.243	0.43	0	1
Pre-pregnancy Obese (BMI $\geq$ 30)[a]	2235522	0.159	0.37	0	1

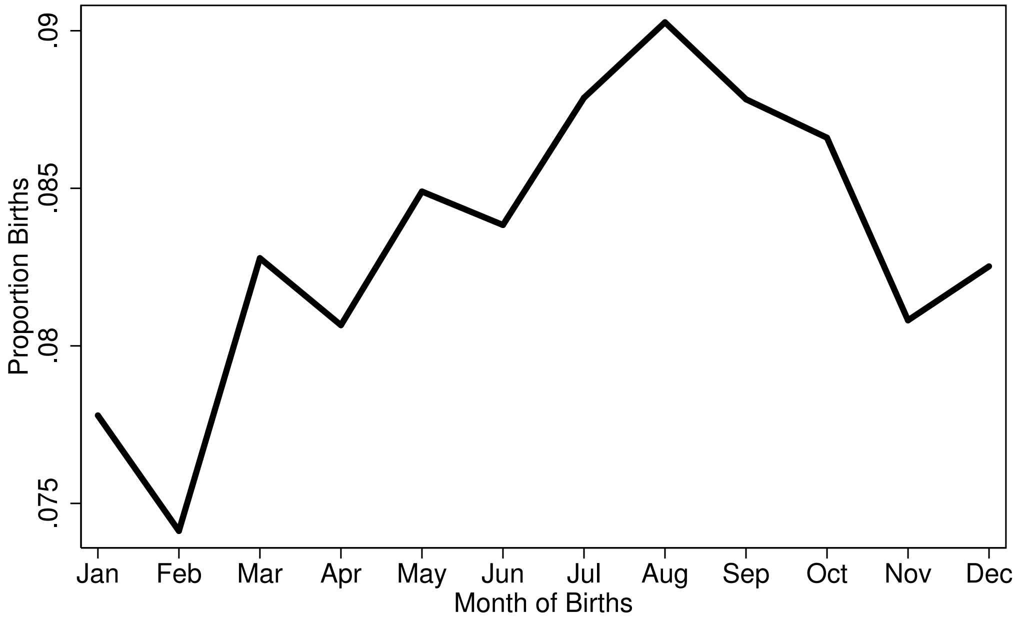
Notes: Sample consists of all white, married first-time mothers aged 20-45 who give birth to a singleton child and for whom education, smoking status during pregnancy and gestational length of (child's) birth are available. ART refers to the proportion of women who undertook assisted reproductive technologies that resulted in these births. [a] Only available from 2009.

Table 2: Descriptive Statistics for Children (White Married Mothers, 20–45)

	N	Mean	Std. Dev.	Min.	Max.
Quarter 1 Birth	3468715	0.235	0.42	0	1
Quarter 2 Birth	3468715	0.249	0.43	0	1
Quarter 3 Birth	3468715	0.266	0.44	0	1
Quarter 4 Birth	3468715	0.250	0.43	0	1
Gestation	3468715	39.001	2.22	17	47
Premature	3468715	0.083	0.28	0	1
Female	3468715	0.486	0.50	0	1
Birthweight	3460454	3334.779	535.67	500	5000
LBW	3460454	0.055	0.23	0	1
APGAR	3449684	8.777	0.82	0	10

Notes: Sample consists of all first-born, singleton children born to white, married mothers aged 20-45 for whom education, smoking status during pregnancy and gestational length of (child's) birth are available. Quarters of birth are determined by the month in which the baby is expected based on conception date. Quarter 1 refers to January to March, Quarter 2 refers to April to June, Quarter 3 refers to July to September, and Quarter 4 refers to October to December due dates.

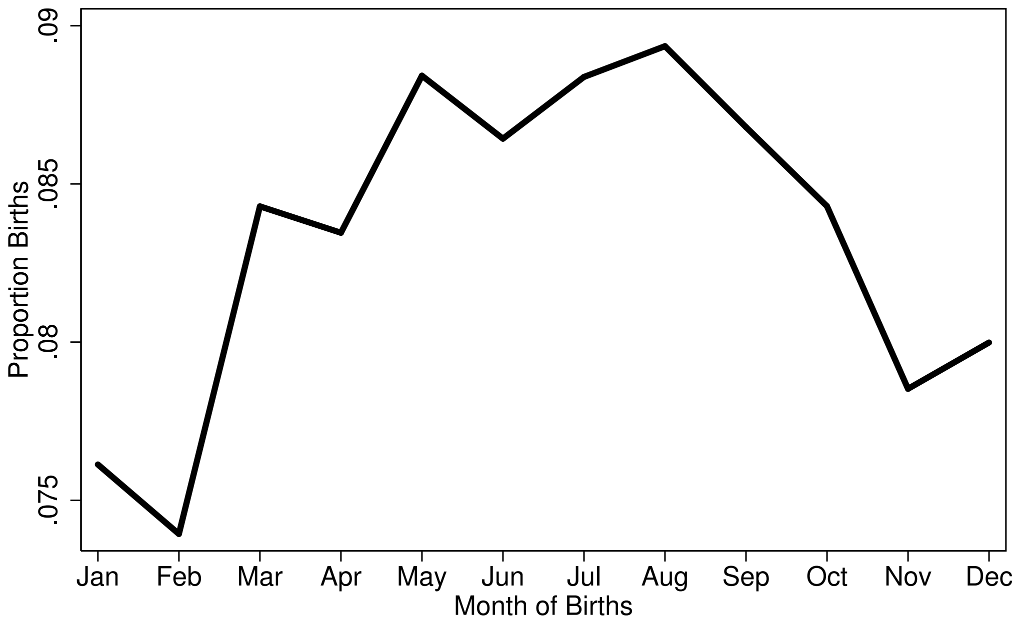
Figure 1: Births by Birth Month (White Married Mothers, 20–45)



Percent by month Jan: 7.78, Feb: 7.41, Mar: 8.28, Apr: 8.07, May: 8.49, Jun: 8.38, Jul: 8.79, Aug: 9.03, Sep: 8.78, Oct: 8.66, Nov: 8.08, Dec: 8.25.

Number of observations = 3,468,715.

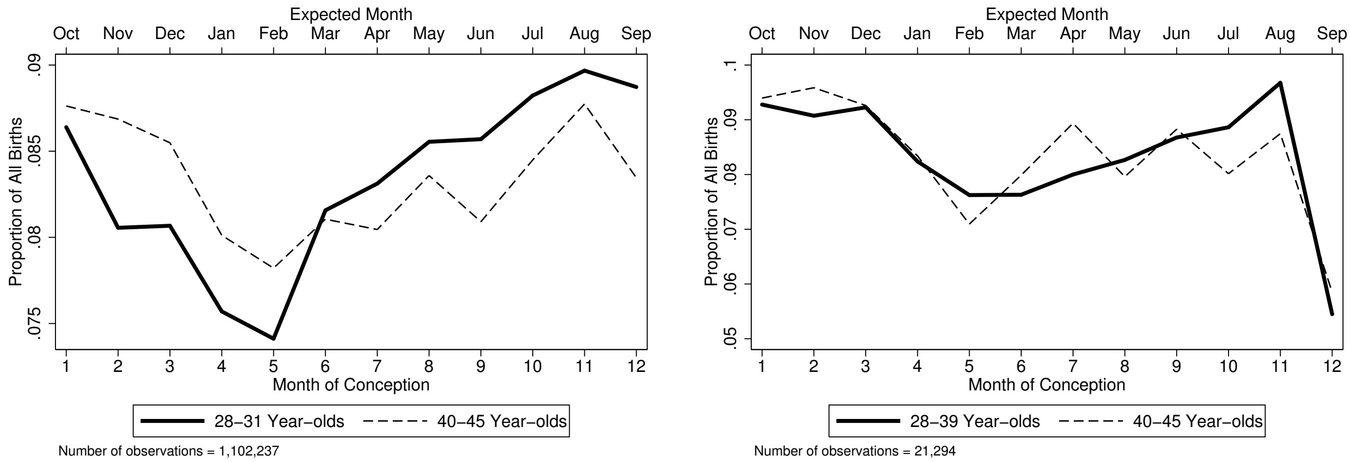
Figure 2: Second Births by Birth Month (White Married Mothers, 20–45)



Percent by month Jan: 7.61, Feb: 7.39, Mar: 8.43, Apr: 8.35, May: 8.84, Jun: 8.64, Jul: 8.84, Aug: 8.94, Sep: 8.68, Oct: 8.43, Nov: 7.85, Dec: 8.00.

Number of observations = 3,501,874.

Figure 3: Birth Prevalence by Month, Age Group, and ART Usage (White Married Mothers)

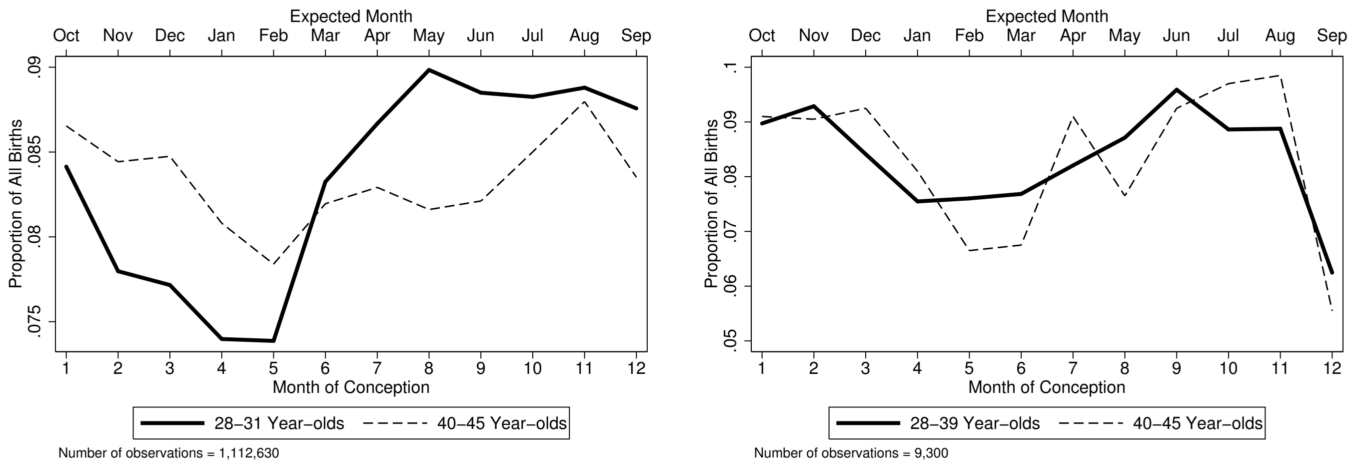


(a) Proportion of Conceptions in Each Month

(b) Proportion of Conceptions (ART Only)

Notes to figure 3: Month of conception is calculated by subtracting the rounded number of gestation months (gestation in weeks × 7/30.5) from month of birth. Each line presents the proportion of all first, singleton births conceived in each month for the relevant age group (28-31 or 40-45) among all white married first-time singleton mothers.

Figure 4: Second Birth Prevalence by Month, Age Group, and ART Usage (White Married Mothers)

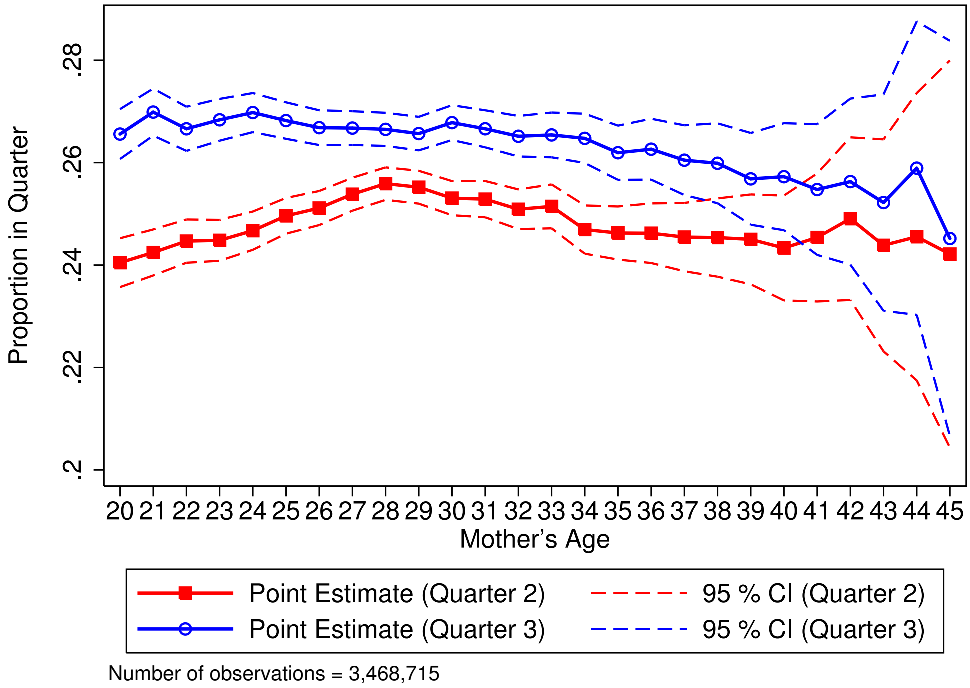


(a) Proportion of Conceptions in Each Month

(b) Proportion of Conceptions (ART Only)

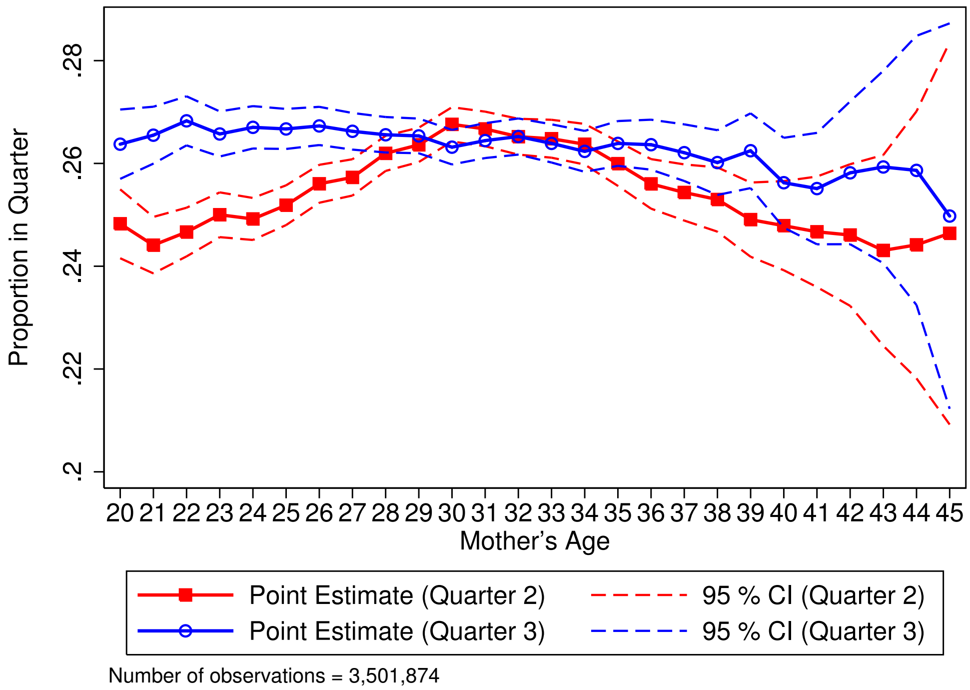
Notes to figure 4: Refer to figure 3.

Figure 5: Prevalence of Quarter 2 and Quarter 3 by Age (White Married Mothers, 20–45)



Notes to figure 5: Coefficients and standard errors are estimated by regressing Quarter 2 or Quarter 3 on dummies of maternal age with no constant. The sample consists of all first-born, singleton children born to white married mothers aged 20-45 for whom education, smoking during pregnancy, and gestational length of child's birth are recorded. 95% CI refers to the confidence intervals and are calculated using Leamer/Schwartz/Deaton critical values adjusting for sample size.

Figure 6: Prevalence of Quarter 2 and Quarter 3 by Age for Second Births (White Married Mothers, 20–45)



Notes to figure 6: Refer to notes in figure 5. The sample consists of all white married mothers aged 20-45 who give birth to their second singleton child and for whom education, smoking during pregnancy, and gestational length of child's birth are recorded.

Table 3: Season of Birth Correlates: Quarter 2 (White Married Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 2	(3) Quarter 2	(4) Quarter 2	(5) Quarter 2
Mother's Age (years)	$0.007^{‡}$	$0.007^{‡}$	$0.004^{‡}$	$0.004^{‡}$	$0.003^{‡}$
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	$-0.012^{‡}$	$-0.011^{‡}$	$-0.008^{‡}$	$-0.008^{‡}$	$-0.006^{‡}$
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			$0.008^{‡}$	$0.008^{‡}$	$0.006^{‡}$
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			$-0.010^{‡}$	$-0.009^{‡}$	$-0.007^{‡}$
			[0.001]	[0.002]	[0.002]
Hispanic			$-0.008^{‡}$	$-0.008^{‡}$	$-0.006^{‡}$
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					$-0.009^{‡}$
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.005
					[0.002]
Pre-pregnancy Overweight ($25 \leq$ BMI$<$ 30)					0.000
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					$-0.004^{‡}$
					[0.001]
Did not undergo ART					0.001
					[0.003]
Observations	3468715	3468715	3468715	2193372	2193372
F-test of Age Variables	128.641	105.222	59.323	40.519	40.821
Leamer Critical Value (F)	15.059	15.059	15.059	14.601	14.601
Optimal Age	30.19	29.82	28.11	27.77	25.95
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first-born children occurring to white, married women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.881 in columns 1-3 and 3.821 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table 4: Season of Birth Correlates for Second Births: Quarter 2 (White Married Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 2	(3) Quarter 2	(4) Quarter 2	(5) Quarter 2
Mother's Age (years)	0.012‡	0.012‡	0.008‡	0.009‡	0.007‡
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.020‡	-0.019‡	-0.014‡	-0.015‡	-0.013‡
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.011‡	0.011‡	0.008‡
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.013‡	-0.012‡	-0.010‡
			[0.001]	[0.001]	[0.001]
Hispanic			-0.011‡	-0.010‡	-0.006‡
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					-0.012‡
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.009‡
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					-0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					-0.007‡
					[0.001]
Did not undergo ART					-0.003
					[0.005]
Observations	3501874	3501874	3501874	2179546	2179546
F-test of Age Variables	385.125	321.104	169.144	114.433	106.893
Leamer Critical Value (F)	15.069	15.069	15.069	14.594	14.594
Optimal Age	31.39	31.11	29.63	29.64	28.55
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, second births occurring to white, married women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.882 in columns 1-3 and 3.820 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table 5: Season of Birth Correlates: Quarter 3 (White Married Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	$0.002^{‡}$	0.002	0.001	0.002	0.001
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	$-0.004^{‡}$	$-0.004^{‡}$	$-0.003^{‡}$	-0.004	-0.003
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.000	0.001	0.001
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.001	-0.000	-0.001
			[0.001]	[0.002]	[0.002]
Hispanic			$0.003^{‡}$	$0.004^{‡}$	$0.004^{‡}$
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					0.001
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.002
					[0.002]
Pre-pregnancy Overweight ($25 \leq$ BMI$<$ 30)					0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					-0.000
					[0.001]
Did not undergo ART					$0.027^{‡}$
					[0.003]
Observations	3468715	3468715	3468715	2193372	2193372
F-test of Age Variables	55.280	61.619	55.663	37.556	27.166
Leamer Critical Value (F)	15.059	15.059	15.059	14.601	14.601
Optimal Age	23.89	22.27	21.81	22.77	22.43
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first-born children occurring to white, married women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.881 in columns 1-3 and 3.821 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table 6: Season of Birth Correlates for Second Births: Quarter 3 (White Married Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	0.001	0.001	0.002	0.001	0.002
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.002	-0.002	-0.003	-0.003	-0.003
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			-0.001	-0.001	-0.000
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			0.002	0.002	0.001
			[0.001]	[0.001]	[0.001]
Hispanic			0.008‡	0.008‡	0.008‡
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					0.002
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					0.000
					[0.002]
Pre-pregnancy Overweight ($25 \leq$ BMI$<$ 30)					0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					0.000
					[0.001]
Did not undergo ART					0.022‡
					[0.005]
Observations	3501874	3501874	3501874	2179546	2179546
F-test of Age Variables	32.371	36.242	23.140	15.553	11.466
Leamer Critical Value (F)	15.069	15.069	15.069	14.594	14.594
Optimal Age	22.83	21.75	25.52	25.05	26.18
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, second births occurring to white, married women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.882 in columns 1-3 and 3.820 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table 7: Season of Birth Correlates in ACS (White Married Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 3
Mother's Age	0.009	0.004
	[0.004]	[0.004]
Mother's Age^2 / 100	-0.015	-0.006
	[0.006]	[0.006]
Some College +	0.012	-0.013
	[0.005]	[0.005]
Hispanic	-0.008	-0.008
	[0.007]	[0.007]
Architecture and Engineering	0.014	0.016
	[0.018]	[0.021]
Building and Grounds Cleaning and Maintenance	0.019	-0.022
	[0.021]	[0.020]
Business Operations Specialists	0.021	0.003
	[0.013]	[0.013]
Community and Social Services	0.032	-0.014
	[0.014]	[0.014]
Computer and Mathematical	0.030	-0.008
	[0.016]	[0.016]
Education, Training, and Library	0.046‡	-0.012
	[0.011]	[0.011]
Financial Specialists	0.021	-0.001
	[0.013]	[0.013]
Food Preparation and Serving	0.023	0.008
	[0.014]	[0.014]
Healthcare Practitioners and Technical	0.016	0.008
	[0.011]	[0.011]
Healthcare Support	0.003	-0.009
	[0.014]	[0.014]
Legal	0.000	-0.001
	[0.014]	[0.015]
Life, Physical, and Social Science	0.010	-0.001
	[0.016]	[0.017]
Management	0.016	0.008
	[0.011]	[0.011]
Office and Administrative Support	0.018	0.001
	[0.010]	[0.011]
Personal Care and Service	0.029	-0.004
	[0.013]	[0.013]
Production	0.010	-0.011
	[0.016]	[0.017]
Protective Service	0.039	-0.014
	[0.025]	[0.025]
Sales	0.006	0.001
	[0.011]	[0.011]
Transportation and Material Moving	0.034	-0.035
	[0.024]	[0.021]
Observations	95136	95136
F-test of Occupation Dummies	2.926	1.162
F-test of Age Variables	3.163	0.606

Sample consists of all singleton first-born children in the US born to white married mothers aged 20-45 included in 2005-2014 ACS data where the mother is either the head of the household or the partner of the head of the household and works in an occupation with at least 500 workers in the full sample. Birth quarter is based on *actual* birth quarter. Occupation classification is provided by the 2 digit occupation codes from the census. The omitted occupational category is Arts, Design, Entertainment, Sports, and Media, as this occupation has Q2+Q3=0.500(0.500). F-tests for occupation report p-values of joint significance of the dummies, and F-test of age variables refers to the F-statistic on the test that the coefficients on mother's age and age squared or all occupation dummies are jointly equal to zero. The Leamer critical value for the t-statistic is 3.384. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on the Leamer criterion at 5%.

Figure 7: First Births by Birth Month (White Unmarried Mothers, 20–45)

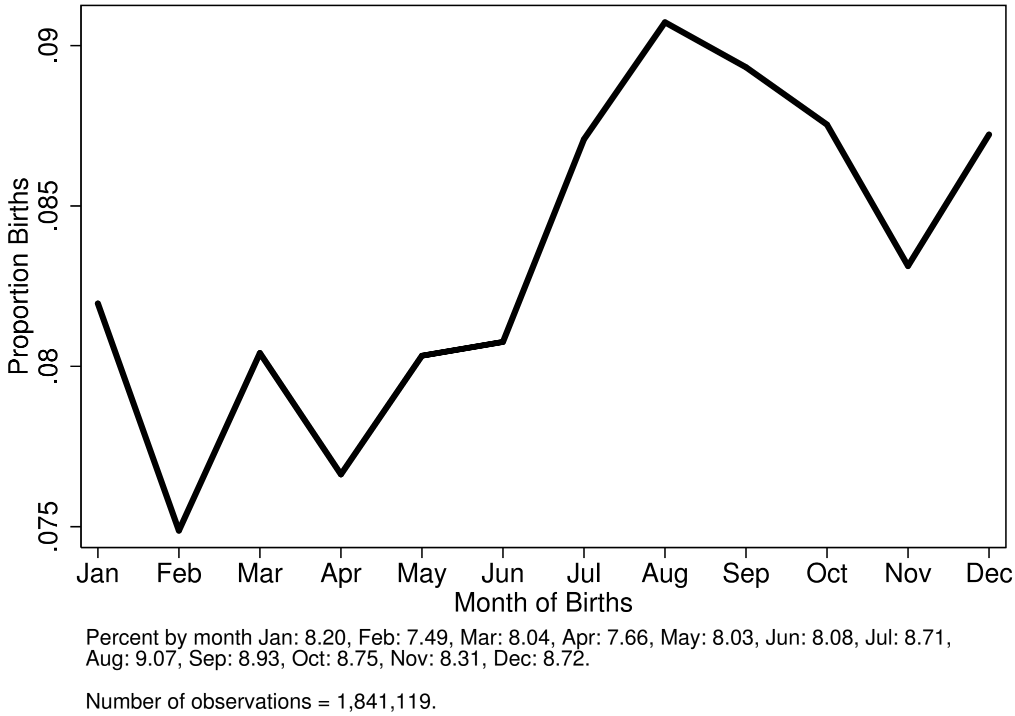
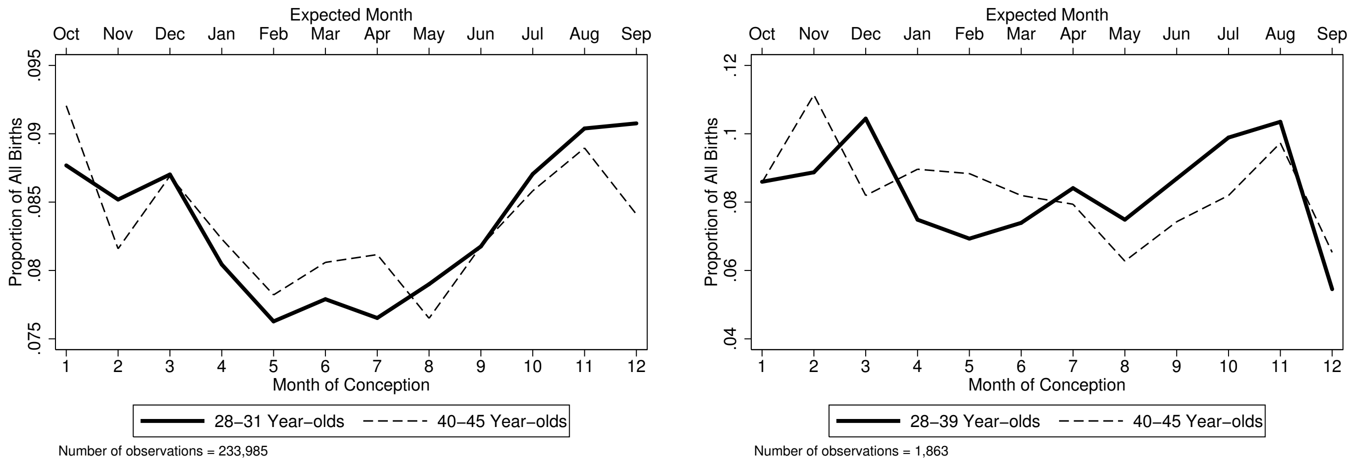


Figure 8: Birth Prevalence by Month, Age Group, and ART Usage (White Unmarried Mothers)

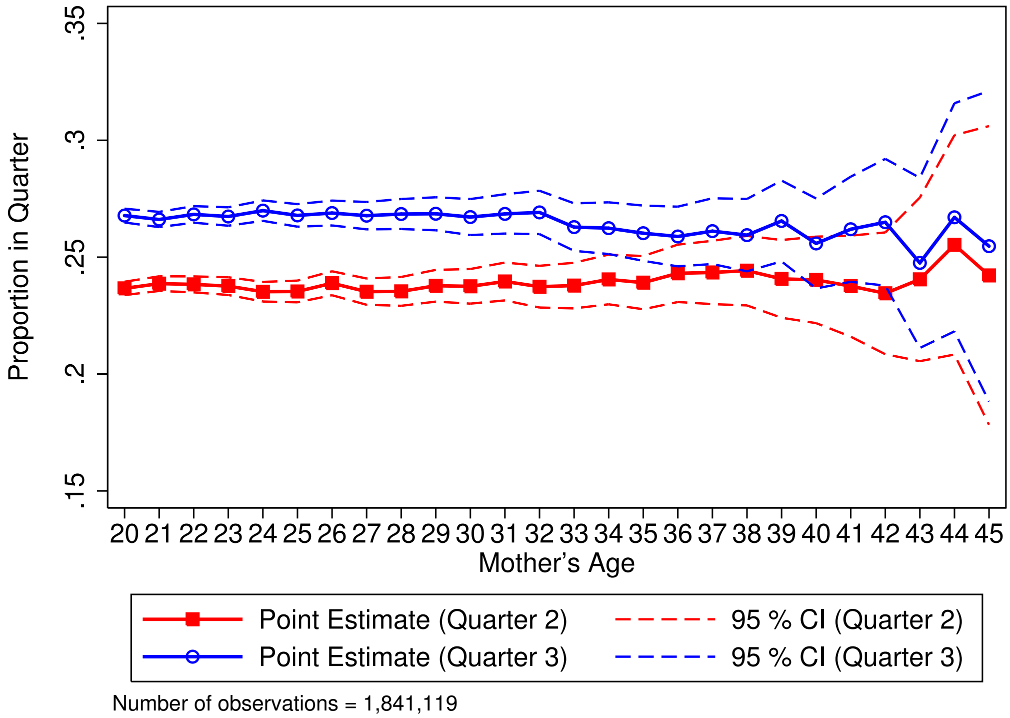


(a) Proportion of Conceptions in Each Month

(b) Proportion of Conceptions (ART Only)

Notes to figure 8: Refer to figure 3.

Figure 9: Prevalence of Quarter 2 and Quarter 3 by Age (White Unmarried Mothers, 20–45)



Notes to figure 9: Refer to notes in figure 5. The sample consists of all white unmarried mothers aged 20-45 who give birth to their first singleton child and for whom education, smoking during pregnancy, and gestational length of child's birth are recorded.

Table 8: Season of Birth Correlates: Quarter 2 (White Unmarried Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 2	(3) Quarter 2	(4) Quarter 2	(5) Quarter 2
Mother's Age (years)	-0.001	-0.001	-0.001	-0.000	-0.000
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Mother's Age^2 / 100	0.002	0.003	0.002	0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.000	0.000	-0.000
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.003	-0.003	-0.003
			[0.001]	[0.001]	[0.001]
Hispanic			-0.005‡	-0.004	-0.003
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					-0.004‡
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.001
					[0.002]
Pre-pregnancy Overweight ($25 \leq$ BMI$<$ 30)					0.000
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					-0.002
					[0.001]
Did not undergo ART					0.008
					[0.010]
Observations	1841119	1841119	1841119	1180774	1180774
F-test of Age Variables	4.284	3.668	2.722	0.396	0.203
Leamer Critical Value (F)	14.425	14.425	14.425	13.981	13.981
Optimal Age	25.35	26.27	26.94	22.22	28.77
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first-born children occurring to white, unmarried women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.798 in columns 1-3 and 3.739 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table 9: Season of Birth Correlates: Quarter 3 (White Unmarried Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	0.002	0.002	0.002	0.002	0.002
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.004‡	-0.004‡	-0.004	-0.004	-0.004
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.002	0.002	0.002
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.003	-0.002	-0.003
			[0.001]	[0.001]	[0.001]
Hispanic			0.001	0.000	-0.000
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					0.002
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.002
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					-0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					-0.001
					[0.001]
Did not undergo ART					0.005
					[0.010]
Observations	1841119	1841119	1841119	1180774	1180774
F-test of Age Variables	13.266	12.502	12.563	14.338	11.517
Leamer Critical Value (F)	14.425	14.425	14.425	13.981	13.981
Optimal Age	25.13	25.24	24.48	22.83	23.47
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first-born children occurring to white, unmarried women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.798 in columns 1-3 and 3.739 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Figure 10: Second Births by Birth Month (White Unmarried Mothers, 20–45)

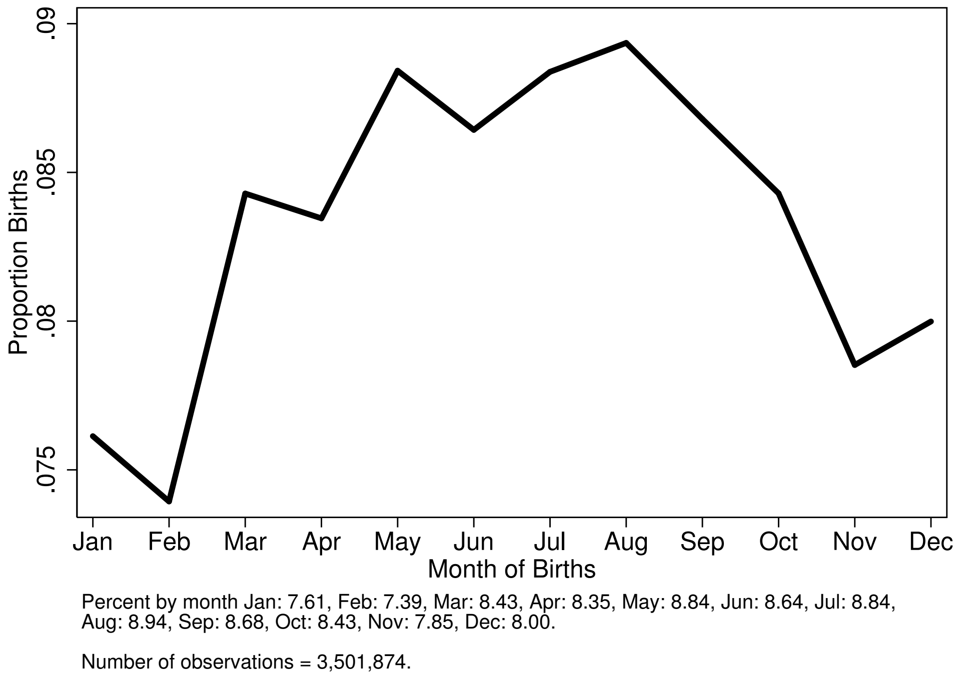
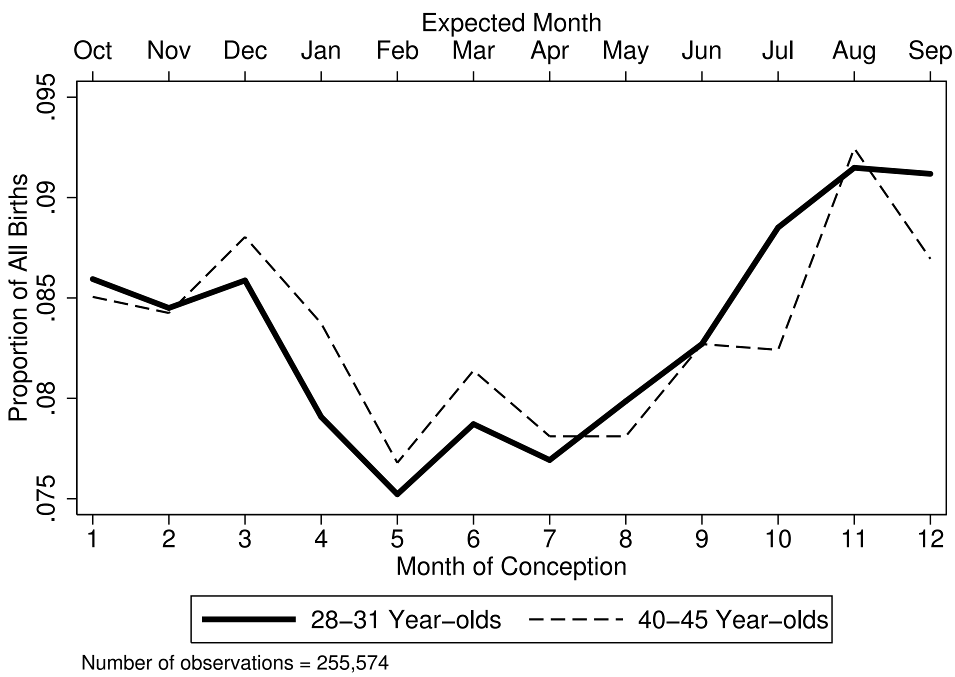
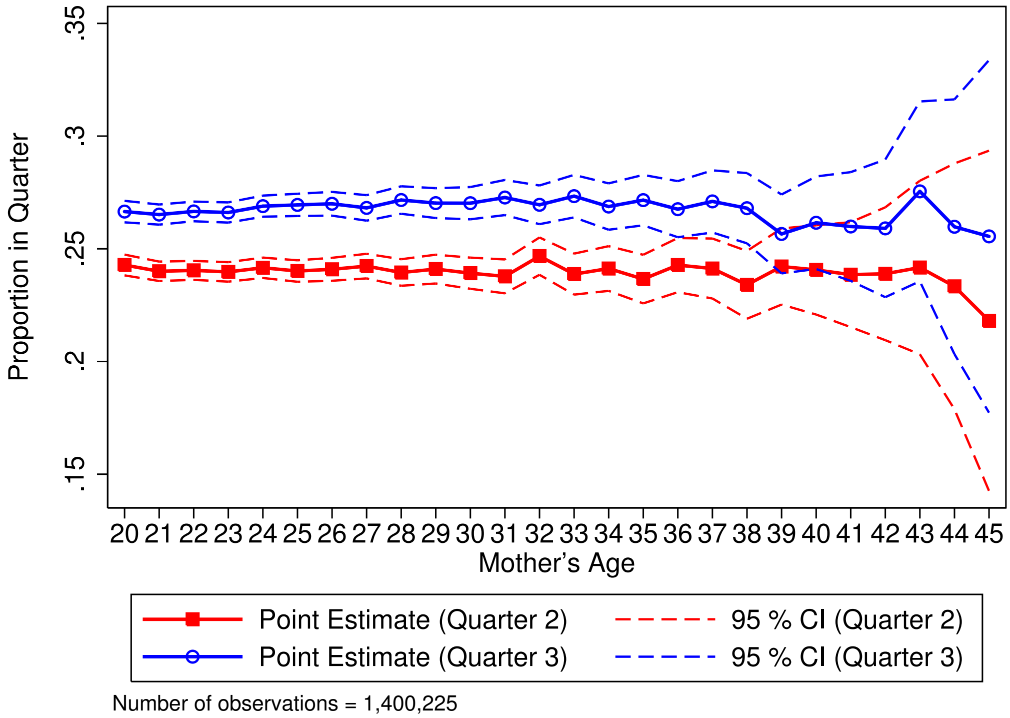


Figure 11: Second Birth Prevalence by Month and Age Group (White Unmarried Mothers)



NOTES TO FIGURE 11: Refer to figure 3. Only non-ART users are displayed.

Figure 12: Prevalence of Quarter 2 and Quarter 3 by Age for Second Births (White Unmarried Mothers, 20–45)



Notes to figure 12: Refer to notes in figure 5. The sample consists of all white unmarried mothers aged 20-45 who give birth to their second singleton child and for whom education, smoking during pregnancy, and gestational length of child's birth are recorded.

Table 10: Season of Birth Correlates for Second births: Quarter 2 (White Unmarried Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 2	(3) Quarter 2	(4) Quarter 2	(5) Quarter 2
Mother's Age (years)	0.000	-0.000	-0.000	0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.000	0.000	0.000	-0.002	-0.002
	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]
Some College +			0.001	0.000	-0.001
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.004‡	-0.004	-0.004
			[0.001]	[0.001]	[0.001]
Hispanic			-0.004‡	-0.004‡	-0.004
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					-0.005‡
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.004
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					-0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					-0.003
					[0.001]
Did not undergo ART					-0.017
					[0.021]
Observations	1400225	1400225	1400225	882672	882672
F-test of Age Variables	0.445	0.817	1.147	1.681	2.746
Leamer Critical Value (F)	14.151	14.151	14.151	13.690	13.690
Optimal Age	10.38	62.01	654.75	24.88	23.76
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, second births occurring to white, unmarried women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.762 in columns 1-3 and 3.700 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table 11: Season of Birth Correlates for Second births: Quarter 3 (White Unmarried Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	$0.004^{‡}$	$0.004^{‡}$	$0.003^{‡}$	0.003	0.003
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Mother's Age^2 / 100	$-0.006^{‡}$	$-0.006^{‡}$	$-0.005^{‡}$	-0.004	-0.004
	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]
Some College +			0.003	0.003	0.003
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.003	-0.003	-0.003
			[0.001]	[0.001]	[0.001]
Hispanic			0.003	0.001	0.001
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					0.002
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					0.002
					[0.002]
Pre-pregnancy Overweight ($25 \leq$ BMI$<$ 30)					0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					0.002
					[0.001]
Did not undergo ART					-0.005
					[0.022]
Observations	1400225	1400225	1400225	882672	882672
F-test of Age Variables	14.104	14.077	10.015	4.473	4.605
Leamer Critical Value (F)	14.151	14.151	14.151	13.690	13.690
Optimal Age	30.05	30.08	29.5	30.13	30.34
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

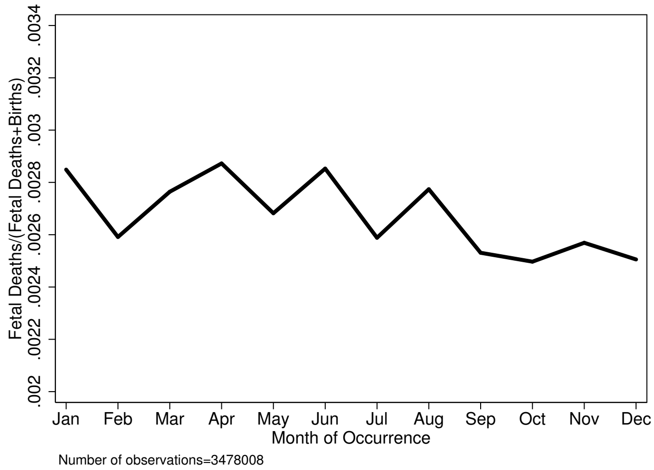
All singleton, second births occurring to white, unmarried women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.762 in columns 1-3 and 3.700 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table 12: Season of Birth Correlates in ACS (White Unmarried Mothers, 20–45)

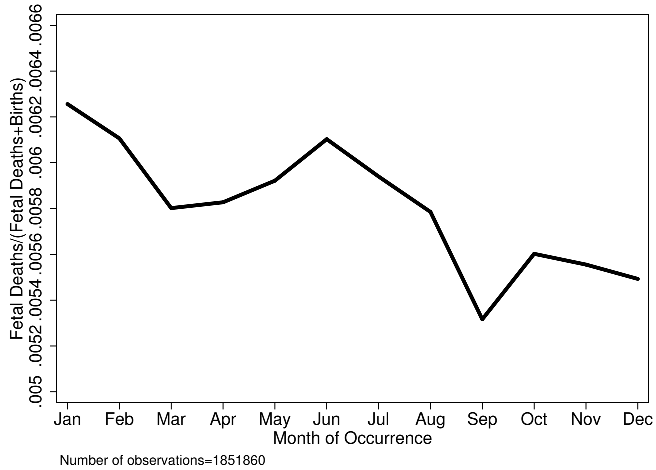
	(1) Quarter 2	(2) Quarter 3
Mother's Age	-0.005	0.015
	[0.007]	[0.008]
Mother's Age^2 / 100	0.006	-0.024
	[0.012]	[0.012]
Some College +	0.018	-0.003
	[0.011]	[0.011]
Hispanic	-0.004	-0.001
	[0.014]	[0.015]
Architecture and Engineering	-0.027	0.145
	[0.074]	[0.087]
Building and Grounds Cleaning and Maintenance	-0.076	0.022
	[0.048]	[0.047]
Business Operations Specialists	-0.003	0.017
	[0.054]	[0.053]
Community and Social Services	-0.087	0.046
	[0.052]	[0.059]
Computer and Mathematical	0.045	-0.046
	[0.075]	[0.064]
Education, Training, and Library	-0.032	0.002
	[0.047]	[0.044]
Financial Specialists	-0.047	0.024
	[0.054]	[0.056]
Food Preparation and Serving	0.002	-0.017
	[0.044]	[0.041]
Healthcare Practitioners and Technical	-0.017	0.000
	[0.046]	[0.043]
Healthcare Support	-0.005	0.008
	[0.047]	[0.044]
Legal	0.034	-0.021
	[0.062]	[0.054]
Life, Physical, and Social Science	-0.012	0.038
	[0.071]	[0.072]
Management	-0.044	-0.029
	[0.046]	[0.043]
Office and Administrative Support	-0.027	0.002
	[0.043]	[0.040]
Personal Care and Service	-0.018	0.028
	[0.046]	[0.044]
Production	-0.036	-0.017
	[0.048]	[0.046]
Protective Service	-0.004	0.065
	[0.067]	[0.070]
Sales	-0.020	0.018
	[0.044]	[0.041]
Transportation and Material Moving	-0.019	-0.017
	[0.052]	[0.048]
Observations	13426	13426
F-test of Occupation Dummies	1.107	0.944
F-test of Age Variables	0.508	2.046

Sample consists of all singleton first-born children in the US born to white unmarried mothers aged 20-45 included in 2005-2014 ACS data where the mother is either the head of the household or the partner of the head of the household and works in an occupation with at least 500 workers in the full sample. Birth quarter is based on *actual* birth quarter. Occupation classification is provided by the 2 digit occupation codes from the census. The omitted occupational category is Arts, Design, Entertainment, Sports, and Media, as this occupation has Q2+Q3=0.500(0.500). F-tests for occupation report p-values of joint significance of the dummies, and F-test of age variables refers to the F-statistic on the test that the coefficients on mother's age and age squared or all occupation dummies are jointly equal to zero. The Leamer critical value for the t-statistic is 3.074. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on the Leamer criterion at 5%.

Figure 13: Fetal Deaths as a Proportion of Births and Fetal Deaths by Month (White Mothers, 20–45, First Conception)



(a) Married



(b) Unmarried

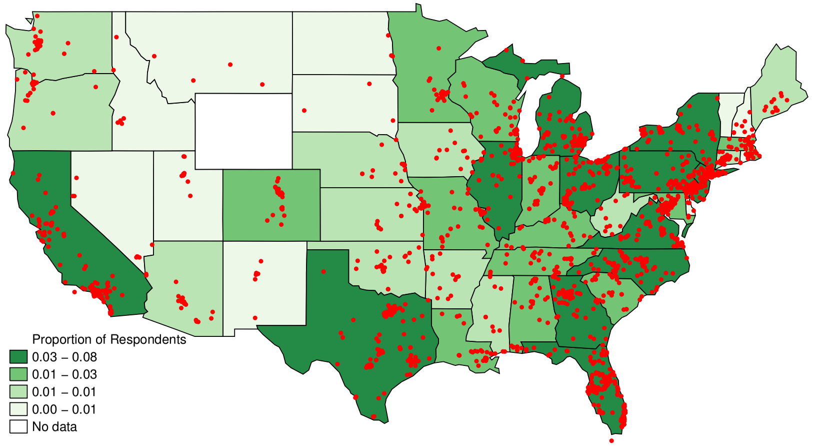
Notes to figure 13: All births and fetal deaths are classified by month of occurrence. Fetal deaths are recorded if occurring at 20 weeks or greater of gestation.

Table 13: Summary of M-Turk Variables

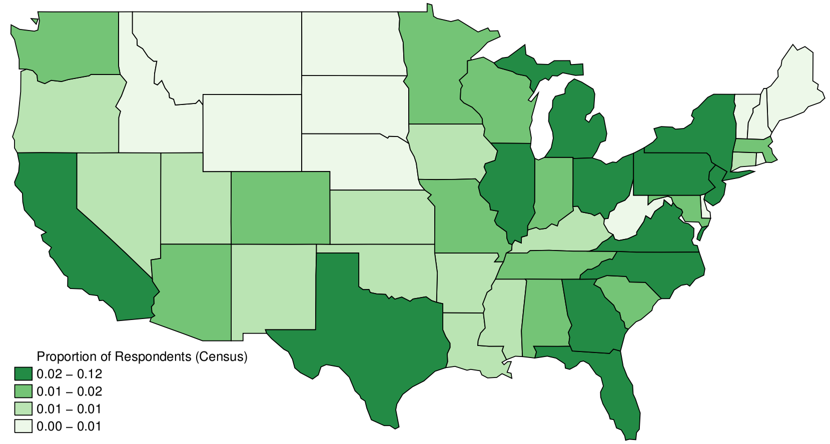
	N	Mean	Std. Dev.	Min	Max
Female	1899	0.56	0.50	0.00	1.00
Age	1899	36.34	11.48	18.00	87.00
Hispanic	1899	0.05	0.22	0.00	1.00
Black	1899	0.08	0.26	0.00	1.00
White	1899	0.84	0.37	0.00	1.00
Married	1899	0.46	0.50	0.00	1.00
Some College +	1899	0.89	0.31	0.00	1.00
Years of Education	1889	14.66	1.73	10.00	17.00
Employed	1899	0.69	0.46	0.00	1.00
"Education, Training, and Library" occupation	1899	0.10	0.30	0.00	1.00
Family Income (1000s)	1899	58.44	39.04	5.00	175.00
Hourly earnings on MTurk	1899	4.13	2.77	1.50	11.50
Parent	1899	0.51	0.50	0.00	1.00
Number of Children	1899	1.06	1.30	0.00	6.00

Notes to table 13: 2,000 individuals were interviewed on Monday September 19, 2016. Of these 2,000 individuals, 74 were located outside of the USA according to their geographic IP address, 16 respondents failed an attention check where the same question was repeated at the beginning and end of the survey, and 16 respondents completed the survey in under 2 minutes (these categories are not mutually exclusive). Any respondent meeting at least one of these criteria was removed from the analysis, resulting in a sample of 1,899 valid surveys.

Figure 14: Geographical Coverage (M-Turk and Census)



(a) Geographical Coverage of M-Turk Respondents



(b) Geographical Coverage from Census Bureau

Notes to figure 14a: Dots represent the precise location of respondents according to their IP address. Proportion of residents by state is based on reported residence of the survey respondent. One respondent from Alaska is omitted from this map. Of all respondents, 74 (3.80%) had IP addresses which suggested that their internet connection was located outside of the USA at the time of the survey response. These non-US observations are removed from the sample (refer to notes to table 13 for details). Notes to figure 14b: Proportion of population by state is calculated from US Census Bureau 2015 estimates.

Table 14: Birth Characteristics and Willingness to Pay for Season of Birth

	(1) Full Sample	(2) BW Sample	(3) DoB Sample
Spring	0.042‡	0.038‡	0.046‡
	[0.008]	[0.011]	[0.011]
Summer	0.015	0.003	0.027
	[0.008]	[0.011]	[0.011]
Fall	0.024	0.015	0.034
	[0.008]	[0.011]	[0.011]
Cost (in 1000s)	-0.068‡	-0.063‡	-0.072‡
	[0.001]	[0.001]	[0.001]
Girl	-0.002	0.000	-0.004
	[0.007]	[0.010]	[0.010]
5lbs, 13oz	0.012	0.012	
	[0.020]	[0.020]	
6lbs, 3oz	0.119‡	0.119‡	
	[0.020]	[0.020]	
6lbs, 8oz	0.141‡	0.141‡	
	[0.020]	[0.019]	
6lbs, 13oz	0.118‡	0.119‡	
	[0.021]	[0.021]	
7lbs, 3oz	0.165‡	0.165‡	
	[0.021]	[0.020]	
7lbs, 8oz	0.182‡	0.181‡	
	[0.021]	[0.021]	
7lbs, 13oz	0.154‡	0.154‡	
	[0.020]	[0.020]	
8lbs, 3oz	0.164‡	0.164‡	
	[0.021]	[0.021]	
8lbs, 8oz	0.170‡	0.170‡	
	[0.020]	[0.020]	
8lbs, 13oz	0.133‡	0.133‡	
	[0.020]	[0.020]	
Weekend Day	0.016		0.015
	[0.008]		[0.008]
WTP for Spring (USD)	622.2	595.6	642.2
95% CI	[240.2;1004.1]	[16.7;1174.6]	[136.5;1148.0]
Observations	26586	13328	13258

Average marginal effects from a logit regression are displayed. All columns include option order fixed effects and round fixed effects. Standard errors are clustered by respondent. Willingness to pay and its 95% confidence interval is estimated based on the ratio of costs to the probability of choosing a spring birth. The 95% confidence interval is calculated using the delta method for the (non-linear) ratio, with confidence levels based on Leamer values. ‡ Significance based on Leamer criterion at 5%.

ONLINE APPENDIX

For the paper:

The Demand for Season of Birth

Damian Clarke, Sonia Oreffice and Climent Quintana-Domeque

Table A1: Descriptive Statistics for Mothers (White Married Mothers, 20–45, Second births)

	N	Mean	Std. Dev.	Min.	Max.
Mother's Age (years)	3501874	29.581	4.99	20	45
Hispanic	3501874	0.228	0.42	0	1
Aged 20-24	3501874	0.175	0.38	0	1
Aged 25-27	3501874	0.182	0.39	0	1
Aged 28-31	3501874	0.291	0.45	0	1
Aged 32-39	3501874	0.325	0.47	0	1
Aged 40-45	3501874	0.027	0.16	0	1
Some College +	3501874	0.521	0.50	0	1
Years of Education	3501874	14.285	2.71	4	17
Smoked in Pregnancy	3501874	0.055	0.23	0	1
Used ART[a]	2359245	0.004	0.06	0	1
Received WIC food in Pregnancy[a]	2333870	0.257	0.44	0	1
Pre-pregnancy BMI[a]	2212478	25.469	5.03	16	40
Pre-pregnancy Underweight (BMI $<$ 18.5)[a]	2212478	0.031	0.17	0	1
Pre-pregnancy Normal Weight (18.5 $\leq$ BMI $<$ 25)[a]	2212478	0.519	0.50	0	1
Pre-pregnancy Overweight (25 $\leq$ BMI $<$ 30)[a]	2212478	0.262	0.44	0	1
Pre-pregnancy Obese (BMI $\geq$ 30)[a]	2212478	0.189	0.39	0	1

NOTES: Sample consists of all white, married second-time mothers aged 20-45 who give birth to a singleton child and for whom education, smoking status during pregnancy and gestational length of (child's) birth are available. ART refers to the proportion of women who undertook assisted reproductive technologies that resulted in these births. [a] Only available from 2009.

Table A2: Descriptive Statistics for Children (White Married Mothers, 20–45, Second births)

	N	Mean	Std. Dev.	Min.	Max.
Quarter 1 Birth	3501874	0.234	0.42	0	1
Quarter 2 Birth	3501874	0.258	0.44	0	1
Quarter 3 Birth	3501874	0.265	0.44	0	1
Quarter 4 Birth	3501874	0.243	0.43	0	1
Gestation	3501874	38.806	1.97	17	47
Premature	3501874	0.075	0.26	0	1
Female	3501874	0.487	0.50	0	1
Birthweight	3493312	3415.186	503.80	500	5000
LBW	3493312	0.036	0.19	0	1
APGAR	3481664	8.866	0.67	0	10

NOTES: Sample consists of all second-born, singleton children born to white, married mothers aged 20-45 for whom education, smoking status during pregnancy and gestational length of (child's) birth are available. Quarters of birth are determined by the month in which the baby is expected based on conception date. Quarter 1 refers to January to March, Quarter 2 refers to April to June, Quarter 3 refers to July to September, and Quarter 4 refers to October to December due dates.

Table A3: Descriptive Statistics for Mothers (White Unmarried Mothers, 20–45)

	N	Mean	Std. Dev.	Min.	Max.
Mother's Age (years)	1841119	24.537	4.68	20	45
Hispanic	1841119	0.361	0.48	0	1
Aged 20-24	1841119	0.623	0.48	0	1
Aged 25-27	1841119	0.165	0.37	0	1
Aged 28-31	1841119	0.116	0.32	0	1
Aged 32-39	1841119	0.085	0.28	0	1
Aged 40-45	1841119	0.011	0.11	0	1
Some College +	1841119	0.177	0.38	0	1
Years of Education	1841119	12.795	2.56	4	17
Smoked in Pregnancy	1841119	0.176	0.38	0	1
Used ART^a	1290887	0.002	0.04	0	1
Received WIC food in Pregnancy^a	1274833	0.652	0.48	0	1
Pre-pregnancy BMI^a	1198005	25.345	5.18	16	40
Pre-pregnancy Underweight (BMI $<$ 18.5)^a	1198005	0.048	0.21	0	1
Pre-pregnancy Normal Weight (18.5 $\leq$ BMI $<$ 25)^a	1198005	0.509	0.50	0	1
Pre-pregnancy Overweight (25 $\leq$ BMI $<$ 30)^a	1198005	0.251	0.43	0	1
Pre-pregnancy Obese (BMI $\geq$ 30)^a	1198005	0.192	0.39	0	1

NOTES: Sample consists of all white, unmarried first-time mothers aged 20-45 who give birth to a singleton child and for whom education, smoking status during pregnancy and gestational length of (child's) birth are available. ART refers to the proportion of women who undertook assisted reproductive technologies that resulted in these births. ^{a} Only available from 2009.

Table A4: Descriptive Statistics for Children (White Unmarried Mothers, 20–45)

	N	Mean	Std. Dev.	Min.	Max.
Quarter 1 Birth	1841119	0.237	0.43	0	1
Quarter 2 Birth	1841119	0.238	0.43	0	1
Quarter 3 Birth	1841119	0.267	0.44	0	1
Quarter 4 Birth	1841119	0.258	0.44	0	1
Gestation	1841119	38.918	2.51	17	47
Premature	1841119	0.100	0.30	0	1
Female	1841119	0.488	0.50	0	1
Birthweight	1835979	3261.987	552.70	500	5000
LBW	1835979	0.071	0.26	0	1
APGAR	1832539	8.767	0.86	0	10

NOTES: Sample consists of all first-born, singleton children born to white, unmarried mothers aged 20-45 for whom education, smoking status during pregnancy and gestational length of (child's) birth are available. Quarters of birth are determined by the month in which the baby is expected based on conception date. Quarter 1 refers to January to March, Quarter 2 refers to April to June, Quarter 3 refers to July to September, and Quarter 4 refers to October to December due dates.

Table A5: Season of Birth Correlates with state-specific linear trends and unemployment rate at conception: Quarter 2 (White Married Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 2	(3) Quarter 2	(4) Quarter 2	(5) Quarter 2
Mother's Age (years)	$0.007^{\ddagger}$	$0.007^{\ddagger}$	$0.004^{\ddagger}$	$0.004^{\ddagger}$	$0.003^{\ddagger}$
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	$-0.012^{\ddagger}$	$-0.011^{\ddagger}$	$-0.008^{\ddagger}$	$-0.008^{\ddagger}$	$-0.006^{\ddagger}$
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			$0.008^{\ddagger}$	$0.008^{\ddagger}$	$0.006^{\ddagger}$
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			$-0.010^{\ddagger}$	$-0.009^{\ddagger}$	$-0.007^{\ddagger}$
			[0.001]	[0.002]	[0.002]
Hispanic			$-0.008^{\ddagger}$	$-0.008^{\ddagger}$	$-0.006^{\ddagger}$
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					$-0.009^{\ddagger}$
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.005
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					0.000
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					$-0.004^{\ddagger}$
					[0.001]
Did not undergo ART					0.001
					[0.003]
Observations	3468715	3468715	3468715	2193372	2193372
F-test of Age Variables	128.641	103.730	58.586	40.764	41.096
Leamer Critical Value (F)	15.059	15.059	15.059	14.600	14.600
Optimal Age	30.19	29.82	28.13	27.77	25.95
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first births occurring to white, married women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.881 in columns 1-3 and 3.821 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table A6: Season of Birth Correlates Logit: Quarter 2 (White Married Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 2	(3) Quarter 2	(4) Quarter 2	(5) Quarter 2
Mother's Age (years)	0.007‡	0.007‡	0.004‡	0.004‡	0.003‡
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.012‡	-0.011‡	-0.008‡	-0.008‡	-0.006‡
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.008‡	0.008‡	0.006‡
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.010‡	-0.009‡	-0.007‡
			[0.001]	[0.002]	[0.002]
Hispanic			-0.009‡	-0.008‡	-0.006‡
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					-0.009‡
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.005
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					0.000
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					-0.004‡
					[0.001]
Did not undergo ART					0.001
					[0.003]
Observations	3467667	3467667	3467667	2193372	2193372
χ^2 test of Age Variables	258.926	210.569	118.400	80.891	81.440
Leamer Critical Value (Age)	30.117	30.117	30.117	29.201	29.201
Optimal Age	30.19	29.81	28.12	27.77	25.95
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

A small number of observations are removed from the regression sample as there is no variation in quarter 2 births (all births occur in quarters 1, 3 or 4) for a specific state by year cell. In total, 0.03% of observations are removed from the sample in order to estimate the logit specification. Average marginal effects of logit parameters are reported. All singleton, first-born children occurring to white, married women aged 20-45 are included. χ^2 test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the test statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.881 in columns 1-3 and 3.821 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table A7: Season of Birth Correlates Logit: Quarter 3 (White Married Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	0.002‡	0.002	0.001	0.002	0.001
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.004‡	-0.004‡	-0.003‡	-0.004	-0.003
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.000	0.001	0.001
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.001	-0.000	-0.001
			[0.001]	[0.002]	[0.002]
Hispanic			0.003‡	0.004‡	0.004‡
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					0.001
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.002
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					-0.000
					[0.001]
Did not undergo ART					0.028‡
					[0.003]
Observations	3468715	3468715	3468715	2193372	2193372
χ^2 test of Age Variables	110.542	123.227	111.396	75.173	54.453
Leamer Critical Value (Age)	30.118	30.118	30.118	29.201	29.201
Optimal Age	23.93	22.34	21.89	22.84	22.52
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

Average marginal effects of logit parameters are reported. All singleton, first-born children occurring to white, married women aged 20-45 are included. χ^2 test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the test statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.881 in columns 1-3 and 3.821 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table A8: Season of Birth Correlates Excluding December conceptions: Quarter 3 (White Married Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	0.002‡	0.001	0.001	0.002	0.002
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.004‡	-0.003‡	-0.003	-0.004	-0.003
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.001	0.001	0.000
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			0.001	0.002	0.002
			[0.001]	[0.002]	[0.002]
Hispanic			0.001	0.002	0.002
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					-0.001
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.003
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					0.000
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					0.000
					[0.001]
Did not undergo ART					0.001
					[0.003]
Observations	3160687	3160687	3160687	1997748	1997748
F-test of Age Variables	22.729	25.156	21.990	19.481	19.819
Leamer Critical Value (F)	14.966	14.966	14.966	14.507	14.507
Optimal Age	26.52	24.81	24.34	25.29	24.41
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first births occurring to white, married women aged 20-45 are included (with the exception of December conceptions). F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.869 in columns 1-3 and 3.809 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table A9: Season of Birth Correlates Excluding December Conceptions with Linear Age: Quarter 3 (White Married Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	0.002‡	0.001	0.001	0.002	-0.000‡
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
Mother's Age^2 / 100	-0.004‡	-0.003‡	-0.003	-0.004	
	[0.001]	[0.001]	[0.001]	[0.001]	
Some College +			0.001	0.001	0.001
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			0.001	0.002	0.002
			[0.001]	[0.002]	[0.002]
Hispanic			0.001	0.002	0.002
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					-0.002
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.003
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					0.000
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					0.000
					[0.001]
Did not undergo ART					0.002
					[0.003]
Observations	3160687	3160687	3160687	1997748	1997748
F-test of Age Variables	22.729	25.156	21.990	19.481	5.371
Leamer Critical Value (F)	14.966	14.966	14.966	14.507	3.809
Optimal Age	26.52	24.81	24.34	25.29	–
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first births occurring to white, married women aged 20-45 are included (with the exception of December conceptions). F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.869 in columns 1-3 and 3.809 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table A10: Season of Birth Correlates with state-specific linear trends and unemployment rate at conception: Quarter 3 (White Married Mothers, 20–45)

	(1) Quarter 3	(2) Quarter 3	(3) Quarter 3	(4) Quarter 3	(5) Quarter 3
Mother's Age (years)	0.002‡	0.002	0.001	0.002	0.001
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.004‡	-0.004‡	-0.003‡	-0.004	-0.003
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Some College +			0.000	0.001	0.001
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.001	-0.000	-0.001
			[0.001]	[0.002]	[0.002]
Hispanic			0.003‡	0.003‡	0.003
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					0.000
					[0.001]
Pre-pregnancy Underweight (BMI$<$ 18.5)					-0.002
					[0.002]
Pre-pregnancy Overweight (25 $\leq$ BMI$<$ 30)					0.001
					[0.001]
Pre-pregnancy Obese (BMI$\geq$ 30)					0.000
					[0.001]
Did not undergo ART					0.024‡
					[0.003]
Observations	3468715	3468715	3468715	2193372	2193372
F-test of Age Variables	55.280	62.209	56.305	34.940	25.610
Leamer Critical Value (F)	15.059	15.059	15.059	14.600	14.600
Optimal Age	23.89	22.33	21.85	23	22.76
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, first births occurring to white, married women aged 20-45 are included. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. The critical value for rejection of joint insignificance is displayed below the F-statistic. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.881 in columns 1-3 and 3.821 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on Leamer criterion at 5%.

Table A11: ACS Descriptive Statistics (White Married Mothers, 20–45)

	N	Mean	Std. Dev.	Min.	Max.
Mother's Age	95136	29.97	4.91	20	45
Hispanic	95136	0.07	0.26	0	1
Aged 20-24	95136	0.14	0.34	0	1
Aged 25-27	95136	0.19	0.39	0	1
Aged 28-31	95136	0.32	0.47	0	1
Aged 32-39	95136	0.32	0.47	0	1
Aged 40-45	95136	0.04	0.19	0	1
Some College +	95136	0.81	0.39	0	1
Years of education	95136	14.25	1.67	0	16
Works in Education, Training and Library	95136	0.15	0.35	0	1
Quarter 1 Birth	95136	0.24	0.43	0	1
Quarter 2 Birth	95136	0.25	0.44	0	1
Quarter 3 Birth	95136	0.27	0.44	0	1
Quarter 4 Birth	95136	0.24	0.43	0	1

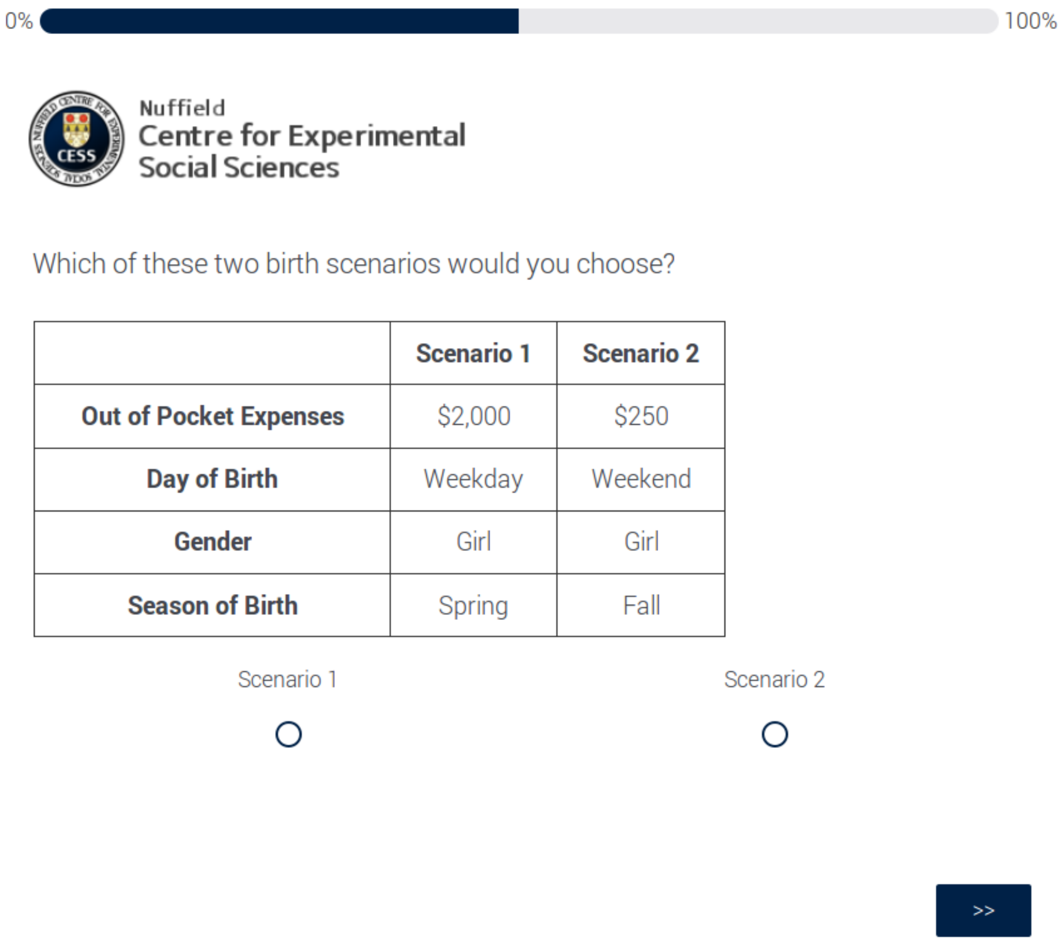
NOTES: Summary statistics are for white, married mothers aged 20-45 who are either head of the household or spouse of the head of the household, and have a first singleton child who is *at most* one year old. We exclude women who are in the military, in a farm household, or currently in school. We retain only women who had worked within the previous five years where each occupation must have at least 500 women over the entire range of survey years. Birth quarter is based on *actual* birth quarter.

Table A12: Logit Estimates of Season of Birth Correlates in ACS (White Married Mothers, 20–45)

	(1) Quarter 2	(2) Quarter 3
Mother's Age	0.009	0.004
	[0.004]	[0.004]
Mother's Age^2 / 100	-0.015	-0.006
	[0.006]	[0.006]
Some College +	0.012	-0.013
	[0.005]	[0.005]
Hispanic	-0.009	-0.008
	[0.007]	[0.007]
Architecture and Engineering	0.015	0.016
	[0.019]	[0.020]
Building and Grounds Cleaning and Maintenance	0.020	-0.022
	[0.021]	[0.021]
Business Operations Specialists	0.022	0.003
	[0.013]	[0.013]
Community and Social Services	0.033	-0.014
	[0.014]	[0.014]
Computer and Mathematical	0.030	-0.008
	[0.016]	[0.016]
Education, Training, and Library	0.045‡	-0.012
	[0.011]	[0.011]
Financial Specialists	0.021	-0.001
	[0.013]	[0.013]
Food Preparation and Serving	0.023	0.008
	[0.014]	[0.014]
Healthcare Practitioners and Technical	0.017	0.008
	[0.011]	[0.011]
Healthcare Support	0.003	-0.009
	[0.014]	[0.014]
Legal	0.000	-0.001
	[0.015]	[0.015]
Life, Physical, and Social Science	0.010	-0.001
	[0.016]	[0.017]
Management	0.016	0.008
	[0.011]	[0.011]
Office and Administrative Support	0.018	0.001
	[0.011]	[0.011]
Personal Care and Service	0.030	-0.004
	[0.013]	[0.013]
Production	0.011	-0.011
	[0.017]	[0.017]
Protective Service	0.039	-0.015
	[0.024]	[0.025]
Sales	0.006	0.001
	[0.011]	[0.011]
Transportation and Material Moving	0.035	-0.037
	[0.024]	[0.023]
Observations	95136	95136
χ^2 test of Occupation Dummies	56.492	21.639
χ^2 test of Age Variables	6.222	1.196

Refer to notes in table 7. Results are replicated here using a Logit regression and reporting average marginal effects. Birth quarter is based on *actual* birth quarter. χ^2 tests for occupation report p-values of joint significance of the dummies, and χ^2 test statistics refer to the test that the coefficients on mother's age and age squared or all occupation dummies are jointly equal to zero. The Leamer critical value for the t-statistic is 3.384. Heteroscedasticity robust standard errors are reported in parentheses. ‡ Significance based on the Leamer criterion at 5%.

Figure A1: Example of One Round of the Discrete Choice Experiment



NOTES TO FIGURE A1: One discrete choice comparison is displayed. The full survey can be viewed for posterity at https://cessoxford.eu.qualtrics.com/SE/?SID=SV_8Cc4YNPyfZOCbCl.