DISCUSSION PAPER SERIES

IZA

IZA DP No. 10072

The Demand for Season of Birth

Damian Clarke
Sonia Oreffice
Climent Quintana-Domeque

July 2016

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

The Demand for Season of Birth

Damian Clarke
Universidad de Santiago de Chile

Sonia Oreffice
University of Surrey
and IZA

Climent Quintana-Domeque
University of Oxford
and IZA

Discussion Paper No. 10072
July 2016

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 10072
July 2016

ABSTRACT

The Demand for Season of Birth

We study the determinants of season of birth of the first child, for white married women aged 25-45 in the US, using birth certificate and Census data. We also analyze stated preferences for season of birth using our own Amazon Mechanical Turk survey. The prevalence of quarters 2 and 3 is significantly related to mother's age, education, and smoking status during pregnancy. Moreover, those who did *not* use assisted reproductive technology present a higher prevalence of these births. The frequency of April to September births is also higher and more strongly related to mother's age in states where cold weather is more severe, and varies with mother's occupation, exhibiting a particularly strong positive association with working in "education, training, and library" occupations. Remarkably, this relationship between season and weather disappears for mothers in "education, training, and library" occupations, revealing that season of birth is a matter of choice and preferences, not simply a biological mechanism. We find that the average willingness to pay for season of birth of mothers who report to have chosen season of birth is 19% of financial wealth while for those who report not to have chosen it is only 2% and not statistically different from zero, with the former always targeting an April to September birth. In addition, the average willingness to pay for season of birth is higher among individuals, and parents, in "education, training, and library" occupations. We also document that the top-3 reasons for choosing season of birth are mother's wellbeing, child's wellbeing, and job requirements, while those in "education, training, and library" occupations rank job requirements as the most important reason. Finally, we present evidence that babies born between April and September have on average better health at birth even conditional on the observable maternal characteristics which predict selection.

JEL Classification: I10, J01, J13

Keywords: quarter of birth, fertility timing, pregnancy, first birth, teachers, birth outcomes, willingness to pay, NVSS, ACS, Amazon Mechanical Turk

Corresponding author:

Climent Quintana-Domeque
University of Oxford
Department of Economics
Manor Road Building
Manor Road
Oxford OX1 3UQ
United Kingdom
E-mail: climent.quintana-domeque@economics.ox.ac.uk

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 economics, biology and social sciences more generally. By now there is a well-established literature illustrating a variety of aspects that are significantly correlated with season of birth, namely birth weight, education, earnings, height, life expectancy, schizophrenia, etc. Although understanding the channels through which season of birth affects these outcomes is still challenging, a clear and consistent pattern of "good" (quarters 2 and 3) and "bad" (quarters 1 and 4) 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). Here we show that season of birth is a matter of choice and preferences above and beyond biological constraints.

This paper. We first present novel correlates of season of birth in the US, investigating women's decisions of when to have their first child in terms of season of birth, for white married women aged 25-45. Using US Vital Statistics data from 2005 to 2013 on all first singleton births, we show that the prevalence of quarters 2 and 3 is related to mother's age in a concave fashion, positively related to education and negatively related to smoking during pregnancy and receiving Women, Infants and Children federal assistance (WIC) during pregnancy. Maternal pre-pregnancy body mass index (BMI)[1] is related to "good" season in a concave way: both underweight (BMI < 18.5) and obese (BMI ≥ 30) women are less likely to have their first birth in the "good" season. In addition, we find that women who did *not* use assisted reproductive technology (ART) are 3 percentage points more likely to give birth between April and September. This finding, which is robust to controlling for

[1] BMI is defined as the individual's body weight (in kg) divided by the square of his/her height (in m).

gestation length fixed effects, is consistent with season of birth being a choice outcome, if undergoing ART is associated with *no* longer being able to control conception timing or caring about season of birth. Moreover, if women undergoing ART do not choose season of birth, we should expect to find no seasonality gap, and we present supportive evidence of this prediction.

Using data from the American Community Survey for 2005-2014, we examine the interaction of a child's season of birth with his or her mother's occupation. Our findings reveal that in professions in which strong seasonality of work hours exists (such as teachers), mothers are additionally more likely to choose "good" season of birth, and spring births in particular. Moreover, this holds conditional on observed age, education, being Hispanic, and state and year fixed effects. Using temperature data from the National Centers for Environmental Information, we show that the prevalence of first births occurring in the spring or summer is higher in states with more severe cold weather in winter. Women respond to incentives, have a more acute sense of the costs of a winter birth if they live in cold winter states, and behave differently by occupation. Quite remarkably, we unveil that among mothers in "education, training, and library" occupations weather does *not* play any role in explaining "good" season, whereas among occupations other than "education, training, and library" it does. These novel and different seasonal patterns by *occupation-age-weather* highlight the role of preferences and decision-making behavior above and beyond biological mechanisms.

Buckles and Hungerman (2013) recognize that a thorough investigation of preferences for birth timing is an open and fertile challenge for future work. We pursued this endeavor by devising and running our own survey in the Amazon Mechanical Turk market place in May 2016. This allows us to collect direct measures of stated preferences in birth timing, eliciting seasonality choice, willingness to pay for season of birth, and reasons why this season is deemed important. Focusing on the same demographic group of white married women aged 25-45 at time of their first birth, we find that the average willingness to pay for season of birth of mothers who report to have chosen season of birth is 19% of their financial wealth while for those who report not to have chosen, it is only 2%, and not statistically different from zero, with the former always targeting an April to September birth. Reassuringly, the average willingness to pay to avoid having a child born with diabetes is not statistically different between these two groups. In addition, the average willingness to pay for season of birth is higher among individuals in "education, training, and library" occupations, and also among parents who are in "education, training, and library" occupations. We also document that the top-3 reasons for choosing season of birth are mother's wellbeing (1), child's wellbeing (2), and job requirements (3), instead of school entry rules or tax benefits, while those in "education, training, and library" occupations rank job requirements as the most important reason.

Finally, we examine how birth outcomes, such as birth weight, prematurity ($<$ 37 weeks of gestation) and APGAR scores, are related to season of birth, controlling or not for mother's characteristics. We find that being born in quarters 2 or 3 is positively associated with better birth outcomes. Our correlational evidence (with and without controls) is consistent with "good" season of birth having a positive causal effect on birth outcomes, echoing the findings by Currie and Schwandt (2013) who focus on births to the same mother and show that the seasonal patterns in birth weight and gestation are not entirely driven by the fact that women with different characteristics tend to give births at different times.

Given the prominence of fertility planning in balancing people's work and family life (Jones and Tertilt, 2008) as well as the above findings, 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 both birth outcomes (such as birth weight) and child's long-term outcomes (such as future earnings) 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,[2] and on the other, work commitments may make it much easier to take time off with a spring-summer birth.[3] These reasons to target a specific season of birth are precisely the ones that the respondents in our Mechanical Turk sample report as the most prominent. All in all, we believe that our results highlight that there is indeed an appreciable demand for season of birth.

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 April-September and October-March. 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, whereas Buckles and Hungerman (2013) emphasize the role of maternal characteristics in shaping the later socioeconomic disadvantage of winter-born individuals to a very heterogeneous group of mothers, showing that the mothers of these children are significantly less educated, less likely to be married or white, and more likely to be teenagers.[4]

Although prior work on birth seasonality has also focused on sperm motility, hormone production, male and female fecundability, and behavioral changes in the type of riskiness of sexual activity, Currie and Schwandt (2013) show that influenza at birth drives seasonality in gestational length, while Buckles and Hungerman (2013) show that expected weather at

[2]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`

[3]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. An online search on blogs of women planning pregnancies reported the following statements: "It is certainly not a bad time to give birth —less fear of germs getting your baby sick and plenty of sunshiney days for backyard birthday parties when they are older;" "Summer is a great season for your maternity leave to fall on . . . ".

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

birth drives month of conception, and emphasize that "one's birth date is in part the result of a choice made by one's parents". Indeed, using data from the National Survey of Family Growth, they show that seasonality appears to be driven by wanted births – there is no seasonality in maternal characteristics among unwanted births. In France, Régnier-Loilier (2010) shows that birth seasonality is related to occupation, claiming 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.

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 disentangles choice or preferences (e.g., occupational choice) from biological mechanisms (e.g., weather or influenza). Here, we focus on a homogeneous group of mothers: white married women aged 25-45, and document that season of birth is a choice variable, encompassing novel characteristics, including the full range of *occupations*, *ART* use, and the interaction of *occupation-age-weather*. We also explicitly measure preferences, providing the first estimates of the willingness to pay for season of birth and of the reasons behind this choice.

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 (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 it represents a choice made well *after* conception occurs. Our analysis is about a choice made *before* conception occurs. To the best of our knowledge ours is the first study to clearly document the planning of season of birth.

Structure of the paper. Section 2 describes the data sources. Section 3 presents the analysis of the correlates of season of birth using administrative data. Section 4 provides the analysis of preferences and willingness to pay for season of birth using our own survey data collected through the Mechanical Turk platform. Section 5 shows how birth outcomes correlate with season of birth controlling or not for mothers' characteristics. Section 6 contains robustness checks. Section 7 offers a discussion of our findings. Section 8 concludes the paper.

2 Data Sources and Descriptive Statistics

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

[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).

(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, assisted reproductive technology (ART) use, whether the mother received WIC food benefits during pregnancy, height and pre-pregnancy 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 estimation sample consists of the years 2005-2013, and we retain all singleton first-births to white married mothers aged 25-45 who are issued an updated birth certificate with available education and smoking status.[9] 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.[10] We also restrict our main sample to singleton births.[11] This results in a sample of 2,669,586 births, 2,668,115 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

[6] The question on WIC benefits is: "Did you receive WIC (Women, Infants & Children) 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 <1 6) 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 do not include the mother's smoking status.

[9] The analysis is replicated including unmarried women in the online appendix.

[10] The analysis including second-births is provided in the online appendix.

[11] The analysis including twins (and for twins only) is provided in the online appendix.

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.[12]

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 25-45 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.[13] 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 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.[14]

[12] Using *actual* or *expected* season of birth is immaterial for our findings.
[13] We exclude women who are in the military, in a farm household, or currently in school.
[14] The small number of observations of households containing two women have been excluded.

2.3 Temperature 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 the temperature data from Maryland, a contiguous state. Measures of temperature are calculated at the year by month and state level.

2.4 Preference Data

2.4.1 Data Collection

To the best of our knowledge, our study is the first to collect data on preferences for season of birth, including choice of season of birth, willingness to pay to be able to choose season of birth, as well as the importance of a wide array of reasons of why season of birth matters. This information, alongside respondents' demographic and socioeconomic characteristics, was collected by the authors 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 (e.g., (Berinsky et al., 2012; Kuziemko et al., 2015; Francis-Tan and Mialon, 2015).

We published a "HIT" (Human Intelligence Task) request for 3,000 "workers" to complete a short survey, about 7-minutes long, and paid $1.10 plus a potential bonus (which corresponds to a pay rate of about $10 per hour), on a Tuesday in May 2016.[15] We devised the following requirements to ensure the validity of our data. We restricted eligibility to those with approval rates above 95%, with more than 100 tasks already completed, and with US addresses, while including an attention-check question and asking for the education level at the beginning and end of the survey to check for consistency, as well as flagging those who finished the survey in less than 2 minutes (only 2% of respondents were dropped with this check). In addition, the survey has been 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 8.00 am East Coast time, to further ensure that respondents were actually residing in the US rather than in Asia, for instance, since all our analysis is based on US data. By 4.32 pm the 3,000 requested tasks had been completed (by 3,000 different respondents).

The survey records age, race, ethnicity, marital status, education, employment, occupation, state of residence, number of children, and information on season of birth (quarter), whether it was a choice, and the reasons why, associated to the respondent's first birth. The same questions on preferences were also asked to those childless respondents who said they were planning to have a child in the future. All these respondents were asked about their willingness to pay to be able to choose season of birth, as well as a similar question on their willingness to pay to avoid that their child is born with diabetes, and the order in which these two questions were seen was randomized across respondents. Following Blumenschein et al. (2008), who argue that willingness to pay can be accurately estimated by focusing on those respondents who are certain of their answers, our analysis focuses on those individuals

[15]We had run a pilot with a request for 100 "workers" in April, and the same individuals could not retake our May survey.

who are definitely sure about their willingness to pay assessment.

The availability of novel data on preferences for season of birth in a relatively representative sample makes this dataset unique and adequately fit for the unmet challenge to investigate season of birth using stated/direct measures of preferences (Buckles and Hungerman, 2013). This novel information, together with our empirical analysis by demographic, health and occupation characteristics with birth certificates and census data, allows us to establish and characterize the demand for season of birth for the first time.

2.4.2 Sample Characteristics

Our sample consists of US-resident adult men and women, as we aimed at a nationally representative sample. We did not advertise the survey as only for women, or for those of childbearing age, in order not to selectively discourage respondents with "female-sounding" or "maternity" topics and thus bias our sample. However, in the data analysis, we subsequently restrict our estimation sample, retaining all white married parents aged 25-45 at the time of their first birth, or white married individuals who plan to have a child in the future and are currently aged 25-45. We then further restrict it to women only, to make our preference sample consistent with the other two data sets we work on to analyze the demand for season of birth (birth certificates and census data).

2.5 Descriptive Statistics

2.5.1 NVSS Sample

Table 1 presents summary statistics of all births in our sample. The first panel of the table shows that first-time mothers are on average 30 years old, 15% of them are Hispanic, and 97% are aged between 25 and 39 at the time of their first birth ("younger").[16] For those birth certificates with available mother's education and smoking information, 73% 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, WIC assistance, and pre-pregnancy BMI: 1% of these first-births were achieved through ART; 11% are born to mothers who received WIC food during pregnancy; and 43% of first-time mothers have a non-normal pre-pregnancy weight (3% are underweight, and 40% are overweight or obese).

[**Table 1 about here**]

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 due in the "good" season. It is noteworthy that in the US none of the public holidays falls close to the frontiers between the "good" and "bad" seasons defined above.[17] Regarding gender, 49% are girls. Finally, we have information on birth "quality" measures, including birth weight (BW), prematurity (< 37 weeks of gestation) and APGAR score. The averages of these measures (3,341 grams, 8%, and 8.8 respectively) are consistent with those from previous studies.

While not reported in the table (since we are focusing on singleton first-births) we note that 34.4% of first-births achieved through ART are twins, whereas 65.6% are singletons. Among those not achieved through ART, 2.6% are twins and 97.4% are singletons.

[16]Figure 1A in the online appendix displays the histogram of mother's age at first birth.
[17]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, and Christmas Day.

2.5.2 MTurk Sample

Tables 1B and 2B in the online appendix display the means of the main variables in our MTurk sample, for the full sample, and the restricted sample of white married parents aged 25-45 at the time of their first birth, who answered that they were definitely sure about their willingness to pay assessment. 8% of parents report to have targeted the season of birth of their first child, while season of birth is given an average of 2.26 in a scale of importance from 1 to 10. Interestingly, the willingness to pay for season of birth has a mean of around 4% of own financial resources (as a one-off payment), whereas the corresponding willingness to pay to avoid diabetes is 61%, with large standard deviations for both of these measures. It is remarkable that respondents do not report zero willingness or 100% willingness, given the different nature of the two birth characteristics at stake.

Table 3B in the online appendix compares the average characteristics of our main MTurk sample—white married women aged 25-45 at the time of birth who are sure of their willingness to pay values—to the average characteristics of individuals in the birth certificate (NVSS) data. The average number of children is similar in both samples (2 in the MTurk, 2.2 in the NVSS); MTurk respondents are a bit younger than NVSS individuals (29.1 vs. 30, albeit the difference is not statistically significant); the distribution of quarters of birth for the children of MTurk respondents is similar to that for NVSS individuals; however, we find statistically significant differences in both the use of fertility treatments (5.5% in the MTurk sample vs. 2.5% in the NVSS sample, at the 10% level) and gestational length (8.9 months in the MTurk vs. 8.6 months in the NVSS, at the 1% level); finally, MTurk respondents are less likely to be Hispanic (3.3% vs. 22%) and more likely to have some college or above (93% vs. 74%).

Figure 1B in the online appendix shows that the geographical distribution of the respondents in the MTurk sample matches well those of the population at large. Moreover, Figure

2B in the online appendix shows that the distributions of number of births are very similar in both our MTurk and NVSS samples. Finally, in Figure 3B in the online appendix we can see that the monthly distribution of first births in the MTurk data closely follows that observed in the NVSS data.

3 Season of Birth Correlates

3.1 Mother's Age and ART usage

Figure 1 highlights the seasonality gap by age group in the US: it plots the frequency of "good" season of singleton first births for each age from 20 to 45. Two novel features are worth mentioning. First, there is a decreasing gap in age from 28 to 45. In particular, the relative prevalence of "good" season is highest for mothers aged 28, while the lowest prevalence of "good" season is found amongst mothers aged 39-45. Second, the relationship between the proportion of "good" season births and age is non-monotonic, and in particular, concave: 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 can better control their fertility and 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 younger mothers to engage in optimal planning.

[**Figure 1 about here**]

The patterns in Figure 1 are summarized in Table 2, which contains information on the percent of births by "good" season, but also on prematurity and use of assisted reproductive technology (ART). These percentages are examined by age and education groups.

"Good" season is non-monotonically related to age: 51.31% of all births among very young women (aged 20-24) occur in the "good" season, and this value increases to 52.06% among women aged 28-31, before decreasing to 50.00% among older women (aged 40-45). This non-monotonic relationship can reflect two opposing effects: a *selection* effect—very young mothers tend to be negatively selected—and a *biological* effect—older mothers have less control over their fertility timing than younger ones. The positive relationship between "good" season and age from 20 to 28 could capture a (positive) net selection effect, while the negative relationship between "good" season and age from 28 to 45 could capture a (negative) net biological effect.

[**Table 2 about here**]

With regards to education, more educated women are more likely to choose "good" season births. Looking at the percent of premature newborns (born within 37 weeks of gestation) and those from women undertaking ART, we find that prematurity increases with age, from 8% among 20-24 years old to 13% for women aged 40-45, as does ART, from 1% among 28-31 years old to 7% among women aged 40-45. Newborns of women without any college are more likely to be premature than those with some college or above (10% vs. 8%), and among highly-educated women the percent of ART newborns is higher than among their less educated counterparts (1% vs. 0%).

We now examine the birth prevalence by month for two age groups of younger and older first time mothers (28-31 vs. 40-45 year-olds). Figure 2a shows that the gap between the two groups is positive precisely 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 2 about here**]

If women undergoing ART 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 2b show.[18] Moreover, 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 December.[19] 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.[20] Therefore, when the choice of season of birth is not in women's hands or they do not care about it any longer, we observe no seasonality at all.[21]

[Table 3 about here]

In Table 3 we investigate the determinants of "good" season of birth. In column 1 we find a concave relationship between "good" season of birth and age, mimicking the graphical pattern described in Figure 1, and mirroring the descriptive statistics of Table 2. Note that the "optimal" age of 27.11 is close to the peak of 28 described in Figure 1 (optimal age calculates the turning point of the mother's age quadratic). The non-monotonic relationship is robust to controlling for state and year fixed effects, education (an indicator for having some college or above), a dummy for Hispanic, and (an indicator for) smoking during pregnancy (columns 2-3). In addition, highly-educated women are between 0.5 and 0.8 percentage points more likely to have their first-born child in the "good" season than their counterparts. Women who smoked during pregnancy are between 1.1 and 1.2 percentage

[18] Note that the fraction of ART babies for women aged 28-31 is 1%, while for mothers younger than 28 the percentage decreases to 0%.

[19] Figure 2A in the online appendix displays the birth prevalence by month for women of all ages undergoing ART.

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

[21] Buckles and Hungerman (2013), using data from the National Survey of Family Growth, show that seasonality appears to be driven by wanted births, as there is no seasonality in maternal characteristics among unwanted births.

points less likely to choose the "good" season. Hispanic women are between 0.2 and 0.4 percentage points less likely to have their first-born child between April and September. Finally, in column 5, we make use of the additional information contained in the live birth certificates since 2009 and add the following controls: an indicator of whether the mother received WIC food during pregnancy, pre-pregnancy BMI indicators, and a non-ART indicator (1 if the birth did not happen through an ART procedure, 0 otherwise). Since this information is available only from 2009 to 2013, we replicate column 3 with this restricted sample in column 4, finding the same results. Column 5 shows that women who received WIC food during pregnancy are 0.7 pp less likely to give birth in the "good" season. In addition, we find a non-monotonic relationship between pre-pregnancy BMI and "good" season: women who are underweight before the pregnancy are 0.7 pp less likely, and women who are obese are 0.4 pp less likely, to deliver in the "good" season. Finally, women who did not undergo ART are about 3 pp more likely to give birth in the "good" season. This last finding is consistent with season of birth being a choice variable, if undergoing ART is associated with no longer being able to control conception timing. Interestingly, once we control for these additional variables, Hispanic women are not (statistically) less likely to have their first-born child in the "good" season than their counterparts.

The "optimal" age for "good" season of birth computed in Table 3 describes an interesting pattern: it decreases as we include additional socioeconomic controls, moving from 27.11 in column 1 to 23.07 in column 5. This pattern is consistent with young women being *biologically* more able to plan "good" season of birth, once the *negative selection* of young women into motherhood (e.g., less educated, more likely to smoke, more likely to receive welfare) is accounted for.[22] Indeed, once these negative factors are accounted for, younger mothers are indeed *more* likely to choose the "good" season. This shows that the relationship between season of birth and age is not solely governed by a biological mechanism. It is

[22] Note that smoking during pregnancy captures both the effect of low socioeconomic status on fertility decisions and the potential biological effects of smoking on conception.

worth noting that the fact that December is the most popular conception month in the US or that the sperm is better in winter and early spring (Levitas et al., 2013) cannot explain the observed seasonality.[23] Moreover, Table 2A in the online appendix shows that including fetal deaths (deaths occurring between 25 and 44 weeks of gestation) does not affect our findings.[24]

Our estimated seasonality gaps, between 1.1 pp (smoking during pregnancy gap) and 3 pp (non-ART gap), 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 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 a few (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).[25] We will return to this issue in Section 7, after discussing our estimates based on stated preferences for season of birth.

[23]We also run our main regressions excluding September (December + 9 months) and find the same patterns of results. See Table 1A in the online appendix.

[24]Accounting for fetal deaths is also a crude way to account for the influence of miscarriages, which we cannot observe.

[25]This last finding excludes honeymoon effects.

3.2 Temperature

If women choose season of birth at all, their willingness to give birth in the spring or summer may be higher in states with more severe cold weather in winter, as cold weather in winter is associated with higher disease prevalence (Currie and Schwandt, 2013) and limited time outside for mothers and their babies (Régnier-Loilier, 2010). In Figure 3 we plot the percentage of "younger" (28-31) 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 = -0.736, p-value=0.000, N=1,822,855), whereas we do not find any such relationship for women aged 40-45 (correlation coefficient = -0.117, p-value=0.211, N=131,378).[26] In Figure 4A in the online appendix, we perform a similar exercise replacing the coldest monthly temperature in the horizontal axis with the annual variation in temperature (highest mean monthly temperature $-$ lowest mean monthly temperature).

[Figure 3 about here]

This finding suggests that season of birth is not simply a biological mechanism due to weather or influenza, as women appear to respond to incentives: in states where winters are colder, women exhibit a more acute sense of the costs of winter births (Figure 3a) but *not* when they are older and *no* longer control conceptions, or care about season (Figure 3b). We further explore season of birth as a matter of choice and preferences beyond biological constraints or mechanisms in the following analysis by occupation.

[26] Buckles and Hungerman (2013) documented that expected weather at birth explains much of the seasonal patterns due to racial, marital, and teen pregnancy status, but did not run the analysis by age groups. Figure 3A in the online appendix replicates this with ACS data.

3.3 Occupation

There is considerable evidence that labor market flexibility affects women's job choices as well as partially explains the pay gap (Goldin, 2014). 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 (Régnier-Loilier, 2010). This is particularly relevant in the US, given the very limited maternity leave available in this country. While the NVSS (2005-2013) has no information on occupation, we use the ACS data (2005-2014) to shed light on the relationship between "good" season of birth and occupation.[27]

Table 4 shows that occupation is a relevant determinant of season of birth. In the first column, we regress season of birth on age, age squared, education, Hispanic, year and state fixed effects, documenting the previously reported concave relationship between age and "good" season (the p-value on the F-test for the coefficients on age variables being zero is 0.044). In column 2, we include the 2-digit occupational dummy variables from the Census classification.[28] From the 18 occupational indicators, the coefficient that has both the largest magnitude and highest statistical significance is the one corresponding to "education, training, and library": women in these types of jobs are 3.7 percentage points more likely to plan their birth in the "good" season (with respect to those working in "arts, design, entertainment, sports and media"), and such a sizable gap is statistically significant at the 1% level. In addition, we reject at the 10% level the hypothesis that occupation is irrelevant in explaining season of birth: the p-value associated to the F-test for the coefficients on all occupation indicators being zero is 0.052. Finally, column 3 repeats the same exercise replacing 2-digit occupational dummy variables with 3-digit occupational indicators. If anything, this further indicates the relevance of occupation as a predictor of

[27] Tables 3A and 4A in the online appendix provide the descriptive statistics for the ACS data.

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

"good" season of birth: the p-value associated to the corresponding F-test is now < 0.001.

[Table 4 about here]

One of the key messages from this table is that being employed in "education, training, and library" occupations makes it more likely to want to target the "good" season. In Figure 4 we examine birth timing and occupation class by quarter of birth. Teachers are much more likely to time their births in the spring to align the end of the maternity leave with the beginning of their summer break, and thus maximize their time home with their baby while fully paid, which is consistent with the explanation given by Régnier-Loilier (2010) in France. Other "significant" occupations (those whose coefficient is statistically significant in Table 4) are more likely to target quarter 3. Interestingly, 74% of respondents in the whole MTurk sample (N=2,938) think that teachers target spring-summer because of job requirements, 11% don't know, and the remaining 15% is split among 6 other reasons: birthdays parties, lucky dates, school entry rules, tax benefits, child's wellbeing, and mother's wellbeing. We return to this discussion below.

[Figure 4 about here]

This evidence clearly suggests that there is a decision-making process behind season of birth: "education, training, and library" is not a high-salary occupation or one with only very young women, so that the strong positive significant correlation with "good" season of birth cannot simply be explained by a biological mechanism or a budget constraint channel (income) but rather with the implementation of a choice. We now present further evidence to support this claim.

In Table 5, we compare the "good" season of birth prevalence between women in Teacher related jobs ("education, training, and library") and those in "non-teacher" related jobs (all the remaining occupations), controlling or not for age and education, finding that "teachers" are 2 pp more likely to achieve the "good" season.

[Table 5 about here]

3.4 Temperature and Occupation

In Figures 5 and 6, we reexamine our finding on the gradient between "good" season of birth prevalence and cold weather among younger mothers by "teacher" and "non-teacher" occupations. Interestingly, for younger "teachers" there is *no* seasonality pattern due to weather (Figure 5a) while there is among younger "non-teachers" (Figure 5b). For "older" women, the pattern is *not* there, *regardless* of their occupational status (Figures 6a, 6b). This finding reinforces our contention that season of birth represents the implementation of a choice above and beyond biological mechanisms. In Figures 5A and 6A in the online appendix, we perform a similar exercise replacing the coldest monthly temperature in the horizontal axis with the annual variation in temperature.

[Figure 5 about here]

[Figure 6 about here]

We now take this reasoning one step further, and claim that if individuals value (good) season of birth, then the average willingness to pay for (good) season of birth must be positive, in particular, for those individuals who chose the season of births of their children. We investigate whether this is the case in the next section.

4 Preferences for Season of Birth

4.1 Average Willingness to Pay by Actual Choice of Season of Birth

In Table 6 we present our first findings on willingness to pay (WTP) for season of birth in panel A, for parents and mothers, by actual choice of season of birth. The average WTP for the preferred season is 18.8% for parents who chose season of birth (N=14), while it is only 2.3% for those who did not (N=157): this is not only a large difference (16.5 pp), but it is also a statistically significant difference (t-statistic > 2.58). Similar results are obtained when focusing on women only: 19% (N=7) vs. 1.8% (N=84). While not reported in the table, all women who chose season of birth chose to target a spring or summer birth. Hence, among women, the average WTP for the preferred season of birth among those who chose is the average WTP for the "good" season of birth.[29]

[Table 6 about here]

In panel B we analyze the WTP individuals report to avoid their child being born with diabetes, by choice of season of birth. Two features stand out in this panel: first, and not surprisingly, the average WTP for avoiding diabetes is much larger than that for choosing the preferred season of birth; second, the average WTP to avoid diabetes does not statistically differ between those who chose and those who did not choose season of birth. While one cannot discard the fact that this difference in average WTP for season of birth by choosers and non-choosers is due to *ex post rationalization*, the fact that the average WTP to avoid diabetes is not statistically different between these two groups is quite reassuring, in the sense that it is not the case that those who chose season of birth tend to report a higher WTP than those who did not.

[29]For men, 11 out of 14 report choosing spring-summer.

These estimates show that there is a *preference* for season of birth, that people are aware that season of birth is a decision to be made rather than an event that happens randomly, and that they value this decision making strongly: one fifth of own financial resources to be able to control birth timing between seasons of the year is a substantial amount of money.

4.2 Average Willingness to Pay by Teacher Status

In a similar spirit to Table 5, in Table 7 we display a series of regressions of WTP for season of birth on age, age squared, a dummy for some college and above, a Hispanic dummy, and an indicator of whether the respondent works in "education, training, library" occupations (the same "teacher" category as in the census data analysis). "Teachers" have (on average) a 7 pp higher willingness to pay for season of birth than "non-teachers". This is a sizable magnitude, taking into account that the average WTP is about 19% among those who chose season of birth. Focusing on women only, this difference is about 5 pp, albeit not statistically significant, partly due to the dramatic reduction in sample size, from 171 to 91 observations. In addition, it seems that the relationship between WTP for season of birth and age is concave, as was the relationship between the prevalence of "good" season and age.

[**Table 7 about here**]

We further explore the role of occupation in the assessment of the value of season of birth in Table 8, by regressing willingness to pay on a parent indicator (whether the respondent has at least one child), a "teacher" dummy, and the interaction between these two variables, which should measure the average differential in preferences for season of birth, controlling for age, age squared, an indicator for some college and above, and for being Hispanic. The most interesting and novel feature in this table is that the average WTP for season of birth is 11-13 percentage points higher (somewhat noisily estimated) among parents in "teacher" occupations (or those "teachers" who are parents) than among non-parent-"teachers". This finding and its estimation procedure are consistent with our compensating wage differential analysis in the online appendix where, using the ACS data (2005-2014), we regress annual log(earnings) on a mother indicator (whether the woman has at least one child), a non-"non-teacher" occupation indicator, and the interaction between these two variables, which—under certain assumptions (Rosen, 1986)—should measure the (average) compensating wage differential.

[**Table 8 about here**]

4.3 Reasons for Choosing Season of Birth

We also study the reasons for targeting season of birth, which encompass a wide array of motivations and preferences: lucky birth dates, tax benefits, birthday parties, job requirements, school entry rules, child's wellbeing, and mother's wellbeing around the time of birth. Respondents were asked to rate each of these seven reasons, on a scale from 1 (not important at all) to 10 (very important), and the order in which the seven reasons were prompted on the screen was *randomized* across respondents. This set of questions was asked to respondents who are parents and targeted season of birth, or to those who plan to have children in the future.

The findings in Table 9 are striking: the ranking of the score for the top-3 reasons are mother's wellbeing (1), child's wellbeing (2), and job requirements (3), for all samples with the exception of "teachers". For the latter, job requirements is scored the highest, followed by mother's wellbeing and child's wellbeing. A regression analysis of the score for each reason confirms the role of job requirements as an important reason among "teachers" who are parents (column 4 in Tables 10 and 11).

[Table 9 about here]

[Table 10 about here]

[Table 11 about here]

These novel findings lend strong support to our analysis of season of birth as a choice variable, and to the contention that season of birth is indeed a decision that people make taking into account and responding to biology, job requirements, and wellbeing around birth time.

5 Season of Birth and Birth Outcomes

In this section, we assess some of the *direct* benefits of "good" season of birth, namely, its effects on birth outcomes. Table 12 shows that babies born in the "good" season tend to have better outcomes at birth: they are 10.1 grams heavier, 0.2 percentage points less likely to be low birth weight (<2500 g), 0.1 percentage points less likely to be very low birth weight (<1500 g), they have 0.03 additional weeks of gestation and they are 0.1 percentage points less likely to be premature.[30]

[Table 12 about here]

Of course, such a naive comparison of average birth outcomes by season of birth is unlikely to reveal the average causal effect of "good" season of birth on birth outcomes. Formally, if we compare the average birth outcome Y of first-born babies born in the "good"

[30] We use *expected* rather than *actual* season of birth, but results are virtually the same using both definitions. Results available upon request.

season ($D = 1$) with those born in the "bad" season ($D = 0$), and using the potential outcomes framework notation, we obtain

$$E[Y|D=1] - E[Y|D=0] = E[Y(1)|D=1] - E[Y(0)|D=0] = \underbrace{E[Y(1)|D=1] - E[Y(0)|D=1]}_{\text{ATT}} + \underbrace{E[Y(0)|D=1] - E[Y(0)|D=0]}_{\text{SB}} \tag{1}$$

where $Y(1)$ ($Y(0)$) is the potential birth outcome if the baby is born in the "good" ("bad") season of birth; ATT is the *average treatment effect on the treated*—the average causal effect of "good" season of birth on birth outcomes of those born in the "good" season—and SB is the *selection bias*—the selection effect due to the fact that mothers who choose the "good" season of birth are likely to be *positively* selected (more educated, less likely to smoke during pregnancy, less likely to be on welfare, more likely to have a normal BMI).

Controlling for X (mother's age, education, smoking during pregnancy, receipt of WIC food during pregnancy, pre-pregnancy BMI indicators and ART usage),

$$E[Y|X,D=1] - E[Y|X,D=0] = E[Y(1)|X,D=1] - E[Y(0)|X,D=0] = \underbrace{E[Y(1)|X,D=1] - E[Y(0)|X,D=1]}_{\text{ATT(X)}} + \underbrace{E[Y(0)|X,D=1] - E[Y(0)|X,D=0]}_{\text{SB(X)}} \tag{2}$$

should reduce the selection bias, so that $SB(X) \in [0, SB]$. Table 13 shows that, controlling for a bundle of maternal characteristics, we can explain 12% of the "good" season advantage in average BW (the coefficient decreases from 10.143 in Table 12 to 8.946 in Table 13) and 20% of that in average gestational length (the coefficient decreases from 0.030 to 0.024). Our results are consistent with the findings in Currie and Schwandt (2013), who show that—focusing on births occurring to the *same* mother—the seasonal patterns in birth weight and gestation are not entirely driven by the fact that women with different characteristics tend to give births at different times. In addition, our control variables exhibit the same features as in previous work. Highly-educated women tend to have babies with better outcomes at birth (Currie and Moretti, 2003). Moreover, women who smoke in pregnancy have babies who are 176 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. Finally, the positive relationship between pre-pregnancy BMI and birth weight echoes the recent results by Yan (2015). It is worth noting that the "good" season of birth advantage in terms of average birth weight is substantial: Almond et al. (2011) estimate the impact of the Food Stamp Program in the US on participants' birth weight to be between 15 and 20 grams for whites.

[Table 13 about here]

6 Robustness checks

In the online appendix we examine a number of alternative specifications and samples to test the robustness of season of birth as a choice variable. The inclusion of state specific linear trends and unemployment rate at season of conception leads to essentially no changes in the estimated coefficients (see Table 5A in the online appendix).[31] Considering the additional sample of second births (see Table 6A in the online appendix) or including twins (see Table 7A in the online appendix) and running our main regressions of "good" season of birth on maternal characteristics, we find the same pattern of results and significance.

Considering only twin births (see Table 8A in the online appendix) leads to no seasonality patterns. Controlling for household income (see Table 9A in the online appendix) does not qualitatively affect our findings by occupation.

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

We also consistently re-calculate the tests on coefficients using the sample size correction discussed in Deaton (1997), and originally in Leamer (1978), given that we use different, and at times very large, sample sizes. This procedure corrects for the increasing likelihood of rejecting the null hypothesis when the sample size increases and the null is not exactly true (which Deaton refers to as over-rejection). We refer to critical values of these tests as Leamer/Schwartz/Deaton critical values[32] for F- and t-tests. These values are reported in the footnotes to each regression table using NVSS or ACS data. For F-tests of the joint significance of the age quadratic, in all tables these can be directly compared to the reported value of the F-statistic, and in each case these variables remain statistically significant after correcting for large sample sizes. In the case of each parameter in each regression table, individual tests of significance depend on the t-statistic of the estimate. In order to faciliate comparison between Leamer/Schwartz/Deaton critical values and each parameter, we replicate all tables from the paper reporting t-statistics in place of standard errors as Tables 10A-14A in the online appendix. We still observe a significant quadratic effect of age and BMI on "good" season births, significance of not undergoing ART, significance of the teacher occupations in the ACS sample and significant effects of "good" season on birth quality outcomes. Results for all coefficients can be examined in the online appendix.

Finally, replicating our analysis by including unmarried mothers does not alter our seasonality patterns of results. All the main tables of the paper are replicated including unmarried women in the online appendix.

[32]These critical values are calculated as $\frac{N-K}{p} \times N^{\left(\frac{p}{N}-1\right)}$ for an F-test with p exclusion restrictions and $N-K$ degrees of freedom, so increases with the sample size. The same critical value for a t-test is calculated taking the square root of this quantity after setting $p = 1$.

7 Discussion

It is difficult to reconcile the above patterns with a story in which seasonality of births is only driven by "infectious disease" or any other correlate of it, since (a) influenza and infectious disease are prevalent throughout the entire US (https://flunearyou.org), while we document a very sharp gradient by temperature in season of birth, and (b) influenza affects mothers of all ages, and if anything will affect older mothers more severely, whereas we estimate that the prevalence of "good" season is correlated with weather only among "younger" mothers, not among "older" mothers. It seems that—beyond mothers' characteristics differing by season of birth (Buckles and Hungerman, 2013)—mothers who can respond, do respond to incentives: mothers in cold states have a much more acute sense of the cost of winter births, so are more likely to have summer births (if they can, i.e., *only* younger mothers).

Similarly, women who have labor market incentives time their birth: mothers in "education, training, and library" occupations are more likely to give birth in the "good" season of birth (Régnier-Loilier, 2010). What is even more remarkable, however, is the fact that the relationship between "good" season and weather *disappears* for babies born to mothers in "education, training, and library" occupations. This reveals that season of birth is a matter of choice and preferences, and not simply governed by biological mechanisms.

In terms of magnitudes, the administrative data reveal that the proportion of first-born babies who were born in the "good" season is 0.52, and 0.48 in the "bad" one; the difference is 0.04 (or 4 pp). This is a diluted ("intent-to-treat" or reduced-form) effect, because it captures the difference between "good" and "bad" seasons of birth for children of both parents who targeted (and for whom season of birth is a choice) and those who did not (and for whom season of birth is not a choice). We can get an estimate of the fraction of parents who targeted season of birth from our M-turk data. As we can see in Table 6, 8.2%

of parents (14/171) state that they chose season of birth. Hence, dividing 0.04 by 0.082 we obtain 0.49, which is the scaled-up difference (effect): the difference between "good" and "bad" season of birth among parents who chose season of birth is 0.49 (or 49 pp). In addition, among those who chose season of birth, 79% (11/14) state that they chose the "good" season of birth. Thus, the difference in prevalence of "good" and "bad" seasons among those who chose season of birth is $0.79 - 0.21$, which is 0.58. Hence, we have two point estimates for the difference in the prevalence of "good" vs. "bad" season of birth among those who choose season of birth: 0.49 and 0.58.[33]

8 Conclusions

The role of season of birth on newborn and adult socioeconomic outcomes has been widely documented across disciplines. We present a series of novel stylized facts in the US which are consistent with season of birth being a choice variable above and beyond biological channels. First, the prevalence of "good" season is non-monotonically (concavely) related to mother's age, positively related to her education, negatively to her smoking during pregnancy, the receipt of WIC food during pregnancy, and to being underweight or obese prior to pregnancy. Second, we find that women who did *not* use ART are 3 percentage points more likely to give birth in the "good" season. Third, we document that the prevalence of first births born in the spring or summer is higher in states with more severe cold weather in winter, but only among younger women. Fourth, in professions in which strong seasonality of work hours exists (such as teachers), mothers are more likely to choose "good" season of birth, whereas they do *not* respond to cold weather incentives. This last finding highlights the role of behavior and preferences above and beyond biological

[33] Note that this also implies that we also have two estimates for the "intent-to-treat" (or reduced-form) effect: 0.04 from the administrative data, and 0.048 from MTurk data which can be obtained as the product of 0.58 (the difference between "good" and "bad" season targeters) and 0.082 (the total proportion of targeters).

mechanisms.

We find that the average willingness to pay of mothers who report to have chosen season of birth is 19% of financial wealth while for those who report not to have chosen it is only 2% and not statistically different from zero, with the former always targeting an April to September birth. In addition, the average willingness to pay for season of birth is higher among individuals in "education, training, and library" occupations, and higher once again among parents who are in "education, training, and library" occupations. We also document that the top-3 reasons for choosing season of birth are mother's wellbeing (1), child's wellbeing (2), and job requirements (3), but those in "education, training, and library" occupations rank job requirements as the most important reason. Finally, we show that those babies born in the "good" season tend to have better birth outcomes, controlling or not for mothers' characteristics, suggesting that good season of birth has a positive causal effect on birth outcomes. All in all, our evidence points to the fact that the seasonal timing of birth is a valuable choice with health benefits.

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 "good" season births. These are occupations that, while not highly-paid on average, traditionally provide time off in the summer.

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.

Almond, D., H. W. Hoynes, and D. W. Schanzenbach (2011): "Inside the War on Poverty: The Impact of Food Stamps on Birth Outcomes," *Review of Economics and Statistics*, 93, 387–403.

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.

Blumenschein, K., G. C. Blomquist, M. Johannesson, N. Horn, and P. Freeman (2008): "Eliciting Willingness to Pay Without Bias: Evidence from a Field Experiment," *The Economic Journal*, 118, 114–137.

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 E. Moretti (2003): “Mother’s Education and the Intergenerational Transmission of Human Capital: Evidence from College Openings,” *Quarterly Journal of Economics*, 118, 1495–1532.

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.

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.

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.

Jones, L. E. and M. Tertilt (2008): "An Economic History of Fertility in the U.S.: 1826-1960," in *Frontiers of Family Economics*, ed. by P. Rupert, Emerald Press, vol. 1 of *Frontiers of Family Economics*, chap. 5.

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.

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

Levitas, E., E. Lunenfeld, N. Weisz, M. Friger, and I. Har-Vardi (2013): "Seasonal variations of human sperm cells among 6455 semen samples: a plausible explanation of a seasonal birth pattern," *American Journal of Obstetrics and Gynecology*, 208, 406.e1–406.e6.

Lien, D. S. and W. N. Evans (2005): "Estimating the Impact of Large Cigarette Tax Hikes: The Case of Maternal Smoking and Infant Birth Weight," *The Journal of Human Resources*, 40, 373–392.

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.

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

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.

Rosen, S. (1986): "The theory of equalizing differences," in *Handbook of Labor Economics*, ed. by O. Ashenfelter and R. Layard, Elsevier, vol. 1 of *Handbook of Labor Economics*, chap. 12, 641–692.

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.

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.

Yan, J. (2015): "Maternal pre-pregnancy BMI, gestational weight gain, and infant birth weight: A within-family analysis in the United States," *Economics & Human Biology*, 18, 1–12.

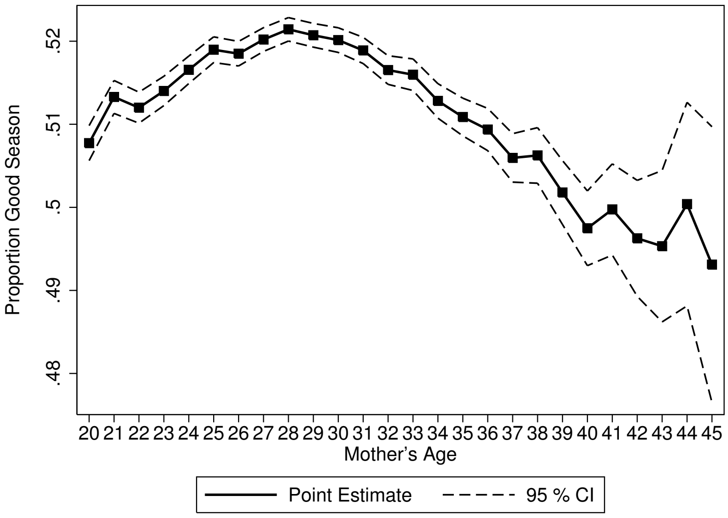
Figures and Tables

Table 1: Descriptive Statistics (NVSS 2005-2013)

	N	Mean	Std. Dev.	Min.	Max.
Panel A: Mother					
Mother's Age	2669586	30.26	3.94	25	45
Hispanic	2669586	0.15	0.36	0	1
Young (aged 25-39)	2669586	0.97	0.16	0	1
Aged 25-27	2669586	0.28	0.45	0	1
Aged 28-31	2669586	0.39	0.49	0	1
Aged 32-39	2669586	0.30	0.46	0	1
Aged 40-45	2669586	0.03	0.16	0	1
Some College +	2669586	0.73	0.44	0	1
Years of education	2669586	15.32	2.02	4	17
Smoked during Pregnancy	2669586	0.03	0.17	0	1
Used ART[a]	1853253	0.01	0.11	0	1
Received WIC food in Pregnancy[a]	1839060	0.11	0.32	0	1
Pre-pregnancy BMI[a]	1751936	24.95	4.80	16	40
Pre-pregnancy Underweight (BMI $<$ 18.5)[a]	1751936	0.03	0.17	0	1
Pre-pregnancy Normal Weight (18.5 $\leq$ BMI $<$ 25)[a]	1751936	0.57	0.49	0	1
Pre-pregnancy Overweight (25 $\leq$ BMI $<$ 30)[a]	1751936	0.24	0.43	0	1
Pre-pregnancy Obese (BMI $\geq$ 30)[a]	1751936	0.16	0.36	0	1
Panel B: Child					
Good season of birth (birth date)	2669586	0.52	0.50	0	1
Good season of birth (due date)	2668115	0.52	0.50	0	1
Female	2669586	0.49	0.50	0	1
Birthweight (grams)	2662981	3341.21	538.67	500	5000
Low Birth Weight (<2500 g)	2662981	0.06	0.23	0	1
Weeks of Gestation	2668115	38.99	2.21	17	47
Premature (< 37 weeks)	2668115	0.08	0.28	0	1
APGAR (1-10)	2654261	8.78	0.81	0	10

NOTES: Sample consists of all first-born, singleton children born to white, married mothers aged 25-45 for whom education and smoking during pregnancy are available. 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). ART refers to the proportion of women who undertook assisted reproductive technologies that resulted in these births. [a] Only available from 2009.

Figure 1: Prevalence of Good Season by Age



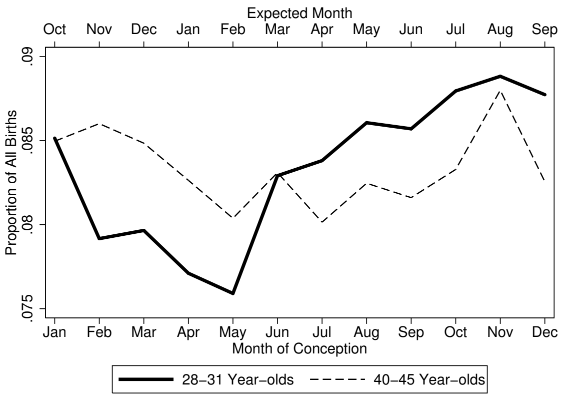
NOTES TO FIGURE 1: Coefficients and standard errors are estimated by regressing "good season" on dummies of maternal age with no constant. The full sample consists of mothers aged 20-45.

Table 2: Percent of Births

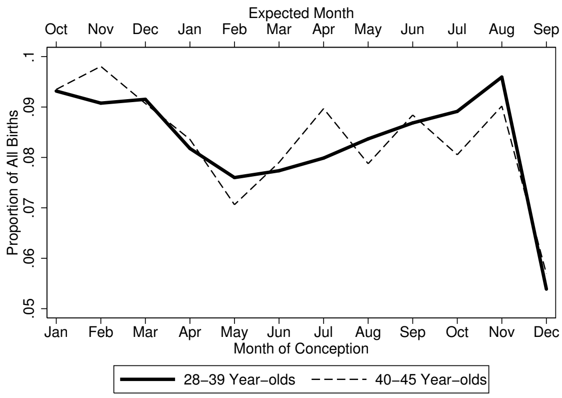
	Seasons				Characteristics	
	Bad Season	Good Season	Diff.	Ratio	<37 Gestation Weeks	ART
PANEL A: BY AGE						
20-24 Years Old	48.69	51.31	2.62	1.05	0.08	0.00
25-27 Years Old	48.1	51.9	3.80	1.08	0.08	0.00
28-31 Years Old	47.94	52.06	4.12	1.09	0.08	0.01
32-39 Years Old	48.81	51.19	2.38	1.05	0.09	0.02
40-45 Years Old	50	50	0.00	1.00	0.13	0.07
PANEL B: BY EDUCATION						
No College	49.31	50.69	1.38	1.03	0.10	0.00
Some College +	48.18	51.82	3.64	1.08	0.08	0.01

NOTES: Main estimation sample augmented with mothers aged 20-24.

Figure 2: Birth Prevalence by Month, Age Group, and ART Usage



(a) Proportion of Conceptions



(b) Proportion of Conceptions (ART Only)

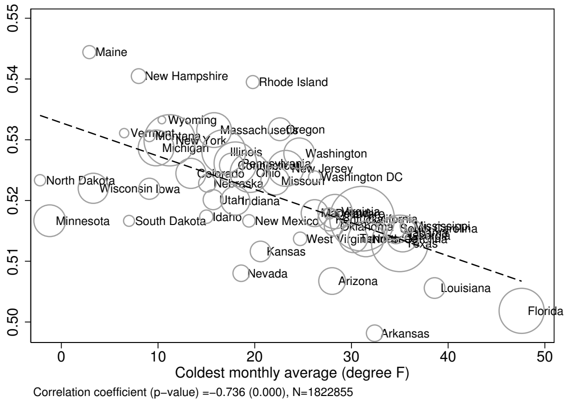
Notes to figure 2: Month of conception is calculated by subtracting the rounded number of gestation months (gestation in weeks $\times$ 7/30.5) from month of birth. Each line presents the proportion of all births conceived in each month for the relevant age group.

Table 3: Season of Birth Correlates

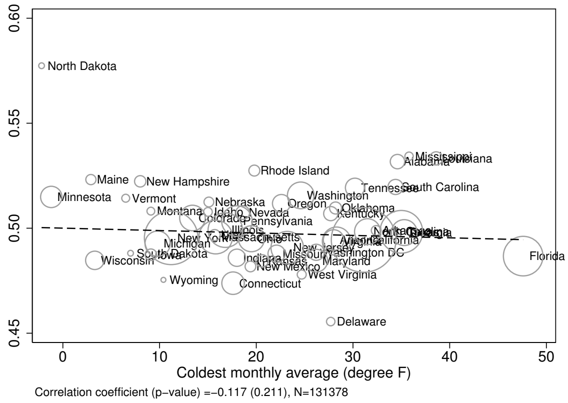
	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season
Mother's Age (years)	0.006***	0.005***	0.004***	0.005***	0.004***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Mother's Age^2 / 100	-0.012***	-0.010***	-0.008***	-0.009***	-0.008***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Some College +			0.008***	0.007***	0.005***
			[0.001]	[0.001]	[0.001]
Smoked in Pregnancy			-0.011***	-0.012***	-0.011***
			[0.002]	[0.002]	[0.002]
Hispanic			-0.004***	-0.002**	-0.001
			[0.001]	[0.001]	[0.001]
Received WIC food in Pregnancy					-0.007***
					[0.001]
Pre-pregnancy Underweight (BMI $<$ 18.5)					-0.007***
					[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					0.029***
					[0.003]
Observations	2668115	2668115	2668115	1717251	1717251
F-test of Age Variables	135.761	149.520	148.983	109.730	97.470
p-value of F-test	0.000	0.000	0.000	0.000	0.000
Leamer Critical Value	14.796	14.796	14.796	14.356	14.356
Optimal Age	27.11	25.77	24.03	24.46	23.07
State and Year FE		Y	Y	Y	Y
Gestation FE			Y	Y	Y
2009-2013 Only				Y	Y

All singleton, firstborn children from the main sample 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. Reported p-values are those corresponding to this classical F-test. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The Leamer critical value for a t-statistic is 3.847 in columns 1-3 and 3.789 in columns 4 and 5. Optimal age calculates the turning point of the mother's age quadratic. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Figure 3: Prevalence of Good Season and Cold Temperatures by State and Age



(a) Younger Mothers (28-31)



(b) Older Mothers (40-45)

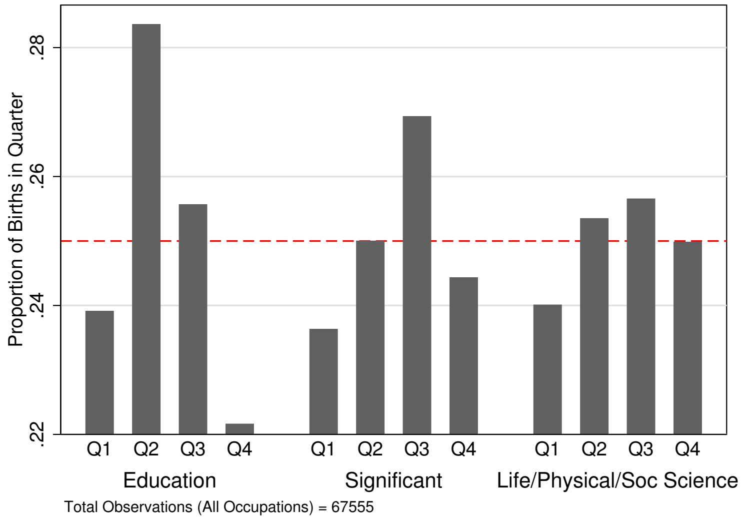
Notes to figure 3: Each circle represents a state average of the proportion of women giving birth in the good birth season between 2005 and 2013. Circles are proportional to the number of births in the state. The dotted line is a fitted regression line. Monthly temperature data is collected from the National Centers for Environmental Information.

Table 4: Season of Birth Correlates: Occupation

	(1) Good Season	(2) Good Season	(3) Good Season
Mother's Age (year)	0.011*	0.011*	0.011*
	[0.007]	[0.007]	[0.007]
Mother's Age^2 / 100	-0.018*	-0.018*	-0.018*
	[0.010]	[0.010]	[0.010]
Some College +	0.011	0.007	0.006
	[0.007]	[0.007]	[0.007]
Hispanic	-0.022**	-0.020**	-0.021**
	[0.009]	[0.009]	[0.009]
Architecture and Engineering		0.024	
		[0.022]	
Building and Grounds Cleaning and Maintenance		-0.013	
		[0.028]	
Business Operations Specialists		0.023	
		[0.015]	
Community and Social Services		0.025	
		[0.016]	
Computer and Mathematical		0.026	
		[0.019]	
Education, Training, and Library		0.037***	
		[0.013]	
Financial Specialists		0.019	
		[0.016]	
Food Preparation and Serving		0.036**	
		[0.018]	
Healthcare Practitioners and Technical		0.023*	
		[0.013]	
Healthcare Support		-0.003	
		[0.018]	
Legal		0.002	
		[0.017]	
Life, Physical, and Social Science		0.010	
		[0.019]	
Management		0.025*	
		[0.013]	
Office and Administrative Support		0.023*	
		[0.013]	
Personal Care and Service		0.033**	
		[0.016]	
Production		0.014	
		[0.021]	
Sales		0.005	
		[0.014]	
Transportation and Material Moving		0.002	
		[0.030]	
Observations	81306	81306	81306
Occupation Codes (level)	-	2	3
F-test of Occupation Dummy Variables	-	.052	0.000
F-test of Age Variables	0.044	0.069	0.07

Sample consists of all singleton first-born children in the US to white married mothers aged 25-45 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 sample. Occupation codes refer to the level of occupation codes (2 digit, or 3 digit). The omitted occupational category in column 2 and column 3 is Arts, Design, Entertainment, Sports, and Media, as this occupation has good quarter=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 p-value on the test that the coefficients on mother's age and age squared are jointly equal to zero. The Leamer critical value for the t-statistic is 3.353. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Figure 4: Birth Prevalence by Quarter and Occupation



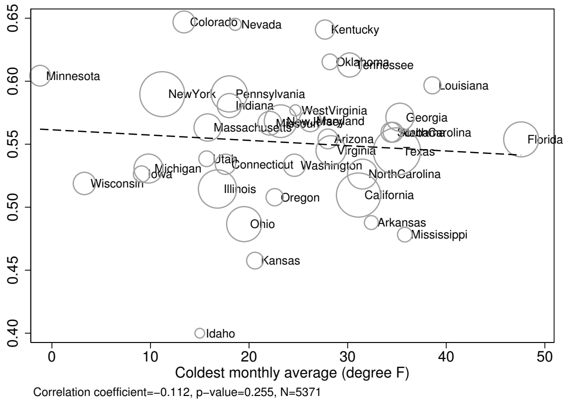
NOTES TO FIGURE 4: Groups are defined as: (1) Education, Training, Library; (2) Occupations with statistically significant coefficients in Table 4 (Food Preparation and Serving; Healthcare Practitioners and Technical; Management, Office and Administrative Support; Personal Care and Service); (3) the occupation with the least seasonality (Life, Physical and Social Science occupations).

Table 5: Season of Birth Correlates: "Teachers" vs. "Non-Teachers"

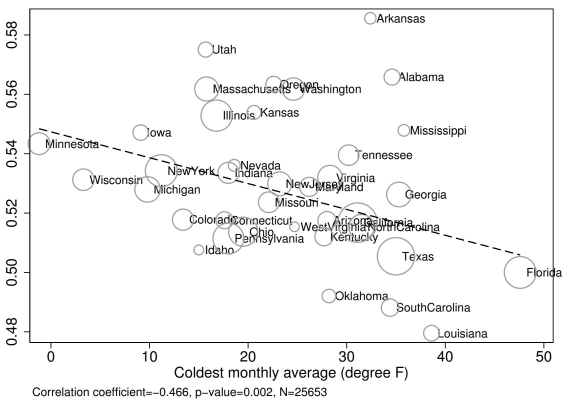
	(1) Good Season	(2) Good Season	(3) Good Season	(4) Good Season	(5) Good Season
Teacher	0.021***	0.021***		0.019***	0.018***
	[0.006]	[0.006]		[0.006]	[0.006]
Some College +			0.013**	0.010	0.008
			[0.006]	[0.007]	[0.007]
Mother's Age (years)					0.011
					[0.007]
Mother's Age^2 / 100					-0.017*
					[0.010]
Hispanic					-0.022**
					[0.009]
Observations	81306	81306	81306	81306	81306
F-test of Age Variables					0.009
State and Year FE		Y	Y	Y	Y

Main ACS estimation sample is used. Teacher refers to individuals employed in "education, training and library" occupations (occupation codes 2200-2550). The omitted occupational category is all non-educational occupations. F-test of age variables refers to the p-value on the test that the coefficients on mother's age and age squared are jointly equal to zero. The Leamer critical value for the t-statistic is 3.363. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Figure 5: Temperature and Good Season (28-31 “Teachers” vs. “Non-Teachers”)



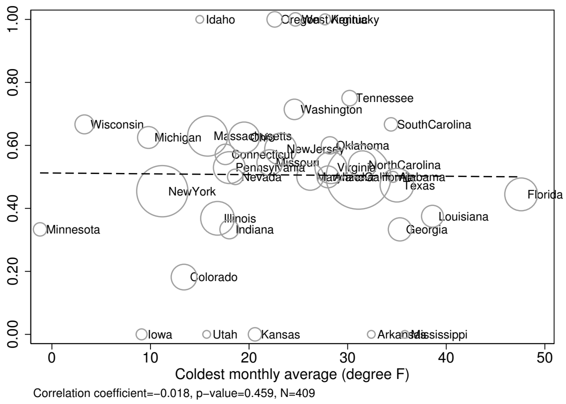
(a) “Teachers”



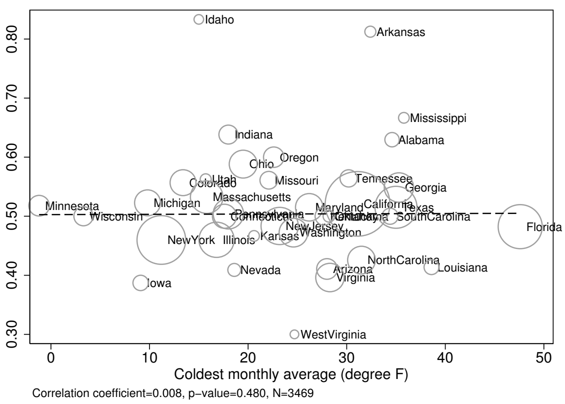
(b) “Non-Teachers”

Notes to figure: State averages of good season are plotted against the coldest average monthly temperature in the state. Panel A includes all workers who are in “Education, Training and Library Occupations”, while Panel B includes all other workers.

Figure 6: Temperature and Good Season (40-45 “Teachers” vs. “Non-Teachers”)



(a) “Teachers”



(b) “Non-Teachers”

Notes to figure: State averages of good season are plotted against the coldest average monthly temperature in the state. Panel A includes all workers who are in “Education, Training and Library Occupations”, while Panel B includes all other workers.

Table 6: MTurk: Willingness to Pay by actual choice of SOB

	Mean	Standard Deviation	t Statistic	Standard Error	Obs.	Equal Means (t)
PANEL A: WILLINGNESS TO PAY TO HAVE CHILD BORN IN PREFERRED SEASON						
Both Genders						
Choose SOB	18.786	23.202	5.893	3.188	14	5.027
Don't Choose SOB	2.306	10.238	2.240	1.030	157	
Women Only						
Choose SOB	19.000	29.331	3.810	4.987	7	3.319
Don't Choose SOB	1.833	11.099	1.191	1.539	84	
PANEL B: WILLINGNESS TO PAY TO AVOID CHILD BEING BORN WITH DIABETES						
Both Genders						
Choose SOB	56.786	43.083	2.941	19.306	14	-0.363
Don't Choose SOB	61.064	42.176	16.941	3.605	157	
Women Only						
Choose SOB	41.429	47.846	1.583	26.177	7	-0.861
Don't Choose SOB	56.107	43.008	11.522	4.870	84	

NOTES: The sample consists of married white respondents who are parents and had their first child when they were between 25 and 45 years old, and who answered that they were definitely sure about their willingness to pay assessment. The small portion of respondents who incorrectly responded to consistency checks in the survey are removed from the sample. Parents are asked: *When deciding to become pregnant (you or your partner), what percentage of your financial resources (income, savings, etc.) would you be willing to pay as a one-off payment to have your child born in your preferred season [avoid your child being born with diabetes]?* and are prompted to enter a value between 0 and 100. Equal Means refers to the value of a t-test for the equality of means between choosing and not choosing season of birth.

Table 7: MTurk: Willingess to Pay for Season of Birth and Teachers

	Both Genders				Women Only			
	(1) WTP	(2) WTP	(3) WTP	(4) WTP	(5) WTP	(6) WTP	(7) WTP	(8) WTP
Teacher	6.753**	7.484**	6.773**	7.485**	5.545	4.347	5.556	4.408
	[3.028]	[3.104]	[3.038]	[3.114]	[3.815]	[4.488]	[3.837]	[4.520]
Hispanic	14.782***	15.129***	14.843***	15.146***	30.116***	30.206***	30.068***	30.096***
	[5.050]	[4.994]	[5.072]	[5.016]	[7.476]	[7.482]	[7.528]	[7.538]
Age (years)		7.136**		7.125**		6.688*		6.764*
		[2.929]		[2.943]		[3.838]		[3.872]
$Age^2/100$		-11.259**		-11.241**		-10.117*		-10.244*
		[4.609]		[4.632]		[6.002]		[6.060]
Some College +			-0.726	-0.216			0.673	1.264
			[3.403]	[3.383]			[5.390]	[5.382]
Observations	171	171	171	171	91	91	91	91
F-test of Age Variables		2.984		2.945		1.643		1.645
p-value of F-test		0.053		0.055		0.199		0.199

Sample described in Table 6. F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. Reported p-values are those corresponding to this classical F-test. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Table 8: MTurk: Willingness to Pay for SOB – Parents and Teachers

	Both Genders	Women Only
	(1) WTP	(2) WTP
Parent	-1.990	-5.511
	[2.483]	[4.731]
Teacher	-3.509	-5.706
	[5.065]	[8.022]
Parent × Teacher	10.968*	13.494
	[6.095]	[9.893]
Age (years)	3.318	4.068
	[2.245]	[3.539]
$Age^2/100$	-5.362	-6.682
	[3.428]	[5.361]
Some College +	0.620	3.286
	[3.050]	[5.693]
Hispanic	10.081**	14.500**
	[4.640]	[7.181]
Observations	219	113

Sample used in Table 7 augmented with non-parents aged 25-45. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Table 9: MTurk: Reasons for Targeting Season of Birth

	All	Women Only	Teachers Only	Non Teachers
Lucky Birth Dates	2.370	2.467	4.000	1.905
Tax Benefits	3.222	3.800	3.333	3.190
Birthday Parties	3.370	3.733	2.167	3.714
Job Requirements	5.778	6.267	7.667	5.238
School Entry Rules	4.963	5.800	4.167	5.190
Child's Wellbeing	7.074	6.533	6.500	7.238
Mother's Wellbeing	7.556	7.867	6.667	7.810
Observations	27	15	6	21

Reasons are given by these who state that they chose or would choose season of birth. The importance of each aspect is ranked between 1 (not important) to 10 (very important).

Table 10: MTurk: Reasons for SOB – Parents and Teachers (Both Genders)

	(1) Luck	(2) Tax	(3) Birthdays	(4) Jobs	(5) School	(6) M Health	(7) C Health
Parent	-0.745	-3.233**	-2.090	-3.253**	-0.861	-1.327	-0.437
	[1.232]	[1.189]	[1.392]	[1.396]	[1.422]	[1.542]	[1.300]
Teacher	2.180	-2.799*	-2.521	-0.365	-2.985	-1.459	-1.031
	[1.577]	[1.521]	[1.781]	[1.786]	[1.820]	[1.973]	[1.663]
Parent × Teacher	-1.295	6.427**	1.268	6.465*	3.599	1.442	-2.746
	[2.964]	[2.858]	[3.348]	[3.358]	[3.421]	[3.708]	[3.126]
Age (years)	-1.542	1.000	-4.215	4.261	-2.192	-0.691	-6.070
	[4.546]	[4.384]	[5.135]	[5.150]	[5.247]	[5.688]	[4.795]
$Age^2/100$	2.482	-1.845	6.165	-7.181	3.525	0.868	9.811
	[7.411]	[7.148]	[8.372]	[8.397]	[8.555]	[9.273]	[7.817]
Some College +	0.790	1.125	-1.706	1.538	4.433*	-1.065	3.409
	[2.045]	[1.972]	[2.310]	[2.316]	[2.360]	[2.558]	[2.157]
Observations	27	27	27	27	27	27	27

The importance of each reason is ranked between 1 and 10, with 1 being not important at all, and 10 being very important. The Hispanic control is dropped as there is no variation in this indicator in the estimation sample. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Table 11: MTurk: Reasons for SOB – Parents and Teachers (Women Only)

	(1) Luck	(2) Tax	(3) Birthdays	(4) Jobs	(5) School	(6) M Health	(7) C Health
Parent	-3.211	-5.426**	-3.504	-4.317**	-3.149	-0.760	1.118
	[1.844]	[1.734]	[1.970]	[1.360]	[1.954]	[2.788]	[2.339]
Teacher	0.033	-3.807*	-4.335*	-0.753	-5.487**	-0.810	-0.334
	[2.017]	[1.896]	[2.154]	[1.487]	[2.137]	[3.049]	[2.557]
Parent × Teacher	0.793	6.981*	3.770	7.623**	5.444	1.158	-4.579
	[3.567]	[3.353]	[3.810]	[2.630]	[3.779]	[5.393]	[4.523]
Age (years)	-7.460	-2.983	-2.766	2.614	-5.225	-1.112	-6.703
	[6.545]	[6.153]	[6.992]	[4.826]	[6.935]	[9.895]	[8.300]
Age ^{2}/100	11.762	4.677	3.701	-4.959	8.436	1.493	10.851
	[10.579]	[9.946]	[11.302]	[7.801]	[11.209]	[15.994]	[13.416]
Observations	15	15	15	15	15	15	15

The Hispanic and some college or greater controls are dropped as there is no variation in these indicators in the estimation sample. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Table 12: Birth Quality and Season of Birth (without controls)

	(1) Birthweight	(2) LBW	(3) VLBW	(4) Gestation	(5) Premature	(6) APGAR
Good Season	10.143***	-0.002***	-0.001***	0.030***	-0.001***	0.001
	[0.809]	[0.000]	[0.000]	[0.003]	[0.000]	[0.001]
Constant	3337.007***	0.054***	0.008***	39.034***	0.079***	8.787***
	[0.585]	[0.000]	[0.000]	[0.002]	[0.000]	[0.001]
Observations	1713985	1713985	1713985	1717251	1717251	1710102

State and year fixed effects are included. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.

Table 13: Birth Quality and Season of Birth (with controls)

	(1) Birthweight	(2) LBW	(3) VLBW	(4) Gestation	(5) Premature	(6) APGAR
Good Season	8.946***	-0.002***	-0.001***	0.024***	-0.001**	0.001
	[0.803]	[0.000]	[0.000]	[0.003]	[0.000]	[0.001]
Mother's Age (years)	11.655***	-0.004***	-0.001***	0.070***	-0.006***	0.009***
	[1.386]	[0.001]	[0.000]	[0.006]	[0.001]	[0.002]
Mother's Age^2 / 100	-27.687***	0.009***	0.002***	-0.160***	0.014***	-0.020***
	[2.180]	[0.001]	[0.000]	[0.009]	[0.001]	[0.003]
Some College +	40.742***	-0.014***	-0.004***	0.148***	-0.016***	0.030***
	[1.451]	[0.001]	[0.000]	[0.006]	[0.001]	[0.002]
Smoked in Pregnancy	-176.035***	0.048***	0.006***	-0.208***	0.025***	-0.021***
	[2.797]	[0.001]	[0.001]	[0.012]	[0.002]	[0.004]
Received WIC food in Pregnancy	-32.207***	0.008***	0.001***	-0.035***	0.008***	-0.018***
	[1.455]	[0.001]	[0.000]	[0.006]	[0.001]	[0.002]
Pre-pregnancy Underweight (BMI $<$ 18.5)	-118.420***	0.020***	0.001***	-0.122***	0.007***	0.011***
	[2.293]	[0.001]	[0.000]	[0.010]	[0.001]	[0.003]
Pre-pregnancy Overweight (25 $\leq$ BMI $<$ 30)	61.076***	0.000	0.002***	-0.059***	0.007***	-0.025***
	[0.980]	[0.000]	[0.000]	[0.004]	[0.000]	[0.001]
Pre-pregnancy Obese (BMI $\geq$ 30)	61.714***	0.012***	0.007***	-0.203***	0.024***	-0.066***
	[1.259]	[0.001]	[0.000]	[0.005]	[0.001]	[0.002]
ART	-66.453***	0.029***	0.007***	-0.426***	0.049***	-0.031***
	[4.181]	[0.002]	[0.001]	[0.018]	[0.002]	[0.006]
Hispanic	-67.104***	0.009***	0.003***	-0.164***	0.010***	0.019***
	[1.277]	[0.001]	[0.000]	[0.005]	[0.001]	[0.002]
Observations	1713985	1713985	1713985	1717251	1717251	1710102
F-test of Age Variables	1513.324	1061.866	188.887	2564.164	1244.154	231.109
p-value of F-test	0.000	0.000	0.000	0.000	0.000	0.000
Leamer Critical Value	14.354	14.354	14.354	14.356	14.356	14.352

State and year fixed effects are included, and F-test of age variables refers to the test that the coefficients on mother's age and age squared are jointly equal to zero. Reported p-values are those corresponding to this classical F-test. Leamer critical values refer to Leamer/Schwartz/Deaton critical 5% values adjusted for sample size. The maximum Leamer critical value for the t-statistic is 3.789. Heteroscedasticity robust standard errors are reported in brackets. ***p-value<0.01, **p-value<0.05, *p-value<0.1.