Choosing Season of Birth: The Role of Biological and Economic Constraints*

Damian Clarke
University of Oxford

Sonia Oreffice
University of Surrey & IZA

Climent Quintana-Domeque
University of Oxford & IZA

January, 2016

Preliminary Draft

Abstract

We provide novel estimates of women's decision of when to have their first birth in terms of fertility timing (young vs. old) and season of birth (which quarter), for non-Hispanic white women aged 25-45 in the US in 2005-2013. The prevalence of good season (quarters 2 and 3) is very significantly related to mother's age, as well as to her education and marital status, while those who do not undergo assisted reproductive technology procedures to achieve their first birth exhibit a much higher prevalence of good season births. The frequency of good season is also higher and more strongly related to mother's age in states where cold weather is more severe, reinforcing the interpretation that season of birth is a choice outcome. Finally, we find important interactions between good season of birth and a woman's labour market choices. All of these facts point firmly to the fact that the season in which a baby is born is a choice variable made by the mother or family, potentially explaining a considerable portion of the quality difference observed in "good season" births.

JEL Classification Codes: I10, J01, J13.
Keywords: quarter of birth, fertility timing, birth outcomes, wages.

*We thank seminar participants at University of Surrey, participants in the "Family Economics" Workshop (Barcelona Graduate School of Economics) June 2015, The Alicante Health Economics Workshop, and the Vienne LHEDC Workshop for helpful comments and suggestions. The usual disclaimers apply. Any errors contained in the paper are our own.

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 the seminal article by Angrist and Krueger (1991)—in which quarter of birth was shown to be related to education and earnings in the USA—that season of birth became popular in economic research. Recent work has unveiled a variety of channels, beyond school cutoff laws, through which season of birth may affect adult outcomes, for example, its potential effects on birth outcomes. Indeed, a clear and consistent pattern of "good" and "bad" seasons has emerged. 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). However, as yet, no study has considered season of birth as a choice outcome. In this paper we examine this premise. We consider if season of birth is itself a choice variable in a mother's or families' childbearing decision, and quantify the trade-offs that mothers face (if any) when choosing season of birth.

Stylized facts. We begin by documenting a set of rich and consistent stylised facts which suggest that season of birth is indeed an individual choice variable. A significant "good season" gradient is observed by mother's age, by geographic variation in the climatic harshness of winter, and important interactions with women's education and labour market choices are observed. These relationships hold conditional on competing explanations such as non-random fetal death and non-random gestational length by age, geographic location, and educational attainment, and hold in varying contexts in the Southern and Northern Hemisphere. We turn to the discussion of these stylised facts in the body of the paper.

Given the prominence of fertility planning in balancing people's work and family life as well as the above stylized facts, it is hard to believe that season of birth may simply be a matter of chance. In addition, far from assuming that the average woman is aware that birth weight and the child's future earnings are affected by birth timing, it is sufficient to consider that the average woman has a sense that, on the one hand, winter months may be tougher birth months because of cold weather and higher disease prevalence,[1] and on the other, work commitments make it much easier to take time off with a Spring-Summer birth.[2]

This paper. We first present novel correlates of season of birth, investigating women's decision of when to have their first birth in terms of fertility timing (young versus old) and season of birth (which quarter), for non-Hispanic white women aged 25-45. Using US Vital Statistics data from 2005 to 2013 on all first singleton births, we show that the prevalence of good season (quarters 2 and 3) is very significantly related to mother's age, as well as to her education and marital status. In addition, we find that women who do not undergo assisted reproductive technology (ART) are 3 percentage points more likely to give birth in the good season. This finding, which is robust to controlling for gestation length fixed effects, is consistent with season of birth being a choice outcome, if undergoing ART is associated to no longer being under control of birth timing. Moreover, if women undergoing ART cannot choose season of birth, we should expect to find no seasonality gap, and we present supportive evidence for this prediction. We then examine how birth outcomes, such as birth weight, prematurity (< 37 weeks of gestation) and APGAR scores, are related to season of birth controlling for mother's characteristics. We find that being born in the good season is positively associated to better birth outcomes.

[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 birth relative to their job schedules, and gives the example of school teachers who deliver during summer break.

We then examine data on all births occurring in the American Community Survey (ACS) over a similar period. Along with season of birth and mother's characteristics, ACS data allows us to examine the interaction of a child's season of birth with his mother's labour market decisions. In the ACS we find, similarly, that young mothersand mothers in areas with harsher winter climates are considerably more likely to be observed giving birth in good seasons. However, we also find important interactions with labour market choices. We find that professions in which strong seasonality of work hours exist (such as educators), mothers are additionally more likely to choose good season of birth, and this holds conditional on observed age, education, and weather patterns.

Finally, we document that this result is not unique to the United States and its particular institutional and labour market context. Using vital statistics from Spain we find that similar gradients in good season exist by age of mothers, by temperature, and by job type. Once again, these findings are consistent with choice, as we can rule out that it is driven by selective fetal death or selective birth prematurity.

Related literature. While Currie and Schwandt (2013) explain the first quarter of birth disadvantage through the negative impact of the disease environment on birth weight and gestational weeks in cold months, Buckles and Hungerman (2013) emphasize the role of maternal characteristics in shaping the later socioeconomic disadvantage of winter-born individuals, showing that the mothers of those children are significantly less educated, less likely to be married or white, and more likely to be teenagers.[3] Recent work by Barreca et al. (2015) suggests that individuals may make short shifts in conception month in response to very hot days, with resulting declines and rebounds in following months. Apart from the work by Buckles and Hungerman (2013), which may suggest the possibility that season of birth is *not* random, and Barreca et al. (2015)'s work on temperature and short-term shifts, there is a literature on "exact" birth timing analyzing the joint decision of parents and

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

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. 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 in Australia Gans and Leigh (2009) estimate that parents moved forward June deliveries to become eligible for a newly introduced "baby bonus". Fewer births are documented on holidays (Rindfuss et al., 1979) and weekends (Gould et al., 2003), less auspicious dates (Almond et al., 2015) or on medical professional meeting dates (Gans et al., 2007). Although this body of evidence clearly shows that parents may be willing and able to manipulate birth timing, it represents a choice made well after conception occurs. To the best of our knowledge, ours is the first economic analysis of the planning of season of birth.

Structure of the paper. Section 2 describes the data sources. Section 3 presents the reduced-form estimates. Section 4 develops a structural model and provides estimates of the "value" of good season of birth. Section 5 concludes the paper.

2 Data Sources and Descriptive Statistics

2.1 Birth Data

Data on all births occurring each year in the United States are collected from birth certificate records, and publicly released as the National Vital Statistics System (NVSS) by the National Center of Health Statistics. These data are available for download for all years (inclusive) between 1968 and 2013, with all registered births in all states and the District of Columbia reported from 1984 onwards.[4] In total, more than 99% of births occurring in the country are registered (Martin et al., 2015). Our main estimation sample consists of birth years 2005-2013, and we retain all first births to white, non-Hispanic mothers. Table 1 provides descriptive statistics of all births occurring to this group of mothers, and the principal covariates used in our analysis. Restricting to non-hispanic white mothers who have their first birth results in 8,339,931 records for live births, including twins but excluding triplets and above.

The birth certificate data record important information on births and their parents (mostly on mothers). For the mother, this includes age, marital status, education, smoking status during pregnancy, and assisted reproductive technology (ART) use. For the newborn, in addition to place and time of birth, measures include gestation (in weeks), birth weight, and one- and five-minute APGAR scores. However, 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 do not include the mother's smoking status. ART use information was first released in 2009. These changes mean that we do not have information for all variables over the whole period of analysis.[5] As such, our principal estimation sample is restricted only to those women for whom all covariates are recorded.

Table 2 presents summary statistics just for our main estimation sample. This consists of white, non-hispanic first-time mothers who are issued an updated birth certificate with

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

[5] Complete details of missing variables are available in Table 1, and further details regarding birth certificate revisions and the effect on reported variables and representativeness of the country as a whole are provided in appendix B.

education recorded. In the body of the paper we restrict our analysis to married women aged 25-45.[6] This results in a sample of 2,260,745 births, 2,259,553 of which have gestation length recorded, and hence for whom conception month is known.

2.2 Mother's Occupation and ACS Data

In order to supplement analysis using full vital statistics data described above, we use the American Community Survey (ACS) conducted by the United States Census Bureau. The ACS is a mandatory survey conducted on a representative 1% of the US population every year. Along with details on births to all women, we observe their labour market status (occupation), which is classed using the same occupation codes as in recent census data. For the analysis using ACS data, we use surveys from each of the years analysed above, namely 2005-2014.

We extract all women who are household heads, spouses, or unmarried partners and who have given birth in the year of the survey. This results in the sample of all children contained in the ACS data who were born in the period 2005-2014. We then keep data on all women who correspond to our main estimation sample: 25-45 year old white, non-hispanics, who have had their first birth in the year in question. Given that we are interested in labour market outcomes, for this analysis we retain only women who were employed in the last 5 years in non-military occupations that have a sample of at least 500 women over the entire range of survey years.

[6] The analysis is replicated for all married and unmarried women in the online appendix to this paper. Figure 10 displays the histogram of ages of first-time married mothers, and the proportion of these women who fall between 25-45 and hence are included in our main sample.

2.3 Weather and Unemployment Data

A number of other data sources are consulted, and merged with birth data to provide time-varying coverage of local conditions at the time of conception, including measures of weather and unemployment. These are calculated at the year by month and state level, and are merged by conception (not birth) month. We are able to calculate both conception and birth month, given that gestation is reported in the birth data.

Temperature data are provided by the National Centers for Environmental Information from 1895 onwards, updated monthly. We collate measures of monthly means, maxima and minima for each state, year and month over our time period of analysis, as described in Vose et al. (2014). These are available for all states with the exception of Hawaii and the District of Columbia (DC). We assign births that take place in DC temperature data from Maryland, a contiguous state. Unemployment data at the level of the state, year and month is created from the Bureau of Labor Statistics' (BLS) online monthly time series data.[7] These data come from the Local Area Unemployment Statistics (LAUS) Series, and are available for all states plus DC for the entire time period of interest.

2.4 Descriptive Statistics

Summary statistics for married, white, non-Hispanic mothers aged 25-45 and their children, where the unit of observation is the first birth, are presented in Table 2. The first panel of the table shows that women are on average 30 years old, and 97% are aged below 40 by the time of their first birth ("younger"). Figure 10 displays the absolute frequencies of first births by mother's age for married (biological) mothers and our sample (25-45). While essentially there are no first births to women above 45, women younger than 25 represent about 20% of first births to married women. For all women (including unmarried), the

[7]Full records are available at http://download.bls.gov/pub/time.series/la.

number of first time mothers is much higher, with a substantial percentage of them being teenage pregnancies (see online appendices for further details). For those birth certificates with available mother's education information, 77% have at least some college education; for those with non-missing smoking information, 3% reported having smoked during pregnancy. Finally, for the five most recent years in our sample (2009-2013), we have information on the use of ART procedures: 1% of the women report having used them to achieve their first birth.

In the second panel, we present detailed information on birth outcomes. 52% of babies to first-time, married mothers are born in the good season, defined as quarters 2 and 3; taking into account gestational length, a similar proportion (52%) of the newborns were planned for the good season. It is noteworthy that in the US none of the public holidays falls any close to the frontiers between the good and bad seasons defined above[8]. Regarding gender and multiple births, 49% are girls while 2% are twins (triplets and above where dropped from our sample); in our main analysis, we focus on singletons. Finally, we have information on birth "quality" measures, including birth weight, prematurity ($<$ 37 weeks of gestation) and APGAR score. The averages of these measures (3,353 grams, 8%, 8.8, respectively) are consistent with those from previous studies.

We focus on first births, given that higher-order births also involve the additional decision of birth spacing and the role of experience, possibly underestimating the determinants of the choice of season of birth if planning improves with higher-order pregnancies. In the same vein, we consider only singleton births, although we use second-births and twin birth data in the sensitivity analysis, along with robustness checks on school entry rules, earlier years of data, and heterogeneity by socioeconomic status.

Table 3 investigates the seasonality of birth by mother's age in binary age groups, and

[8] Nationally Observed Public Holidays are: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, July 4, Labor Day, Columbus Day, Veteran's Day, Thanksgiving, Christmas Day.

education (no college vs. at least some college). Panel A shows that young women (aged 28-31) are 4.5 percentage points (pp) more likely to give birth in the good season than in the bad season (52.2% good vs. 47.8% bad), whereas for older women the odds are virtually 50-50 (50.1% good vs. 49.9% bad). In Panel B we also observe that more educated women have a higher probability of giving birth in the good season (51.9% vs. 48.1%), while the gap for less educated women is 1.9 pp (50.9% vs. 49.1%).[9]

Figure 3 highlights the seasonality gap by age group, as well as the justification of the particular definition of age groups in table 3 and analysis in the remainder of the paper. This figure plots the frequency of good season for each age, compared to the omitted base group of 40-45 year olds. Two features are worth mentioning. First, there is a decreasing gap in age from 25 to 45. In particular, the relative prevalence of good season is highest (more than 3 pp) for mothers aged 25-34, while it is essentially zero for mothers aged 40-45. Second, the relationship between seasonality gap and age is non-monotonic: The gap increases as women approach the age of 28, is approximately flat up until the age of 31, and then follows a downward trajectory for women aged 32-39. While the former feature is consistent with biological constraints whereby younger women have more flexibility to optimally time their births, the latter suggests that the prevalence of good season of birth cannot be entirely accounted for by the higher biological ability of young mothers to engage in optimal planning.

[9] The same type of investigation is developed with Spanish birth certificate data for the years 2007-2013 in a country with a much more generous maternity leave environment than the US. That is, this allows us to strengthen our interpretation of the choice nature of season of birth and to examine its relationship with mothers' labor force participation and occupation, information that is not at all recorded in the US certificates.

3 Reduced-form estimates

3.1 Births, Mother Characteristics, and Local Conditions

Figure 1 shows the gap between the fraction of first births to "younger" (28-31) and "older" (40-45) women by month: The gap is positive in the months representing the "good" season (April to September) and negative in the "bad" season (October to March). This finding is consistent with "younger" mothers being less biologically constrained than "older" mothers when making their fertility decision, *ceteris paribus*. Figure 6 reveals that, for "younger" women, good season is more prevalent in the North of the US than in the South. However, this pattern does not hold for "older" women, as we can see in Figure 7. Specifically, among "younger" women, a much higher proportion of good season births are observed in the northern states where the winter temperature is more severe. Interestingly, there is a North-South gradient, southern states with milder Winter exhibit lower proportion of births in good seasons. Strikingly, no such geographical pattern is observed of first births to "older" mothers, with the proportion of good season births appearing to be unrelated to geographic location of the state.

We further investigate whether the geographical differences in the prevalence of good season are due to weather conditions in Figure 8. If women choose season of birth at all, they may be more willing to give birth in the Spring or Summer, at least in states with more severe cold weather in Winter. We plot the percentage of "younger" women giving birth in the good season against the coldest monthly average by state: The pattern is spectacular. There is a strong linear negative association between these two variables (correlation coefficient = -0.668). Interestingly, we do not find such a relationship for older women (correlation coefficient = 0.108). Finally, in Figure 9, we present additional evidence that the seasonality of births is strongly related to weather: The US (Northern hemisphere) seasonality patterns of birth are completely reversed in Chile (Southern hemisphere).

Season of birth correlates. In Table 4 we investigate the relationship between good season of birth (quarters 2 and 3) and mother's age. In column 1 we see that "younger" women are approximately 2 pp more likely to have their first child in the good season than "older" women (aged 40-45). These age dummies reflect the graphical pattern observed in figure 1 of a non-monotonic relationship between age and good season with a peak good season age of 28 years. This difference is robust to the addition of control variables (columns 2-4): state and year fixed effects, education (an indicator for having some college or above), and (an indicator for) smoking during pregnancy. In addition, high-educated women (or married women) are at most only 1 pp more likely to have their first born child in the good season than their counterparts, which is only half of the difference between younger and older women. Women who smoked during pregnancy are at most 1 pp less likely to have their first birth in the good season. Hence, a mother's age seems to be the most relevant driving force behind season of birth. Finally, in columns 5-7, we investigate the role of undergoing an ART procedure. Since this information is available only from 2009 to 2013, we replicate column 4 with this restricted sample in column 5, finding the same results. In column 6 we include an ART indicator (1 if the birth did not happen through an ART procedure, 0 otherwise), and estimate a strongly positive significant coefficient: Women who do not undergo ART are 3 pp more likely to give birth in the good season. This finding, which is robust to controlling for gestation length fixed effects, is consistent with season of birth being a choice variable, if undergoing ART is associated to no longer being under control of birth timing.

Placebo test: ART versus non-ART users. If women undergoing ART cannot choose season of birth, we should expect to find no seasonality gap. However, women undergoing ART who are very young (20-24), well below the mean age of mother at first birth in the US (26 years in 2013; see Martin et al., 2015), are likely to suffer from serious infertility problems and may be those who end up in the bad season. These two features are precisely reported in Figure 13. Instead, Figure 13b reports the pattern described above for the non-ART users.[10] Table 7 summarizes these graphical findings in regression format.

While these results suggest that ART users are actually on average more likely to give birth during the "bad season", no systematic or statistically significant difference is observed when comparing older to younger women (figure 4b). Indeed, when examining the distribution of ART births over the year, the entire difference in the proportion of good season births appears to be driven by a large reduction of ART conceptions occurring in January. This is in line with seasonality in opening hours of ART clinics, which in many cases have extended periods of closure in December. This is supported by anecdotal evidence from an online search of clinic opening hours.

Birth outcomes correlates. In Table 8 we investigate the correlates of birth outcomes. Babies born in the good season tend have better outcomes at birth, after controlling for mother characteristics: They are 8 grams heavier; they are 0.1 pp less likely to be LBW ($< 2,500$ grams); they have on average 0.02 more weeks of gestation; and they are 0.02 pp less likely to be premature (< 37 weeks of gestation). Younger women tend to have babies with higher "quality" at birth: Their babies tend to be between 90-105g heavier; they are 4 pp less likely to be LBW; 0.7 pp less likely to be VLBW ($< 1,500$ grams); they have on average 0.5 more weeks of gestation; they are 4 pp less likely to be premature; and they score 0.06 additional units in the APGAR score. In addition, high-educated (and married) women tend to have babies with better outcomes at birth. Finally, women who smoke in pregnancy have babies who are 171 grams lighter, consistent with the findings in Lien and Evans (2005), who use an instrumental variable approach and find that maternal smoking reduces mean birth weight by 182 grams.

[10] See Figure 2a for a month-by-month comparison in the seasonality gap by ART status.

3.2 Robustness checks

We examine a number of alternative specifications and samples to test the robustness of "good season" choice in varying contexts. The inclusion of state specific linear trends and unemployment rate at season of conception leads to essentially no changes in estimated coefficients (table 5). In appendix tables, we consider the additional sample of second births and run our main regressions of good season of birth on maternal characteristics, finding the same pattern of results and significance, with slightly larger estimated coefficients (Table 20). Interestingly, when we instead focus on the sample of twin first births we do not find any statistically significant association between the prevalence of good season among twins and maternal characteristics such as age or education (Table 21). Twins represent only 2% of the total of first births, and nowadays mainly arise as an effect of non-ART and ART procedures in the presence of infertility problems: We believe that the above evidence is consistent with our interpretation of season of birth as a choice variable, since for women undergoing ART treatments birth timing and planning is often out of their control. Finally, including fetal deaths in our regressions does not alter our findings (Table 22).

To check the role of mother's age, we also run regressions using age (and age squared) as a continuous variable, or with an indicator of being 25-34 years old instead of 25-39 for the younger group. Table 23 provides evidence consistent with the relevant role of mother's age in determining season of birth, in line with the quadratic relationship between age and season of birth described in figure 1. Finally, when running the birth quality regressions on the sample of second births or twins, the estimates confirm our previous findings: good season is positively significantly associated to birth quality indicators for second births (table 25), but is considerably less so for twin first births (Tables 13).

In the online appendix to this paper, we replicate the entire analysis using Spanish vital statistical data. Despite the considerably different context, both in terms of the months which are "good season" and the institutional context surrounding maternal leave policy, the results point to largely identical findings. Once again we find that younger mothers are significantly more likely to give birth in good seasons, the prevalence of good season depends strongly on the climatic harshness of the place of birth, and the follow on effect of good season on birth quality outcomes is significant. Full analysis is reproduced in online appendix C.

3.3 Births and Maternal Occupation

By using US Census data, we are able to replicate the above findings, while also observing the mother's stated observation. This allows us not only to test the veracity of our results, but more importantly, to test whether "good season" choices of birth timing interact with a mother's labour market decisions. There is considerable evidence that labour market flexibility effects women's job choices as well as partially explaining the pay gap (Goldin, 2014). Here we test whether labour market flexibility and job type also interact directly with child bearing choices and timing.

Tables 9-13 replicate results from vital statistics data using the 1% census sample contained in ACS data. Despite being based on a much smaller sample, we see that all the principal conclusions of the birth certificate data are backed up in ACS results. In table 14, we examine how good season choices interact with a mother's occupation class. In column 2 we present results from a regression of good season on mother's age and two level occupation class from the census. We see that, conditional on age and education, labour market decisions have an *additional* impact on the likelihood of giving birth in quarters 2 or 3. This is particularly striking among educators ("education, training and library), who have frequently have a long summer break which can be timed to align with child birth. In figures 15-17 we find that these results hold even when conditioning on all of income, education and unemployment rates at conception.

In figure 18 we examine birth timing and occupation class by quarter. As outlined above, educators are much more likely to time their births to aling with the beginning of their summer break (quarter 2), while other significant observations are more likely to target quarter 3: the most temperate birth quarter. Indeed, in online appendix figures, the occupational advantages for teachers giving birth during vacations are found to be completely unrelated to weather. Even in areas in which winters are mild, women working in educational occupations are found to prefer good season given the considerably longer labour market break that this offers after birth and before return to work.

4 Conclusion

The effects of season of birth on newborn and adult socioeconomic outcomes have been widely documented across disciplines, where a clear and consistent pattern of "good" and "bad" seasons has emerged. This is the first analysis of season of birth as a choice that women may make, and to estimate the value of good season of birth in terms of birth weight and wages.

We document a consistent and clear series of stylised facts suggesting that women choose the seasonality of their birth. Firstly, younger women, who have more remainging years for potential child bearing, are considerably more likely to time births to fall in the summer month. Secondly, those women who engage in ART are found to be significantly less likely to give birth in good birth seasons, given that their ability to time births depends much more on the availability of IVF and other treatments at clinics. Thirdly, we document that the probability of choosing good season of birth varies inversely with the plesantness of winter: when winters become harsher, the costs of a winter birth rise, and women are much more likely to time birth in summer. Finally, we find that birth timing decisions interact strongly with labour market choices. Particularly, women who work in educational occupations are found to have a much larger proportion of births which fall in summer.

All in all, this points to birth timing within a year as a choice. This finding has important implications on the question of why babies born in good seasons are healthier. While conditions in utero *are* more favourable, there is also a strong selection effect among young, educated, and employed mothers.

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.

Angrist, J. D. and A. B. Krueger (1991): "Does Compulsory School Attendance Affect Schooling and Earnings?" *The Quarterly Journal of Economics*, 106, 979–1014.

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.

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.

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

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.

Goldin, C. (2014): "A Grand Gender Convergence: Its Last Chapter," *American Economic Review*, 104, 1091–1119.

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.

INE (2013): "Estadísticas del Movimiento Natural de la Población," Metodología, Instituto Nacional de Estadística.

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.

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.

Menacker, F. and J. A. Martin (2005): "Expanded Health Data From the New Birth Certificate," National Vital Statistics Report Vol 56, No 13, 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.

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.

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

Vose, R. S., S. Applequist, M. Squires, I. Durre, M. J. Menne, C. N. Williams, Jr., C. Feinmore, K. Gleason, and D. Arndt (2014): "Improved Historical Temperature and Precipitation Time Series for U.S. Climate Divisions," *Journal of Applied Meteorology & Climatology*, 53, 1232–1251.

Tables

Table 1: Descriptive Statistics All Ages (NVSS 2005-2013)

	N	Mean	Std. Dev.	Min.	Max.
Panel A: Mother					
Mother's Age	8339931	26.26	5.88	12	50
Married	8339931	0.64	0.48	0	1
Young (aged 25-39)	8339931	0.57	0.50	0	1
Aged 20-24	8339931	0.28	0.45	0	1
Aged 25-27	8339931	0.17	0.38	0	1
Aged 28-31	8339931	0.22	0.41	0	1
Aged 32-39	8339931	0.17	0.38	0	1
Aged 40-45	8339931	0.02	0.13	0	1
Some College +	5441099	0.46	0.50	0	1
Years of education	5441099	14.16	2.40	4	17
Smoked during Pregnancy	4786782	0.13	0.33	0	1
Used ART (2009-2013 only)	3619301	0.01	0.10	0	1
Panel B: Child					
Good season of birth (birth date)	8339931	0.51	0.50	0	1
Good season of birth (due date)	8330198	0.51	0.50	0	1
Twin	8339931	0.02	0.15	0	1
Female	8339931	0.49	0.50	0	1
Birthweight (grams)	8316651	3292.33	566.87	500	5000
Low Birth Weight (<2500 g)	8316651	0.07	0.26	0	1
Weeks of Gestation	8330198	38.88	2.46	17	47
Premature (< 37 weeks)	8330198	0.10	0.30	0	1
APGAR (1-10)	8172256	8.79	0.83	0	10

NOTES: Each sample consists of all first-born children born to white, non-hispanic mothers of any age ocurring in the NVSS. birth register. Good season refers to birth quarters 2 and 3 (Apr-Jun and Jul-Sept).

Table 2: Descriptive Statistics Main Sample (NVSS 2005-2013)

	N	Mean	Std. Dev.	Min.	Max.
Panel A: Mother					
Mother's Age	2260745	30.28	3.92	25	45
Married	2260745	1.00	0.00	1	1
Young (aged 25-39)	2260745	0.97	0.16	0	1
Aged 25-27	2260745	0.28	0.45	0	1
Aged 28-31	2260745	0.39	0.49	0	1
Aged 32-39	2260745	0.30	0.46	0	1
Aged 40-45	2260745	0.03	0.16	0	1
Some College +	2260745	0.77	0.42	0	1
Years of education	2260745	15.59	1.59	4	17
Smoked during Pregnancy	2260745	0.03	0.18	0	1
Used ART (2009-2013 only)	1572674	0.01	0.11	0	1
Panel B: Child					
Good season of birth (birth date)	2260745	0.52	0.50	0	1
Good season of birth (due date)	2259553	0.52	0.50	0	1
Female	2260745	0.49	0.50	0	1
Birthweight (grams)	2255282	3352.85	535.94	500	5000
Low Birth Weight (<2500 g)	2255282	0.05	0.22	0	1
Weeks of Gestation	2259553	39.02	2.17	17	47
Premature (< 37 weeks)	2259553	0.08	0.27	0	1
APGAR (1-10)	2248425	8.78	0.82	0	10

NOTES: Each sample consists of all first-born children born to married white, non-hispanic mothers aged between 25-45 for whom education, smoking, and marital status is recorded. This is the main estimation sample. Good season refers to birth quarters 2 and 3 (Apr-Jun and Jul-Sept).

Table 3: Percent of Births, Singletons

	Seasons				Characteristics	
	Bad Season	Good Season	Diff.	Ratio	<37 Weeks	ART
PANEL A: BY AGE						
20-24 Years Old	48.41	51.59	3.18	1.07	0.08	0.00
25-27 Years Old	47.94	52.06	4.12	1.09	0.08	0.00
28-31 Years Old	47.77	52.23	4.46	1.09	0.08	0.01
32-39 Years Old	48.69	51.31	2.62	1.05	0.09	0.02
40-45 Years Old	49.89	50.11	0.22	1.00	0.12	0.08
PANEL B: BY EDUCATION						
No College	49.07	50.93	1.86	1.04	0.10	0.00
Some College +	48.07	51.93	3.86	1.08	0.08	0.01

NOTES: Good season refers to birth quarters 2 and 3 (Apr-Jun and Jul-Sept). Bad season refers to quarters 1 and 4 (Jan-Mar and Oct-Dec). Values reflect the percent of yearly births each season from 2005-2013.

Table 4: Season of Birth Correlates

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Aged 25-27	0.020***	0.022***	0.022***	0.021***	0.023***	0.021***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Aged 28-31	0.022***	0.023***	0.022***	0.021***	0.024***	0.022***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Aged 32-39	0.013***	0.013***	0.013***	0.012***	0.013***	0.011***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Some College +			0.010***	0.009***	0.007***	0.008***
			[0.001]	[0.001]	[0.001]	[0.001]
Smoked in Pregnancy				-0.012***	-0.012***	-0.012***
				[0.002]	[0.002]	[0.002]
Did not undergo ART						0.027***
						[0.004]
Constant	0.501***	0.499***	0.490***	0.503***	0.550***	0.527***
	[0.002]	[0.002]	[0.002]	[0.062]	[0.077]	[0.077]
Observations	2259553	2259553	2259553	2259553	1571996	1571996
F-test of Age Dummies	0.000	0.000	0.000	0.000	0.000	0.000
State and Year FE		Y	Y	Y	Y	Y
Gestation FE				Y	Y	Y
2009-2013 Only					Y	Y

Sample consists of singleton first born children to married non-Hispanic white women aged 25-45. Independent variables are all binary measures. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 5: Season of Birth Correlates (Robustness)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season	(7) Good Season
Aged 25-27	0.024***	0.026***	0.026***	0.025***	0.021***	0.027***	0.025***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.004]	[0.004]
Aged 28-31	0.026***	0.027***	0.026***	0.025***	0.022***	0.027***	0.025***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.004]	[0.004]
Aged 32-39	0.017***	0.017***	0.017***	0.016***	0.012***	0.016***	0.015***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.004]	[0.004]
Some College +			0.009***	0.008***	0.008***	0.007***	0.007***
			[0.002]	[0.002]	[0.001]	[0.002]	[0.002]
Smoked in Pregnancy				-0.011***	-0.012***	-0.010***	-0.010***
				[0.003]	[0.002]	[0.003]	[0.003]
Unemployment Rate				-0.009***	-0.009***	-0.152***	-0.152***
				[0.001]	[0.001]	[0.001]	[0.001]
Did not undergo ART							0.026***
							[0.005]
Constant	0.498***	0.496***	0.488***	0.567***	2.028	1.723***	1.701***
	[0.003]	[0.003]	[0.003]	[0.080]	[5.556]	[0.095]	[0.096]
Observations	1161560	1161560	1161560	1161560	2259553	807620	807620
F-test of Age Dummies	0.000	0.000	0.000	0.000	0.000	0.000	0.000
State and Year FE		Y	Y	Y	Y	Y	Y
Gestation FE				Y	Y	Y	Y
State Specific Linear Trends					Y		
2009-2013 Only						Y	Y

Sample consists of singleton first born children to married non-Hispanic white women aged 25-45. Independent variables are binary, except for unemployment, which is measured as the unemployment rate in the mother's state in the month of conception. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 6: Season of Birth, Age and Education

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season
Aged 25-27	0.022***	0.022***	0.012*		
	[0.002]	[0.002]	[0.007]		
Aged 28-31	0.022***	0.022***	0.011		
	[0.002]	[0.002]	[0.007]		
Aged 32-39	0.013***	0.013***	0.007		
	[0.002]	[0.002]	[0.007]		
Some College +		0.009***	-0.001		
		[0.001]	[0.007]		
Aged 25-27 × Some College			0.011		
			[0.008]		
Aged 28-31 × Some College			0.013*		
			[0.008]		
Aged 32-39 × Some College			0.007		
			[0.008]		
Mother's Age (years)				0.005***	0.003***
				[0.001]	[0.001]
Mother's Age^2				-0.000***	-0.000***
				[0.000]	[0.000]
Years of Education					0.003***
					[0.000]
Observations	2259553	2259553	2259553	2259553	2259553
F-test of Age Dummies	0.000	0.000	.127	0.000	0.000

Sample consists of singleton first-born children to married non-Hispanic white women aged 25-45. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 7: Season of Birth Correlates: Very Young (20-24) and ART users

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Aged 20-24	-0.004***	-0.002**	0.001	-0.003***	-0.002**	0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
ART	-0.030***	-0.033***	-0.033***	-0.029***	-0.032***	-0.033***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.004]	[0.004]
Some College +			0.009***			0.009***
			[0.001]			[0.001]
Smoked in Pregnancy			-0.011***			-0.011***
			[0.002]			[0.002]
Aged 20-24× ART				-0.022	-0.021	-0.022
				[0.030]	[0.030]	[0.030]
Constant	0.521***	0.517***	0.509***	0.521***	0.517***	0.509***
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
Observations	1949090	1949090	1949090	1949090	1949090	1949090
State and Year FE		Y	Y		Y	Y
Controls			Y			Y

Sample consists of singleton first-born children to married non-Hispanic white women aged 20-45 in the years 2009-2013. Controls in columns 3 and 6 are a dummy for college education, and whether the mother smokes. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 8: Birth Quality by Age and Season (Main Sample)

	(1) Birthweight	(2) LBW	(3) VLBW	(4) Gestation	(5) Premature	(6) APGAR
Aged 25-27	104.476***	-0.039***	-0.008***	0.594***	-0.054***	0.071***
	[2.552]	[0.001]	[0.001]	[0.010]	[0.001]	[0.004]
Aged 28-31	93.994***	-0.035***	-0.007***	0.541***	-0.049***	0.064***
	[2.521]	[0.001]	[0.000]	[0.010]	[0.001]	[0.004]
Aged 32-39	62.272***	-0.023***	-0.005***	0.350***	-0.032***	0.041***
	[2.543]	[0.001]	[0.001]	[0.010]	[0.001]	[0.004]
Good Season	9.530***	-0.002***	-0.001***	0.022***	-0.000	0.003**
	[0.711]	[0.000]	[0.000]	[0.003]	[0.000]	[0.001]
Some College +	47.798***	-0.019***	-0.005***	0.187***	-0.020***	0.044***
	[1.350]	[0.001]	[0.000]	[0.006]	[0.001]	[0.002]
Smoked in Pregnancy	-171.144***	0.047***	0.006***	-0.198***	0.026***	-0.026***
	[2.173]	[0.001]	[0.000]	[0.010]	[0.001]	[0.003]
Constant	3232.703***	0.104***	0.020***	38.252***	0.157***	8.656***
	[3.222]	[0.001]	[0.001]	[0.013]	[0.002]	[0.005]
Observations	2254226	2254226	2254226	2259553	2259553	2247469
F-test of Age Variables	0.000	0.000	0.000	0.000	0.000	0.000

Sample consists of singleton first-born children to married non-Hispanic white women aged 25-45. State and year fixed effects are included, and heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 9: Descriptive Statistics (IPUMS 2005-2014)

	N	Mean	Std. Dev.	Min.	Max.
Mother's Age	77875	31.12	4.20	25	45
Married	77875	1.00	0.00	1	1
Young (aged 25-39)	77875	0.96	0.21	0	1
Aged 25-27	77875	0.22	0.41	0	1
Aged 28-31	77875	0.38	0.48	0	1
Aged 32-39	77875	0.37	0.48	0	1
Aged 40-45	77875	0.04	0.21	0	1
Some College +	77875	0.87	0.34	0	1
Years of education	77875	14.53	1.47	0	16
Good Season of Birth	77875	0.52	0.50	0	1

NOTES: Sample consists of all singleton first-born children from the ACS born in the USA to white non-hispanic married mothers aged 25-45 who are either the head of their household or the partner of the head of the household, and who work in an occupation with at least 500 workers in the sample. Good season refers to children born in birth quarters 2 and 3 (Apr-Jun and Jul-Sept).

Table 10: Percent of Births, Singletons

	Bad Season	Good Season	Diff.	Ratio
Panel A: By Age Groups				
20-24 Years Old	49.65	50.35	0.70	1.01
25-27 Years Old	48.26	51.74	3.48	1.07
28-31 Years Old	47.16	52.84	5.68	1.12
32-39 Years Old	48.07	51.93	3.86	1.08
40-45 Years Old	49.38	50.62	1.24	1.03
Panel B: By Education				
No College	48.98	51.02	2.04	1.04
Some College	48.46	51.54	3.08	1.06
Complete College	47.64	52.36	4.72	1.10

Notes: Good season refers to birth quarters 2 and 3 (Apr-Jun and Jul-Sept). Bad season refers to quarters 1 and 4 (Jan-Mar and Oct-Dec).

Table 11: Season of Birth Correlates (IPUMS 2005-2014)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season
Aged 25-27	0.010	0.012	0.013	0.012
	[0.012]	[0.012]	[0.012]	[0.012]
Aged 28-31	0.022*	0.023**	0.023**	0.021*
	[0.011]	[0.011]	[0.011]	[0.011]
Aged 32-39	0.012	0.012	0.011	0.012
	[0.011]	[0.011]	[0.011]	[0.011]
Some College +			0.008	0.005
			[0.007]	[0.008]
Constant	0.509***	0.516***	0.509***	0.551***
	[0.011]	[0.013]	[0.014]	[0.058]
Observations	74780	74780	74780	74780
F-test of Age Dummies	0.074	0.056	0.06	0.104
State and Year FE		Y	Y	Y
Occupation FE				Y

Sample consists of all first born children in the USA to white, non-hispanic, married mothers aged 25-45 included in 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 sample. Age 40-45 is the omitted base category. Heteroscedasticity robust standard errors are reported.

Table 12: Season of Birth Correlates (Robustness)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Aged 25-27	0.010	0.012	0.013	0.013	0.013	0.012
	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Aged 28-31	0.022*	0.023**	0.023**	0.023**	0.023**	0.022*
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Aged 32-39	0.012	0.012	0.011	0.011	0.012	0.012
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Some College +			0.008	0.008	0.008	0.005
			[0.007]	[0.007]	[0.007]	[0.008]
Unemployment Rate				0.003	0.002	0.002
				[0.003]	[0.003]	[0.003]
Constant	0.509***	0.516***	0.509***	0.491***	-20.956	0.509***
	[0.011]	[0.013]	[0.014]	[0.024]	[35.819]	[0.103]
Observations	74780	74780	74780	74780	74780	74780
F-test of Age Dummies	0.074	0.056	0.06	0.06	0.057	0.1
State and Year FE		Y	Y	Y	Y	Y
State Linear Trends					Y	Y
Occupation FE						Y

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Age 40-45 is the omitted base category. Heteroscedasticity robust standard errors are reported.

Table 13: Season of Birth, Age and Education

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season
Aged 25-27	0.012	0.013	-0.014		
	[0.012]	[0.012]	[0.031]		
Aged 28-31	0.023**	0.023**	0.003		
	[0.011]	[0.011]	[0.031]		
Aged 32-39	0.012	0.011	0.016		
	[0.011]	[0.011]	[0.032]		
Some College +		0.008	-0.009		0.008
		[0.007]	[0.031]		[0.007]
Aged 25-27 × Some College			0.032		
			[0.034]		
Aged 28-31 × Some College			0.022		
			[0.034]		
Aged 32-39 × Some College			-0.004		
			[0.034]		
Age				0.012*	0.011
				[0.007]	[0.007]
motherAge2				-0.000*	-0.000*
				[0.000]	[0.000]
Observations	74780	74780	74780	74780	74780
F-test of Age Variables	0.013	0.06	0.371	0.029	0.031

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 14: Season of Birth and Occupation

	(1) Good Season	(2) Good Season	(3) Good Season
Aged 25-27	0.013	0.012	0.012
	[0.012]	[0.012]	[0.012]
Aged 28-31	0.023**	0.021*	0.021*
	[0.011]	[0.011]	[0.011]
Aged 32-39	0.011	0.011	0.012
	[0.011]	[0.011]	[0.011]
Some College +	0.008	0.006	0.005
	[0.007]	[0.008]	[0.008]
Unemployment Rate	0.003	0.003	0.003
	[0.003]	[0.003]	[0.003]
Architecture and Engineering		0.015	
		[0.023]	
Business Operations Specialists		0.018	
		[0.016]	
Community and Social Services		0.022	
		[0.017]	
Computer and Mathematical		0.030	
		[0.020]	
Education, Training, and Library		0.036***	
		[0.013]	
Financial Specialists		0.015	
		[0.016]	
Food Preparation and Serving		0.036*	
		[0.019]	
Healthcare Practitioners and Technical		0.024*	
		[0.013]	
Healthcare Support		-0.005	
		[0.019]	
Legal		0.000	
		[0.018]	
Life, Physical, and Social Science		0.012	
		[0.020]	
Management		0.026*	
		[0.014]	
Office and Administrative Support		0.023*	
		[0.013]	
Personal Care and Service		0.029*	
		[0.016]	
Production		0.007	
		[0.023]	
Sales		0.004	
		[0.014]	
Constant	0.491***	0.472***	0.251***
	[0.024]	[0.027]	[0.080]
Observations	74780	74780	74780
Occupation Codes (level)	-	2	3
F-test of Occupation Dummies	-	.058	0.000
F-test of Age Dummies	0.06	0.096	0.105

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Occupation codes refer to the level of occupation codes (2 digit, or 3 digit). The omitted occupational category in column 2 and column 4 is Arts, Design, Entertainment, Sports, and Media, as this occupation has good quarter=0.500(0.500). All occupation codes refer to IPUMS occ2010 codes, available at: https://usa.ipums.org/usa/volii/acs_occtooccsoc.shtml

Table 15: Season of Birth and Occupation (No Education Control)

	(1) Good Season	(2) Good Season	(3) Good Season
Aged 25-27	0.013	0.011	0.012
	[0.012]	[0.012]	[0.012]
Aged 28-31	0.023**	0.021*	0.021*
	[0.011]	[0.011]	[0.011]
Aged 32-39	0.012	0.011	0.012
	[0.011]	[0.011]	[0.011]
Unemployment Rate	0.003	0.003	0.003
	[0.003]	[0.003]	[0.003]
Architecture and Engineering		0.015	
		[0.023]	
Business Operations Specialists		0.018	
		[0.016]	
Community and Social Services		0.022	
		[0.017]	
Computer and Mathematical		0.030	
		[0.020]	
Education, Training, and Library		0.036***	
		[0.013]	
Financial Specialists		0.015	
		[0.016]	
Food Preparation and Serving		0.034*	
		[0.019]	
Healthcare Practitioners and Technical		0.024*	
		[0.013]	
Healthcare Support		-0.006	
		[0.018]	
Legal		0.000	
		[0.018]	
Life, Physical, and Social Science		0.012	
		[0.020]	
Management		0.025*	
		[0.014]	
Office and Administrative Support		0.022*	
		[0.013]	
Personal Care and Service		0.028*	
		[0.016]	
Production		0.005	
		[0.023]	
Sales		0.003	
		[0.014]	
Constant	0.498***	0.478***	0.254***
	[0.023]	[0.026]	[0.079]
Observations	74780	74780	74780
Occupation Codes (level)	-	2	3
F-test of Occupation Dummies	-	.046	0.000
F-test of Age Dummies	0.056	0.092	0.101

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Occupation codes refer to the level of occupation codes (2 digit, or 3 digit). The omitted occupational category in column 2 and column 4 is Arts, Design, Entertainment, Sports, and Media, as this occupation has good quarter=0.500(0.500). All occupation codes refer to IPUMS occ2010 codes, available at: https://usa.ipums.org/usa/volii/acs_occtooccsoc.shtml

Table 16: Season of Birth and Occupation (Income Control)

	(1) Good Season	(2) Good Season	(3) Good Season
Aged 25-27	0.013	0.012	0.012
	[0.012]	[0.012]	[0.012]
Aged 28-31	0.023**	0.022*	0.022*
	[0.011]	[0.011]	[0.011]
Aged 32-39	0.012	0.012	0.012
	[0.011]	[0.011]	[0.011]
log(household income)	0.001	0.001	-0.000
	[0.004]	[0.004]	[0.004]
Unemployment Rate	0.003	0.003	0.003
	[0.003]	[0.003]	[0.003]
Architecture and Engineering		0.015	
		[0.023]	
Business Operations Specialists		0.018	
		[0.016]	
Community and Social Services		0.023	
		[0.017]	
Computer and Mathematical		0.029	
		[0.020]	
Education, Training, and Library		0.037***	
		[0.013]	
Financial Specialists		0.015	
		[0.016]	
Food Preparation and Serving		0.033*	
		[0.019]	
Healthcare Practitioners and Technical		0.024*	
		[0.013]	
Healthcare Support		-0.005	
		[0.019]	
Legal		0.001	
		[0.018]	
Life, Physical, and Social Science		0.012	
		[0.020]	
Management		0.025*	
		[0.014]	
Office and Administrative Support		0.022*	
		[0.013]	
Personal Care and Service		0.028*	
		[0.016]	
Production		0.006	
		[0.023]	
Sales		0.002	
		[0.014]	
Constant	0.491***	0.468***	0.256***
	[0.049]	[0.053]	[0.092]
Observations	74730	74730	74730
Occupation Codes (level)	-	2	3
F-test of Occupation Dummies	-	.044	0.000
F-test of Age Dummies	0.052	0.086	0.098

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Occupation codes refer to the level of occupation codes (2 digit, or 3 digit). The omitted occupational category in column 2 and column 4 is Arts, Design, Entertainment, Sports, and Media, as this occupation has good quarter=0.500(0.500). All occupation codes refer to IPUMS occ2010 codes, available at: https://usa.ipums.org/usa/volii/acs_occtooccsoc.shtml

Table 17: Season of Birth and Occupation (Income/Education Controls)

	(1) Good Season	(2) Good Season	(3) Good Season
Aged 25-27	0.013	0.012	0.012
	[0.012]	[0.012]	[0.012]
Aged 28-31	0.023**	0.021*	0.021*
	[0.011]	[0.011]	[0.011]
Aged 32-39	0.012	0.011	0.012
	[0.011]	[0.011]	[0.011]
log(household income)	-0.000	0.000	-0.000
	[0.004]	[0.004]	[0.004]
Some College +	0.008	0.005	0.005
	[0.007]	[0.008]	[0.008]
Unemployment Rate	0.003	0.003	0.003
	[0.003]	[0.003]	[0.003]
Architecture and Engineering		0.015	
		[0.023]	
Business Operations Specialists		0.018	
		[0.016]	
Community and Social Services		0.022	
		[0.017]	
Computer and Mathematical		0.029	
		[0.020]	
Education, Training, and Library		0.036***	
		[0.013]	
Financial Specialists		0.015	
		[0.016]	
Food Preparation and Serving		0.035*	
		[0.019]	
Healthcare Practitioners and Technical		0.024*	
		[0.013]	
Healthcare Support		-0.004	
		[0.019]	
Legal		0.001	
		[0.018]	
Life, Physical, and Social Science		0.012	
		[0.020]	
Management		0.025*	
		[0.014]	
Office and Administrative Support		0.023*	
		[0.013]	
Personal Care and Service		0.030*	
		[0.016]	
Production		0.007	
		[0.023]	
Sales		0.003	
		[0.014]	
Constant	0.496***	0.469***	0.256***
	[0.049]	[0.053]	[0.092]
Observations	74730	74730	74730
Occupation Codes (level)	-	2	3
F-test of Occupation Dummies	-	.056	0.000
F-test of Age Dummies	0.06	0.091	0.103

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Occupation codes refer to the level of occupation codes (2 digit, or 3 digit). The omitted occupational category in column 2 and column 4 is Arts, Design, Entertainment, Sports, and Media, as this occupation has good quarter=0.500(0.500). All occupation codes refer to IPUMS occ2010 codes, available at: https://usa.ipums.org/usa/volii/acs_occtooccsoc.shtml

Table 18: Season of Birth and Occupation (Goldin's Classification)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season
Technology Occupations	0.013	0.015	0.014	0.014	0.014
	[0.014]	[0.014]	[0.014]	[0.014]	[0.014]
Health Occupations	0.010	0.010	0.010	0.010	0.010
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
Science Occupations	-0.005	-0.005	-0.005	-0.005	-0.005
	[0.025]	[0.024]	[0.024]	[0.024]	[0.024]
Education, Training, and Library	0.021***	0.021**	0.021**	0.021**	0.021**
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
Aged 25-27	0.029*	0.033*	0.033*	0.033*	0.033*
	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]
Aged 28-31	0.033**	0.036**	0.036**	0.036**	0.036**
	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]
Aged 32-39	0.018	0.020	0.019	0.019	0.019
	[0.017]	[0.016]	[0.016]	[0.016]	[0.016]
Some College +			0.005	0.005	0.005
			[0.020]	[0.020]	[0.020]
Unemployment Rate				0.000	0.000
				[0.004]	[0.004]
Constant	0.492***	0.498***	0.493***	0.493***	0.493***
	[0.016]	[0.019]	[0.027]	[0.040]	[0.040]
Observations	32845	32845	32845	32845	32845
F-test of Age Dummies	0.083	0.042	0.041	0.041	0.041
State and Year FE		Y	Y	Y	Y

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Heteroscedasticity robust standard errors are reported. Occupations are categorised as in Goldin (2014) table A1. The omitted category is Business Occupations, and Other Occupations (heterogeneous) are excluded. The category Education, Training and Library Occupations has been added.

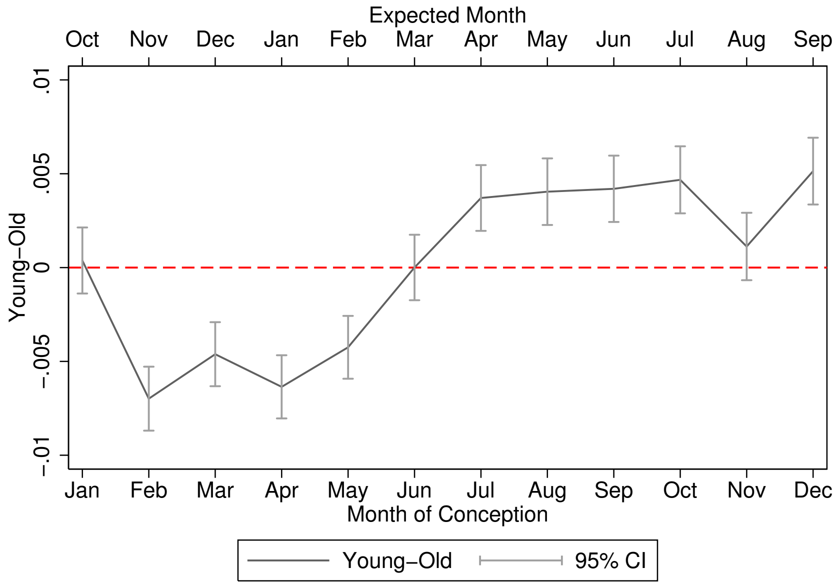
Table 19: Season of Birth and Occupation (Teachers)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Education, Library, Training	0.019***	0.019***	0.019***	0.019***	0.018***	-0.007
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.032]
Some College +			0.006	0.006	0.006	0.005
			[0.007]	[0.007]	[0.007]	[0.007]
Unemployment Rate				0.003	0.003	0.003
				[0.003]	[0.003]	[0.003]
Aged 25-27					0.012	0.007
					[0.012]	[0.013]
Aged 28-31					0.021*	0.019
					[0.011]	[0.012]
Aged 32-39					0.011	0.009
					[0.011]	[0.012]
Aged 2527 × Education Occup						0.043
						[0.035]
Aged 2831 × Education Occup						0.023
						[0.033]
Aged 3239 × Education Occup						0.018
						[0.034]
Constant	0.520***	0.529***	0.524***	0.505***	0.491***	0.494***
	[0.002]	[0.007]	[0.010]	[0.022]	[0.024]	[0.024]
Observations	74780	74780	74780	74780	74780	74780
F-test of Age Dummies					0.084	0.142
State and Year FE		Y	Y	Y	Y	Y

Sample consists of all first born children in the USA to white, non-hispanic married mothers aged 25-45 included in 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 sample. Heteroscedasticity robust standard errors are reported. Education, Library, Training refers to individuals employed in this occupation (occ codes 2200-2550). The omitted occupational category is all non-educational occupations, and the omitted age category is 40-45 year old women.

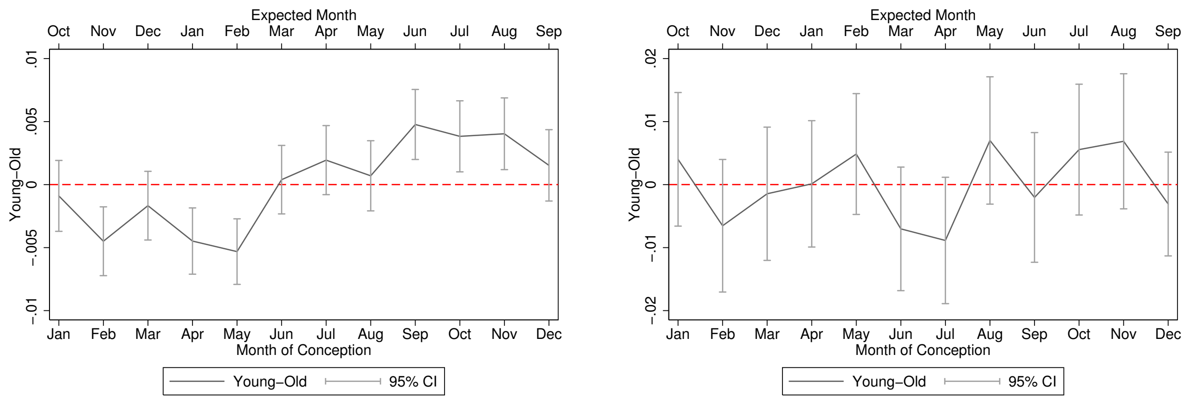
Figures

Figure 1: Differences in Prevalence of Good Season of Birth



Notes to figure: Each point and standard error comes from a regression of conception month x on a binary indicator of being young (28-31), versus older (40-45).

Figure 2: Differences in Prevalence of Good Season of Birth by ART Usage

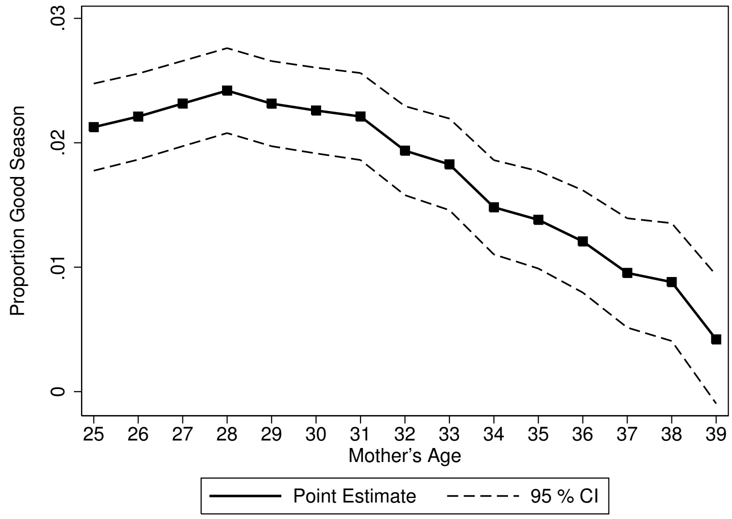


(a) No ART Usage

(b) ART Usage

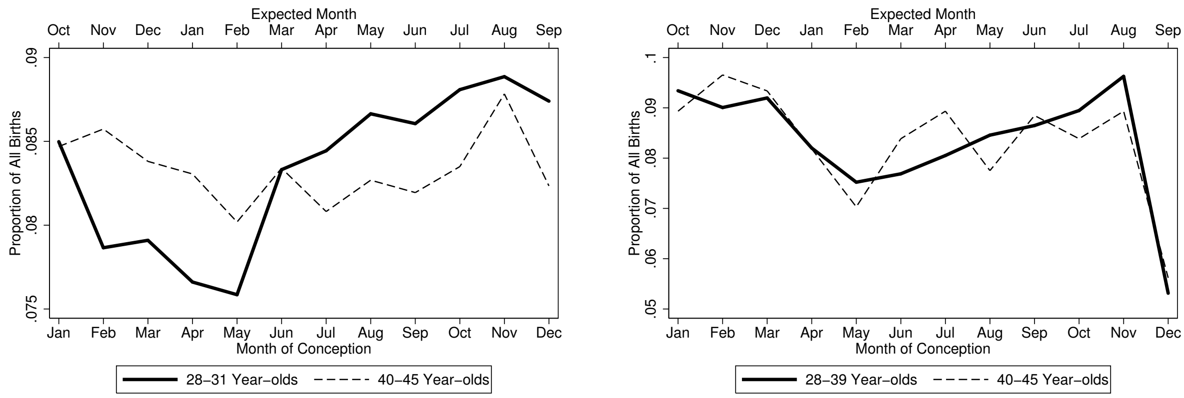
Notes to figure: Each point and standard error comes from a regression of birth month x on a binary indicator of being young (28-31). ART usage is only observed in birth data in the years 2009–2013. In panel (b), young is defined as aged 28-39, given relatively low usage of ART at younger ages.

Figure 3: Prevalence of Good Season by Age



Notes to figure 3: Coefficients and standard errors are estimated by regressing "good season" on dummies of maternal age. Age groups 40-45 are omitted as the base group. The full sample consists of mothers aged 20-45. For the omitted group, proportion good season (and standard error) is 0.497(0.001).

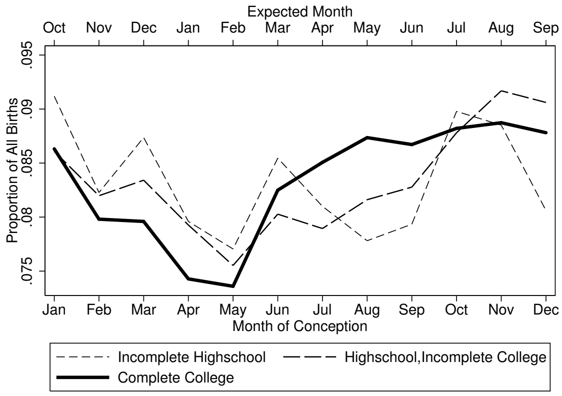
Figure 4: Birth Prevalence by Month, Age Group, and ART Usage



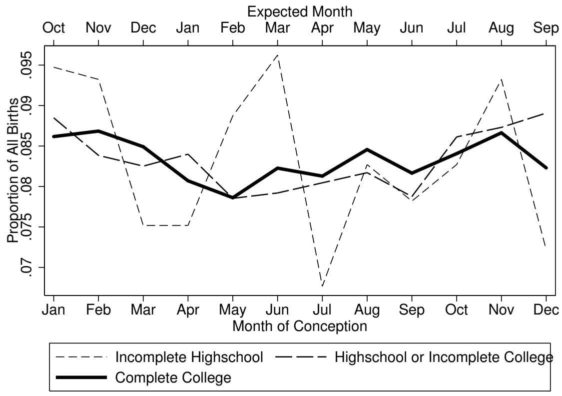
(a) Proportion of Conceptions in Each Month (b) Proportion of Conceptions (ART Only)

Notes to figure 4: Month of conception is calculated by subtracting the rounded number of gestation months (gestation in weeks $\times$ 7/30.5) from month of birth. Each line presents the proportion of all births conceived in each month for the relevant age group.

Figure 5: Birth Prevalence by Month, Age Group, and Education



(a) 28-31 Year Olds



(b) 40-45 Year Olds

Notes to figure 5: Each line presents the proportion of all births conceived in each month for the relevant age group and education level. Refer to figure 4 for additional notes.

Figure 6: Good Season by State (Young)

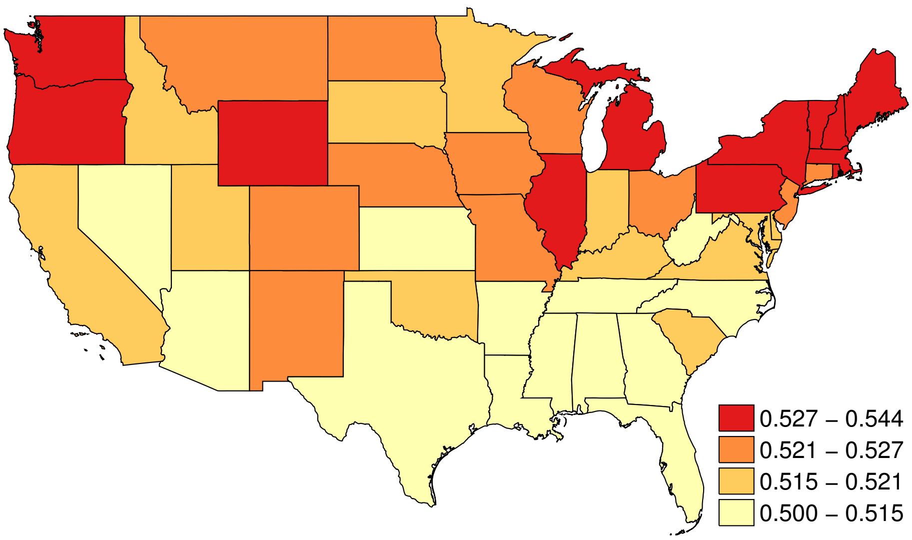
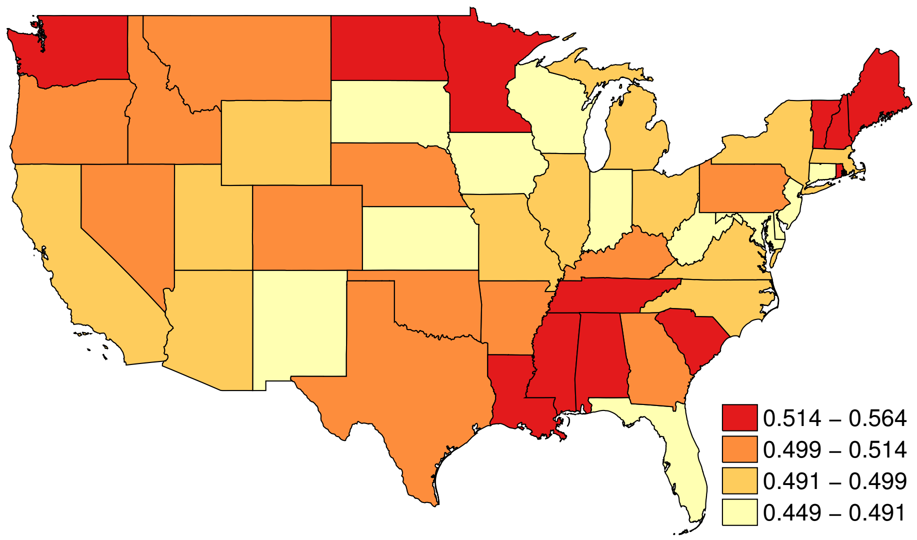
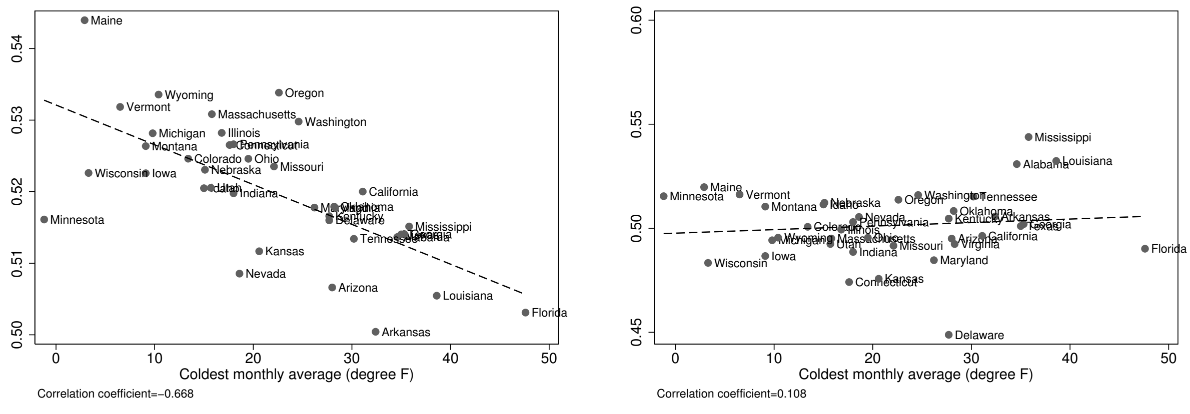


Figure 7: Good Season by State (Old)



Notes to figures 6-7: State data consists of all first births to white non-hispanic women from 2005 and 2013. Figure 6 includes all mothers aged 28-31, while figure 7 includes mothers aged 40-45.

Figure 8: Prevalence of Good Season and Cold Temperatures by State and Age

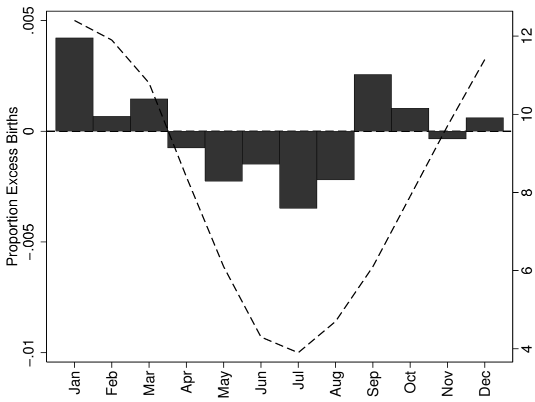


(a) Young Mothers (28-31)

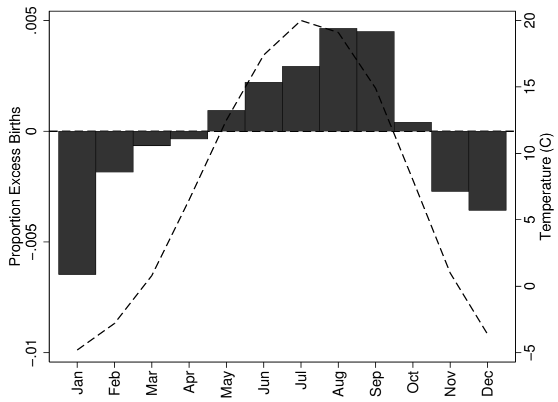
(b) Old Mothers (40-45)

Notes to figure 8: Each point represents a state average of the proportion of women giving birth in the good birth season between 2005 and 2013. The dotted line is a fitted regression line. Monthly temperature data is collected from the National Centers for Environmental Information.

Figure 9: Births per Month and Temperature: Various Countries



(a) Chile



(b) USA

Note to figure 9: Bars represent the difference between expected (evenly spaced) births and actual births. Dotted line represents average temperature in the whole of the country over the period 1990-2009 from the World Bank Climate Change Portal. Births for USA are 2005-2013 and for Chile 2000-2012.

Figure 10: Mother's Age at First Birth

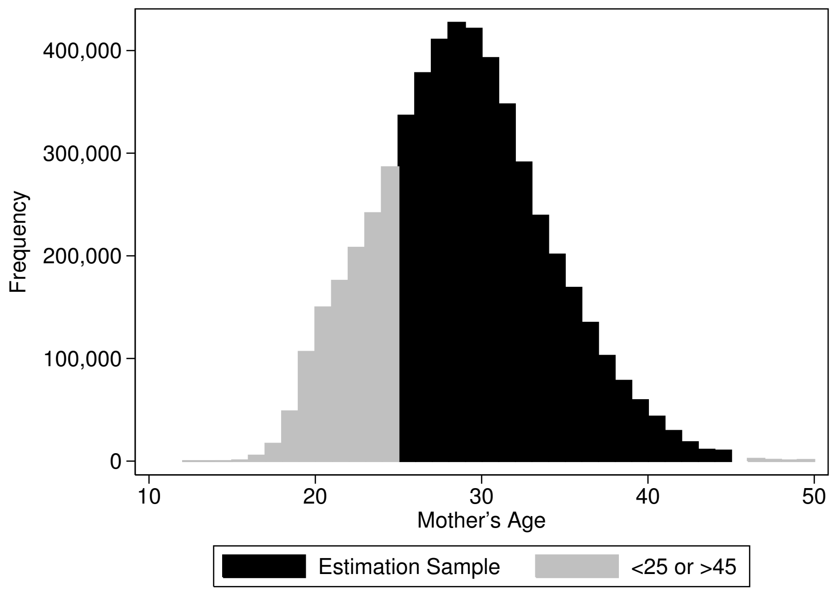


Figure 11: Difference in Births (% Good Season - % Bad Season)

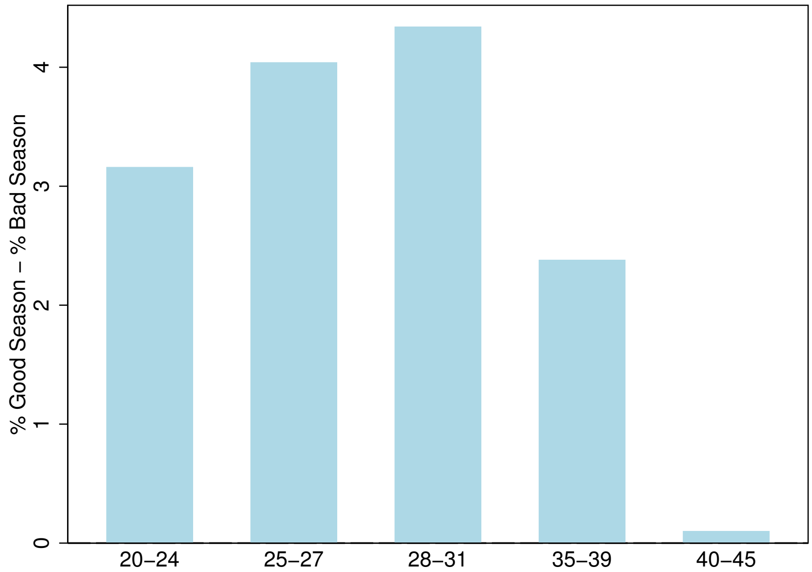
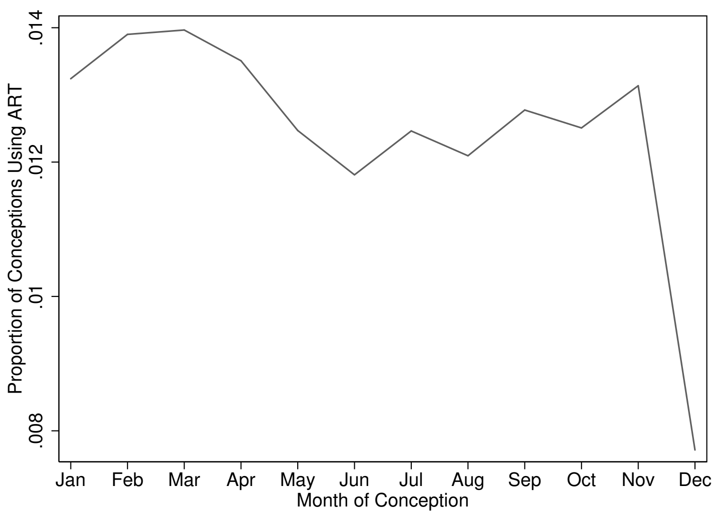
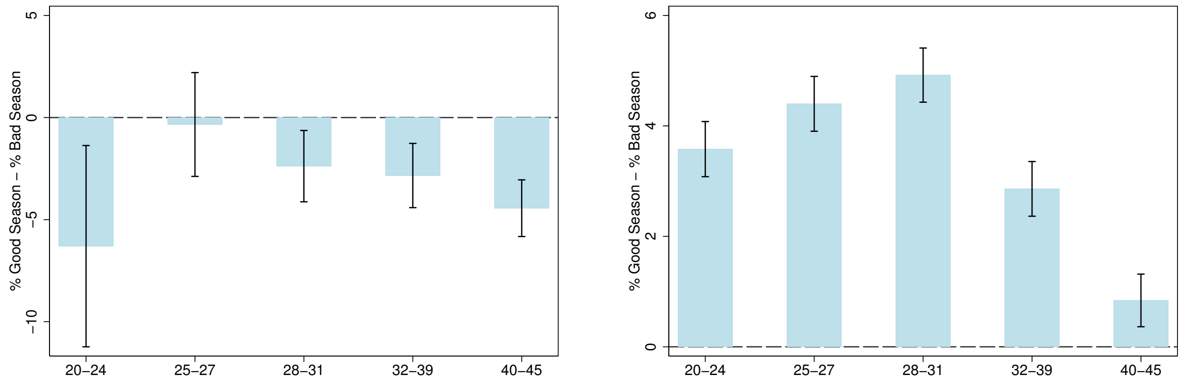


Figure 12: ART Conceptions by Month



Notes to figure 12: Proportion of ART births are calculated using data from 2012-2013 for our main sample. The proportion is calculated as: (ART conceptions)/(Non-ART Conceptions + ART Conceptions).

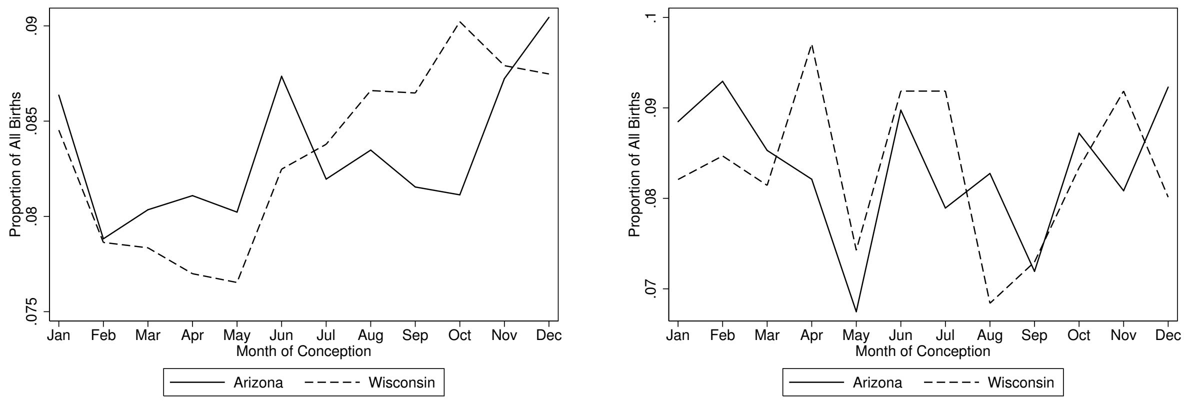
Figure 13: Difference in Births (% Good Season - % Bad Season)



(a) ART Usage

(b) No ART Users

Figure 14: Birth Prevalence by Month (Arizona and Wisconsin)



(a) Young Women (28-31)

(b) Old Women (40-45)

Note to figure 14: Sample consists of all first births from 2005-2013 to white, non-hispanic 25-45 year old mothers occurring in the states of Arizona (142,788 births) or Wisconsin (183,194 births).

Figure 15: Prematurity by Mother's Age

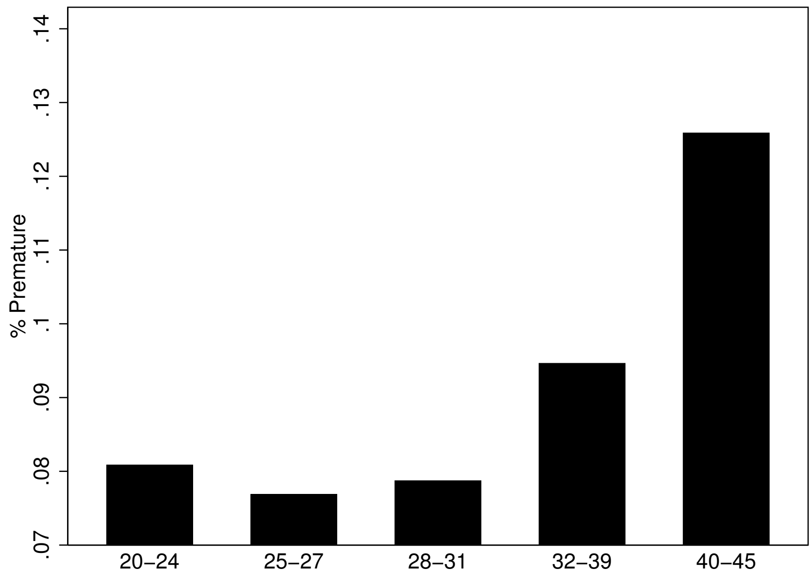
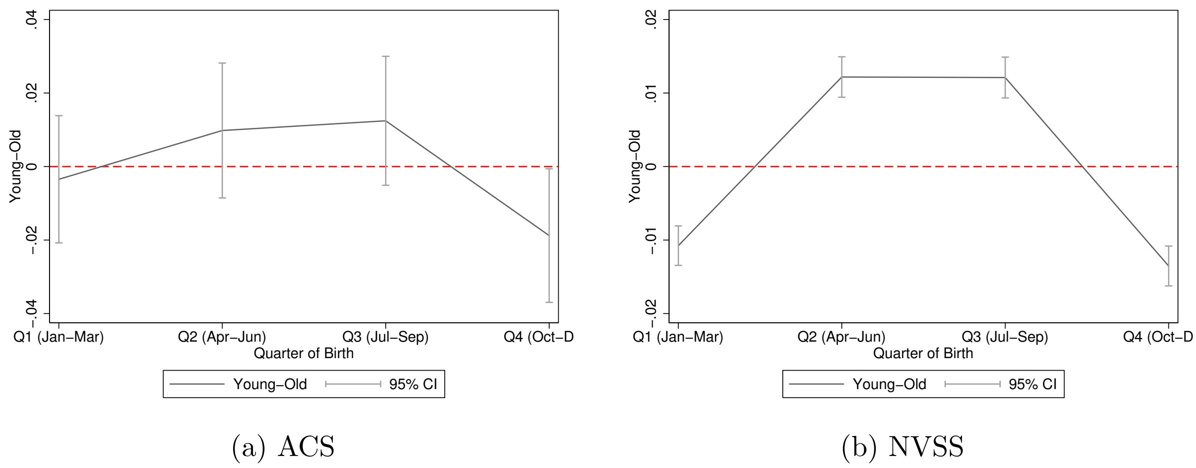
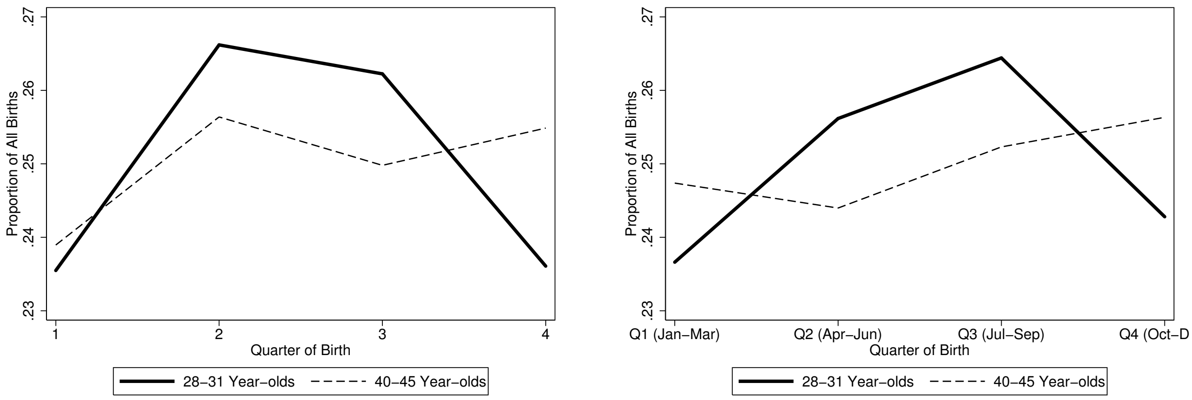


Figure 16: Differences in Prevalence of Good Season of Birth (IPUMS)



NOTES TO FIGURE: Each point and standard error comes from a regression of conception month x on a binary indicator of being young (28-31), versus older (40-45).

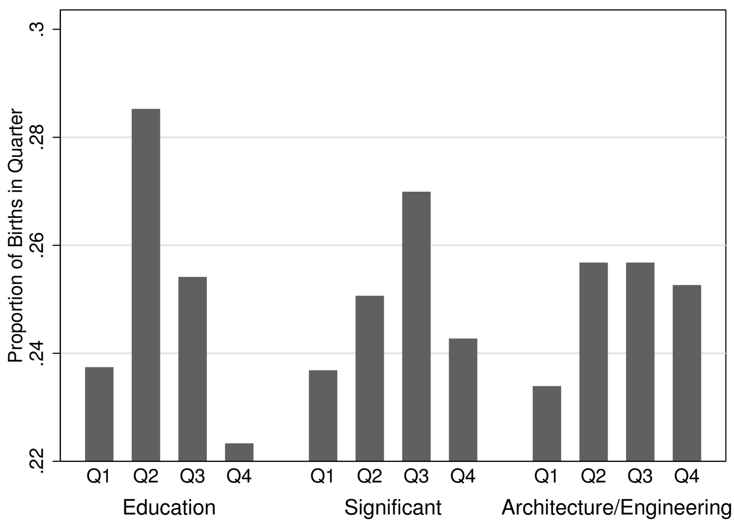
Figure 17: Birth Prevalence by Quarter and Age Group



(a) Proportion of Conceptions (ACS) (b) Proportion of Conceptions (NVSS)

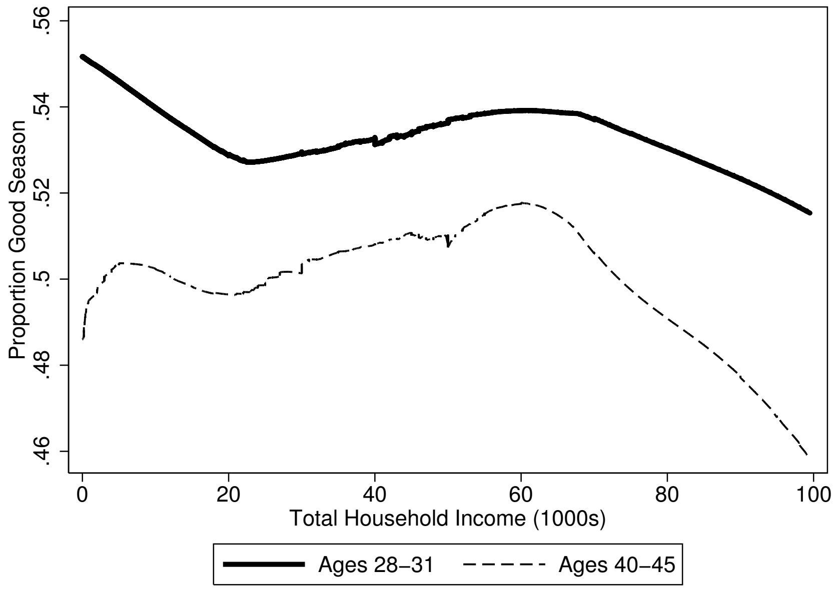
NOTES TO FIGURE 17: Birth quarter is reported in ACS data. Each line presents the proportion of all births occurring in each quarter for the relevant age group. Panel (b) presents an identical figure by quarter of birth from the NVSS data.

Figure 18: Difference in Prevalance of Good Season of Birth by Occupation



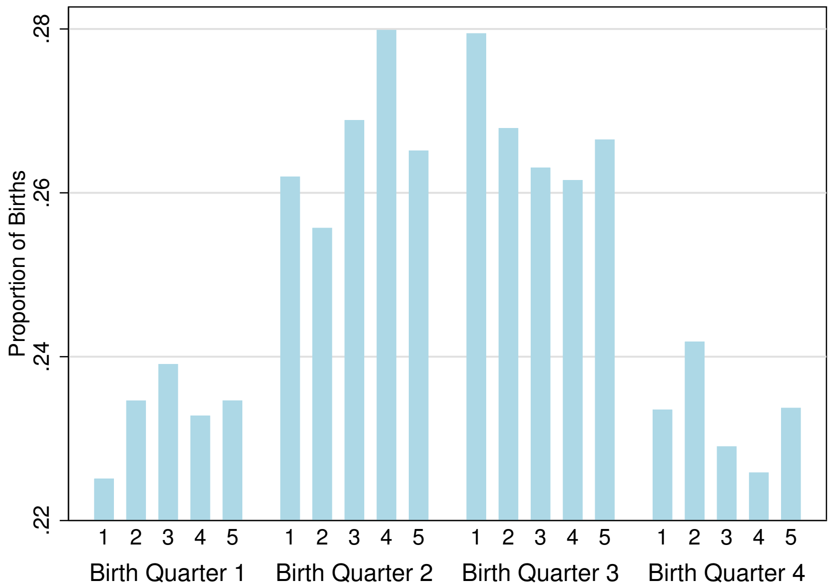
NOTES TO FIGURE 18: Groups are defined as: (1) Education, library, training, (2) occupations with significant coefficients in table 8 (educ, food prep, healthcare, management, office and admin, personal care) and (3) the occupation with least seasonality (architecture and engineering).

Figure 19: Good Season and Income (Non-parametric)



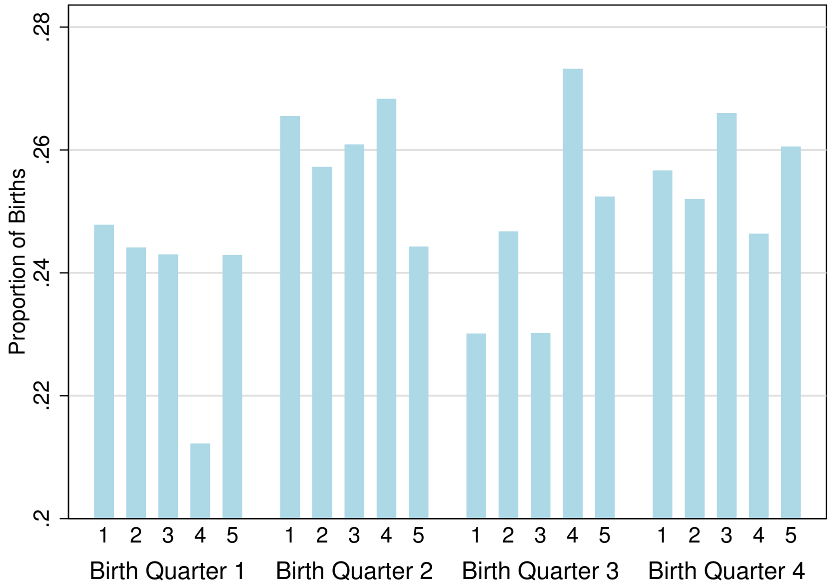
Notes to figure: Each line is estimated by a lowess regression of good season on household income (bandwidth = 0.8 with least squares smoothing). The top and bottom 5% of reported incomes are removed from the sample.

Figure 20: Birth Season and Income (28-31)



Notes to figure: Each bar represents the frequency of births in each birth quarter. Numerical values refer to household income quantiles (1 = lowest, 5 = highest). The top and bottom 5% of reported incomes are removed from the sample.

Figure 21: Birth Season and Income (40-45)



Notes to figure: Each bar represents the frequency of births in each birth quarter. Numerical values refer to household income quantiles (1 = lowest, 5 = highest). The top and bottom 5% of reported incomes are removed from the sample.

A Appendix Tables

Table 20: Season of Birth Correlates (Birth Order = 2)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Aged 25-27	0.020***	0.022***	0.023***	0.024***	0.025***	0.024***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Aged 28-31	0.027***	0.028***	0.029***	0.028***	0.030***	0.029***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Aged 32-39	0.022***	0.022***	0.022***	0.021***	0.023***	0.022***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Some College +			0.011***	0.009***	0.009***	0.009***
			[0.001]	[0.001]	[0.001]	[0.001]
Smoked in Pregnancy				-0.011***	-0.010***	-0.010***
				[0.002]	[0.002]	[0.002]
Did not undergo ART						0.023***
						[0.005]
Constant	0.504***	0.502***	0.492***	0.526***	0.558***	0.535***
	[0.002]	[0.002]	[0.002]	[0.083]	[0.105]	[0.105]
Observations	2300265	2300265	2300265	2300265	1577622	1577622
F-test of Age Dummies	0.000	0.000	0.000	0.000	0.000	0.000
State and Year FE		Y	Y	Y	Y	Y
Gestation FE				Y	Y	Y
2009-2013 Only					Y	Y

Sample consists of singleton second born children to married non-Hispanic white women aged 25-45. Independent variables are all binary measures. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 21: Season of Birth Correlates (Twin sample)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Aged 25-27	0.013	0.013	0.013	0.013	0.010	0.003
	[0.008]	[0.008]	[0.008]	[0.008]	[0.010]	[0.010]
Aged 28-31	0.011	0.011	0.011	0.011	0.016*	0.011
	[0.007]	[0.007]	[0.007]	[0.007]	[0.009]	[0.009]
Aged 32-39	-0.005	-0.005	-0.005	-0.005	-0.004	-0.007
	[0.007]	[0.007]	[0.007]	[0.007]	[0.009]	[0.009]
Some College +			-0.003	-0.003	0.006	0.006
			[0.007]	[0.007]	[0.009]	[0.009]
Smoked in Pregnancy				0.000	0.011	0.009
				[0.013]	[0.017]	[0.017]
Did not undergo ART						0.025***
						[0.006]
Constant	0.496***	0.493***	0.496***	0.452***	0.460***	0.444***
	[0.007]	[0.008]	[0.010]	[0.088]	[0.122]	[0.121]
Observations	81804	81804	81804	81804	54249	54249
F-test of Age Dummies	0.000	0.000	0.000	0.000	0.000	.003
State and Year FE		Y	Y	Y	Y	Y
Gestation FE				Y	Y	Y
2009-2013 Only					Y	Y

Sample consists of twin first born children to married non-Hispanic white women aged 25-45. Independent variables are all binary measures. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 22: Birth Season and Age (Including Fetal Deaths)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season
Aged 25-27	0.020***	0.022***	0.022***	0.021***
	[0.002]	[0.002]	[0.002]	[0.002]
Aged 28-31	0.022***	0.023***	0.023***	0.022***
	[0.002]	[0.002]	[0.002]	[0.002]
Aged 32-39	0.013***	0.013***	0.013***	0.012***
	[0.002]	[0.002]	[0.002]	[0.002]
Smoked in Pregnancy			-0.015***	-0.014***
			[0.002]	[0.002]
Constant	0.501***	0.499***	0.499***	0.517***
	[0.002]	[0.002]	[0.002]	[0.061]
Observations	2269645	2269645	2269645	2269645
F-test of Age Dummies	0.000	0.000	0.000	0.000
State and Year FE		Y	Y	Y
Gestation FE				Y

Sample consists of all first live births and fetal deaths of US-born, white, non-hispanic married women aged between 25 and 45. Fetal deaths are included if occurring between 25 and 44 weeks of gestation. Fetal death files include only a subset of the full set of variables included in the birth files, so education and ART controls are not include. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 23: Season of Birth Correlates (age as a continuous variable)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Mother's Age (years)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Some College +			0.011***	0.009***	0.009***	0.009***
			[0.001]	[0.001]	[0.001]	[0.001]
Smoked in Pregnancy				-0.013***	-0.013***	-0.013***
				[0.002]	[0.002]	[0.002]
Did not undergo ART						0.028***
						[0.004]
Constant	0.555***	0.558***	0.550***	0.551***	0.554***	0.524***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.005]
Observations	2259553	2259553	2259553	2259553	1571996	1571996
State and Year FE		Y	Y	Y	Y	Y
Gestation FE				Y	Y	Y
2009-2013 Only					Y	Y

Sample consists of singleton first-born children to married non-Hispanic white women aged 25-45. Independent variables are binary, except for age, which is in years. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 24: Season of Birth Correlates (No September)

	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season	(6) Good Season
Aged 25-27	0.013***	0.015***	0.015***	0.019***	0.021***	0.021***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Aged 28-31	0.015***	0.016***	0.016***	0.019***	0.022***	0.021***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Aged 32-39	0.008***	0.008***	0.008***	0.010***	0.012***	0.011***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Some College +			0.009***	0.009***	0.008***	0.008***
			[0.001]	[0.001]	[0.002]	[0.002]
Smoked in Pregnancy				-0.012***	-0.012***	-0.012***
				[0.002]	[0.002]	[0.002]
Did not undergo ART						0.010***
						[0.004]
Constant	0.469***	0.466***	0.458***	0.537***	0.579***	0.570***
	[0.002]	[0.002]	[0.003]	[0.063]	[0.078]	[0.078]
Observations	2063308	2063308	2063308	2063308	1434683	1434683
F-test of Age Dummies	0.000	0.000	0.000	0.000	0.000	0.000
State and Year FE		Y	Y	Y	Y	Y
Gestation FE				Y	Y	Y
2009-2013 Only					Y	Y

Sample consists of singleton first born children to married non-Hispanic white women aged 25-45. Independent variables are all binary measures. Heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 25: Birth Quality by Age and Season (Birth Order 2)

	(1) Birthweight	(2) LBW	(3) VLBW	(4) Gestation	(5) Premature	(6) APGAR
Aged 25-27	51.497***	-0.022***	-0.004***	0.481***	-0.039***	0.067***
	[2.100]	[0.001]	[0.000]	[0.008]	[0.001]	[0.003]
Aged 28-31	64.244***	-0.022***	-0.004***	0.432***	-0.040***	0.060***
	[2.035]	[0.001]	[0.000]	[0.008]	[0.001]	[0.003]
Aged 32-39	49.344***	-0.015***	-0.003***	0.285***	-0.028***	0.043***
	[2.023]	[0.001]	[0.000]	[0.008]	[0.001]	[0.003]
Good Season	6.617***	-0.001***	-0.000**	0.002	-0.001**	0.003***
	[0.655]	[0.000]	[0.000]	[0.002]	[0.000]	[0.001]
Some College +	51.202***	-0.015***	-0.003***	0.108***	-0.019***	0.029***
	[1.035]	[0.000]	[0.000]	[0.004]	[0.001]	[0.001]
Smoked in Pregnancy	-226.475***	0.048***	0.004***	-0.188***	0.031***	-0.030***
	[1.668]	[0.001]	[0.000]	[0.007]	[0.001]	[0.002]
Constant	3364.610***	0.061***	0.010***	38.279***	0.126***	8.771***
	[2.626]	[0.001]	[0.000]	[0.010]	[0.001]	[0.004]
Observations	2294303	2294303	2294303	2300265	2300265	2287525
F-test of Age Variables	0.000	0.000	0.000	0.000	0.000	0.000

Sample consists of singleton first-born children to married non-Hispanic white women aged 25-45. State and year fixed effects are included, and heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 26: Birth Quality by Age and Season (Twin Sample)

	(1) Birthweight	(2) LBW	(3) VLBW	(4) Gestation	(5) Premature	(6) APGAR
Aged 25-27	-38.554***	0.019**	0.020***	-0.427***	0.023***	-0.091***
	[9.603]	[0.008]	[0.005]	[0.056]	[0.008]	[0.020]
Aged 28-31	-16.783*	0.004	0.009**	-0.265***	0.011	-0.042**
	[8.671]	[0.007]	[0.004]	[0.050]	[0.007]	[0.017]
Aged 32-39	2.578	-0.007	0.006	-0.118**	-0.008	-0.020
	[8.469]	[0.007]	[0.004]	[0.048]	[0.007]	[0.017]
Good Season	18.198***	-0.010***	-0.007***	0.050**	-0.005	0.012
	[4.182]	[0.003]	[0.002]	[0.025]	[0.003]	[0.009]
Some College +	46.183***	-0.025***	-0.016***	0.234***	-0.007	0.104***
	[8.449]	[0.007]	[0.004]	[0.053]	[0.007]	[0.020]
Smoked in Pregnancy	-114.965***	0.095***	0.022***	-0.216**	0.041***	-0.064*
	[15.540]	[0.012]	[0.009]	[0.097]	[0.012]	[0.037]
Constant	2294.741***	0.602***	0.102***	35.002***	0.642***	8.378***
	[15.059]	[0.012]	[0.007]	[0.089]	[0.012]	[0.032]
Observations	80803	80803	80803	81804	81804	81154
F-test of Age Variables	0.000	0.000	0.000	0.000	0.000	0.000

Sample consists of singleton first-born children to married non-Hispanic white women aged 25-45. State and year fixed effects are included, and heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

Table 27: Birth Quality by Age and Season (Including Fetal Deaths)

	(1) Birthweight	(2) LBW	(3) VLBW	(4) Gestation	(5) Premature	(6) APGAR
Aged 25-27	104.561***	-0.039***	-0.008***	0.594***	-0.054***	0.071***
	[2.554]	[0.001]	[0.001]	[0.010]	[0.001]	[0.004]
Aged 28-31	94.081***	-0.035***	-0.007***	0.541***	-0.049***	0.064***
	[2.522]	[0.001]	[0.001]	[0.010]	[0.001]	[0.004]
Aged 32-39	62.377***	-0.023***	-0.005***	0.351***	-0.032***	0.041***
	[2.544]	[0.001]	[0.001]	[0.010]	[0.001]	[0.004]
Good Season	9.565***	-0.002***	-0.001***	0.022***	-0.000	0.003**
	[0.712]	[0.000]	[0.000]	[0.003]	[0.000]	[0.001]
Some College +	47.906***	-0.019***	-0.005***	0.188***	-0.020***	0.044***
	[1.350]	[0.001]	[0.000]	[0.006]	[0.001]	[0.002]
Smoked in Pregnancy	-171.211***	0.047***	0.006***	-0.198***	0.026***	-0.026***
	[2.174]	[0.001]	[0.000]	[0.010]	[0.001]	[0.003]
Constant	3231.562***	0.104***	0.020***	38.247***	0.157***	8.656***
	[3.226]	[0.001]	[0.001]	[0.013]	[0.002]	[0.005]
Observations	2254450	2254450	2254450	2259803	2259803	2247469
F-test of Age Variables	0.000	0.000	0.000	0.000	0.000	0.000

Sample consists of singleton first-born children to married non-Hispanic white women aged 25-45. State and year fixed effects are included, and heteroscedasticity robust standard errors are reported. ***p-value<0.01, **p-value<0.05, *p-value<0.01.

B Data Appendix

B.1 US Birth Data

A brief description of US birth certificate data is provided in section 2.1 of the paper. As discussed, the format of US birth certificates has undergone two important revisions: The first in 1989 and the second in 2003. The date of adoption of these revisions varies by state. By 2013, 41 states or territories had adopted the revised (2003) format, while the reaminder still follow the 1989 format.[11]

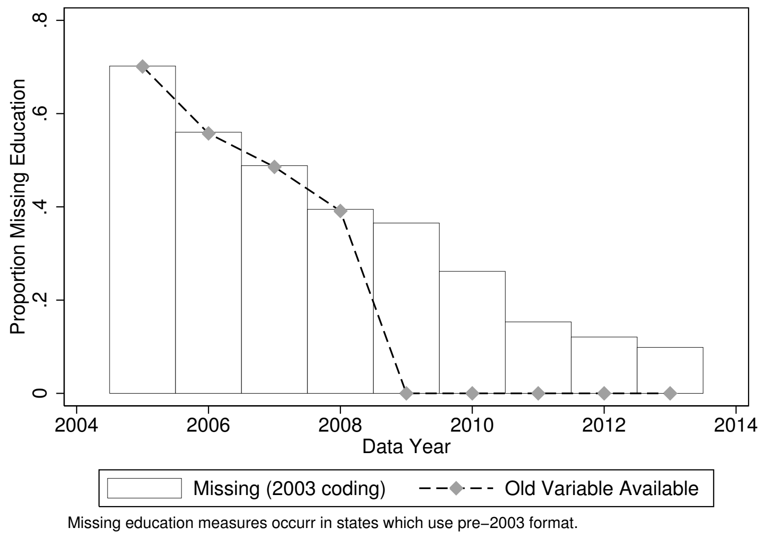
In all cases where variable coding differs between the revised and unrevised certificates (principally education for mother and father), we use the revised 2003 coding of the variables. The reason we do this is because after 2008, variables which are exclusive to 1989 certificates are no longer reported. Figure 22 illustrates this pattern. The dotted line represents the proportion of observations for maternal education which are reported in the 1989 format, while the bars represent the proportion *missing* in the 2003 format. From 2005-2008, all missing 2003 revision variables are recorded in the 1989 format. However, from 2009 onwards only the 2003 revision of education is reported, meaning that those states who still use the 1989 standard certificate do not have publicly released education data.

B.2 Spanish Data

Birth certificate records from Spain are released by the National Institute of Statistics (INE) with coverage from 1979 to 2013 inclusive. These consist of the universe of births registered annually in Spain. Our principal estimation sample consists of all first born

[11]The full birth certificate for each revision is reproduced as figures 1 and 2 in Menacker and Martin (2005). Over time the adoption of the 2003 certificate was as follows: 2005: 12 (31%), 2006: 19 (49%), 2007: 22 (53%), 2008: 27 (65%), 2009: 28 (66%), 2010: 33 (76%), 2011: 36 (83%), 2012: 38 (86%), and 2013: 41 (90%). In each case the first number refers to the number of states, while the parenthesis indicates the percent of births in revised states.

Figure 22: Missing Education Data by Time



children who survived one day, born to Spanish mothers. We use births from the period 2007 to 2013, given that prior to 2007, education was not recorded on birth certificates. This results in a sample of 1,239,749 live births, of which 1,238,685 were singletons.

Like birth certificate data in the US, Spanish certificates provide mother and child characteristics, including education and labour market status of the mother (and father where present), mother's age at time of birth, marital status, and child APGAR, gestation, birth weight, prematurity, and so forth (INE, 2013). The Spanish records include publicly released data on geographical location of birth, at both the provincial and municipal level (similar to US states and counties respectively).

Descriptive statistics for Spanish births are provided in table **??**. In the same age group, the average age and proportion of young mothers is similar to data from USA (32 years and 96% respectively), however a lower proportion report being married (64%), or having at least some post secondary education (53%). Spanish newborns are slightly lighter on average than their USA-born counterparts (3,200g), however are also less likely to be born prematurely, or classified as having low birth weight.

Spanish climate data at the level of the province is calculated from data released by the State Meteorological Agency (AEMET). These data record the temperature at principal state meteorological stations, from which we calculate monthly average, minima and maxima.