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Parental Cheating Regarding Child's Birthday: A Response to the School Cutoff Date*

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This study is the first to provide evidence of birthday manipulation. In South Korea, approximately 13,000 children born in the month of December between 2006 and 2015 were falsely registered as having been home-born in January of the subsequent year. These children differed significantly in terms of certain characteristics from those home-born in other months. Some parents likely manipulated their child's birthday to leverage the benefits enjoyed by the oldest children in a class cohort.

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Keywords: School Cutoff Date, Birth Registration, Birthday Manipulation, Parental Behavior, Relative Age Among Peers

I. Introduction

The literature shows that being older in a school class confers an advantage in academics and, eventually, the labor market. For example, according to Bedard and Dhuey (2006), the youngest students in the fourth grade have lower test scores than the oldest, by 4–12 percentile points; meanwhile, for the youngest eighth graders, that gap is 2–9 percentile points. This advantage appears to continue into adulthood: Du, Gao, and Levi (2012), for example, report that fewer CEOs of S&P 500

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companies were born in June and July, presumably because they were younger than those born in other months.[1]

The findings imply that parents could be motivated to want their children to be older than their in-class peers. To achieve this, parents can plan their family so as to give birth immediately after the school cutoff date, or they may choose redshirting (i.e., delay their child's school entry by one year). Previous studies indeed reported such evidence. For example, Shigeoka (2015) found that in Japan—where redshirting is not legally allowed—the births of more than 1,800 babies each year are moved to the days following April 2, Japan's school cutoff date. That study also reported that their births were actually moved and not manipulated, based on the fact that babies born after April 2 were heavier than babies born before the date. Shigeoka's (2015) finding implies that parents who want to give birth after the school cutoff date but fail to do so may have incentives to falsely report their children's birthday, and state that they were born after the date.

This study provides evidence that some South Korean babies born in December were falsely reported as having been born in January of the following year. Since South Korea's school cutoff date is January 1, those born in January are the oldest in the class, and those born in December are the youngest; therefore, parents are likely to want to give birth in January and avoid a December birth. As Figure 1 shows, in 2006–2015 January was the most common birth month, and December was the least common. Because these two months are adjacent to each other and belong to the same season, i.e., winter, the large difference between the two should be attributed to parental preference, not an environmental factor such as temperature, for example.[2,3]

In cases where parents intend to falsely report a December baby as a January baby, they may report the child as having been home-born; this is because babies born in a hospital should submit birth certificates issued by the hospital, but home-born children have no such obligation. As the birth registry data in Figure 2 show, among

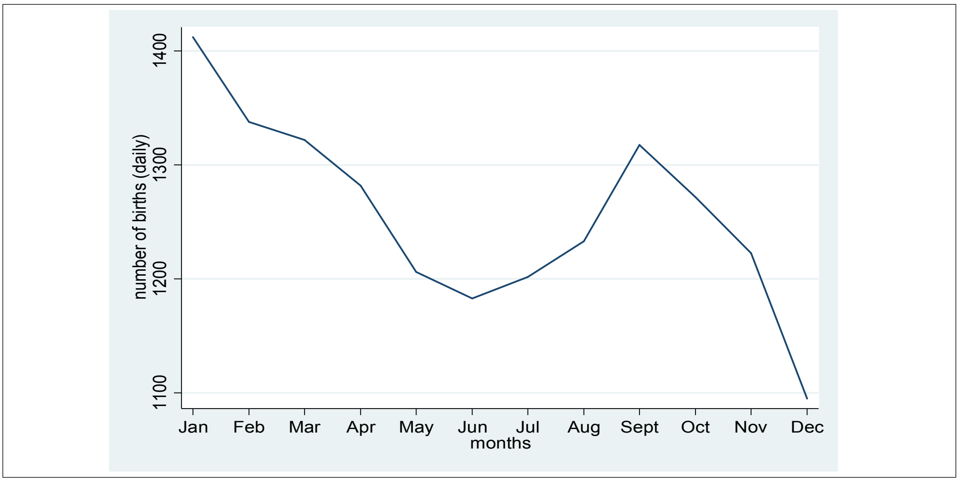
[1] Other relevant studies include those of Datar (2006), McEwan and Shapiro (2008), Elder and Lubotsky (2009), Kim (2011), Black, Devereux, and Salvanes (2011), Kawaguchi (2011), Fredriksson and Öckert (2014), and Attar and Cohen-Zada (2018). Among these, Elder and Lubotsky (2009) found that the oldest child has an advantage only immediately upon entering kindergarten, and that the advantage soon disappears. According to Fredriksson and Öckert (2014), age at school entry affects one's academic performance, but does not affect salary. Finally, Black, Devereux, and Salvanes (2011) report that age at the time of testing increases IQ scores, whereas age at school entry decreases them.

[2] According to Barreca, Deschenes, and Guldi (2018), temperature at conception is a significant factor of the number of newborns, while Buckles and Hungerman (2013) found that temperature at birth is also a significant factor.

[3] This pattern was also observed in the past. For example, in January of 1921, 44,752 babies were born, whereas only 32,229 babies were born in December of 1920. That is, the fact that more babies are born in January is not a new observation, although the reason for it is likely to differ based on the year. The data can be downloaded from
http://kosis.kr/statHtml/statHtml.do?orgId=999&tblId=DT_999N_025038&conn_path=I3

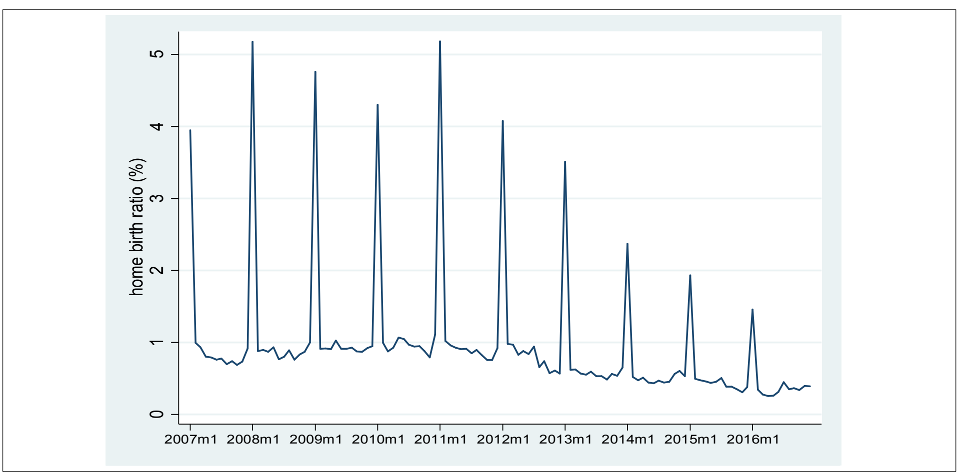
those born in 2007–2016, the proportion of home-born children born in January is unusually high, whereas the proportion for each of the other months is lower: For example, in 2007, the January proportion was 3.9%, while that of the other months ranged from 0.6% to 0.9%.[4]

[Figure 1] Daily average of newborns (2006–2015)



Notes: This graph shows the daily average number of the 4.6 million children born between 2006 and 2015.

[Figure 2] Monthly proportion of home-born children (2007–2016) (%)

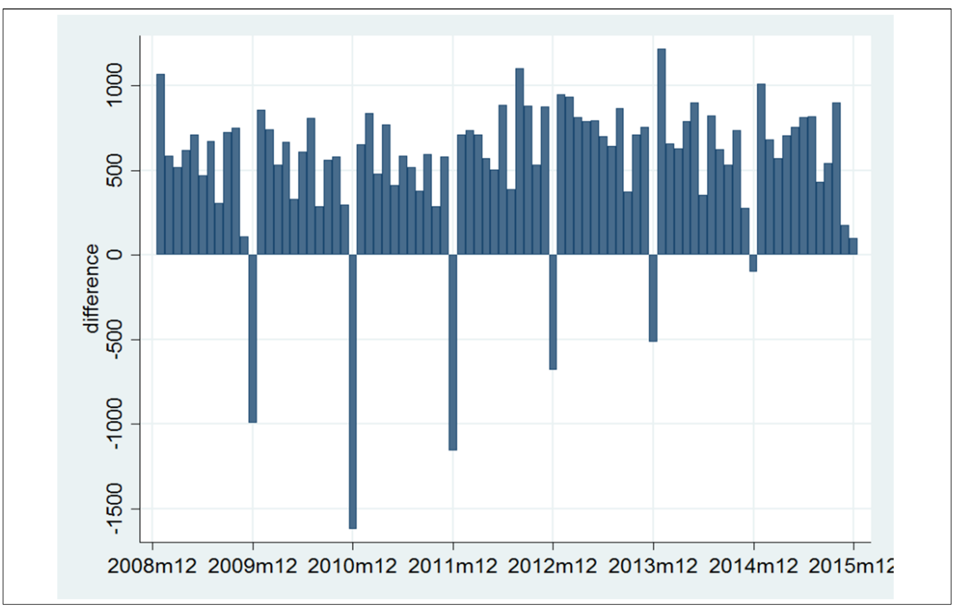


Notes: This graph shows the monthly proportion of children registered as being home-born, among the 4.5 million babies born in 2007–2016. 2007m1 means January in 2007, and so on.

[4] This study examines whether the monthly proportions of home-born children follow a uniform distribution. As Appendix Table 1 shows, they are not uniformly distributed.

One could speculate that the high proportion of home-born children in January is a unique feature of the month, rather than evidence of birthday manipulation. To address this, we compare the number of December delivery patients to the number of hospital-born babies in that month. The patients are limited to those covered by the national health insurance system that is mandatory by law and covers 97% of the whole population; the remaining 3% who receive medical aid from the government are not included. Figure 3 shows the monthly number of babies registered as hospital-born in 2009–2015, minus the monthly number of delivery patients during that same time. As one can see, except in December, the numbers are positive with the bars facing upward; this is attributed to twin births or births covered by the medical aid. The December bars facing downward indicate larger numbers of delivery patients in that month, which can occur if some of the December babies had not been registered as being born in December.[5] Unregistered births could be from foreigners' births, but given that there is no reason for foreigners' births to occur mostly in December, unregistered births in December are likely attributable

[Figure 3] Differences between monthly number of children registered as being hospital-born and the monthly number of delivery patients (2009–2015)



Notes: This graph shows the monthly number of children registered as being hospital-born, minus the monthly number of delivery patients, for 2009–2015. 2009m12 means December in 2009, and so on.

[5] In December 2010, the value is −1,622. This means that the number of babies registered in December 2010 as being hospital-born was 1,622 lower than the number of delivery patients. The number of delivery patients in December 2010 was 36,527; this number represents 4.4% of it.

to birthday manipulation.[6] By combining Figures 2 and 3, one can conclude that some children born in December were falsely reported as having been born at home in January of the following year.

While previous studies examined delaying birth dates and school entry, this study contributes to the literature by being the first to provide evidence of birthday manipulation, i.e., falsely reporting birth dates. This is another type of parental behavior intended to help their children get ahead of others that has not been studied previously. As described earlier, parents who want to give birth immediately after the school cutoff date but fail to do so may have the incentive to manipulate their child's birthday. However, Shigeoka (2015) and other studies did not analyze this. As shown in Figure 2 of the present study, birthday manipulation could be suspected if the proportion of home births were overly large in a given month.

The present study relates to other studies on parental choice of child birth date in response to government policies. In addition to Shigeoka (2015), McEwan and Shapiro (2008) and Dickert-Conlin and Elder (2010) analyzed Chilean and U.S. data, respectively, and found no evidence of birth-date delay with regards to the school cutoff date, possibly because those two countries allowed redshirting. Other studies analyzed birth-date changes in response to policies pertaining to subsidies for newborns or tax deductions for children. For example, Gans and Leigh (2009) found that when the Australian government introduced a policy of subsidizing children born after July 1, 2004, the births of approximately 1,000 babies were postponed to the days after July 1. By comparing the number of newborns in birth registration data to the number reported by hospitals, that study found no evidence of birthday manipulation. However, as Figure 2 of that study indicates, there was one day when the number of newborns as per the hospital data exceeded 800 and the number from birth registration data exceeded 900; this means—if the data are to be believed—that the proportion of babies born outside of hospitals was 11.1% (=100/900) on that day.[7] In addition, Neugart and Ohlsson (2013) analyzed German data to find results similar to those of Gans and Leigh (2009). Still other studies found that parents intentionally give birth in December to receive a tax credit, although it was expected in January of the following year (Dickert-Conlin and Chandra, 1999; Schulkind and Shapiro, 2014; LaLumia, Sallee, and Turner, 2015). For example, LaLumia, Sallee, and Turner (2015) found that an additional $1,000 in tax benefits increases the probability of a December birth by 2% in the United States.

The present study also relates to those that analyze redshirting (Dickert-Conlin

[6] Babies who die before birth registration are included in the birth registry data, as parents are required to register the baby's dates of birth and death when registering a death.

[7] The figure does not specify any dates, save for July 1; thus, it is not clear whether the day is after July 1. According to Laws, Grayson, and Sullivan (2006), in 2004, 2.7% of Australian babies were born outside of hospitals—a number far smaller than 11.1%.

and Elder, 2010; Dobkin and Ferreira, 2010; Bassok and Reardon, 2013; Schanzenbach and Larson, 2017), given that redshirting has the same effect as manipulating the birthday (i.e., redshirted students become older than their peers). According to Dickert-Conlin and Elder (2010), in the United States, 15% of the children born one month before the school cutoff date are redshirted.

The results are as follows. About 13,000 children (i.e., 3.7% of those born in the month of December between 2006 and 2015) were falsely reported as having been home-born in January of the subsequent year. These children differed significantly in terms of various characteristics from the home-born children of other months; meanwhile, there were no such differences among home-born children born in other months. Although South Korea (unlike Japan) allows redshirting, parents appear to manipulate their child's birthday because redshirting a December child would make the child one year older than their peers *in terms of South Korean age*—something that parents do not want.[8]

The remainder of this paper is organized as follows. Section 2 describes the background, and Section 3 describes the data used herein. Section 4 describes the empirical strategy employed in the present study. Section 5 presents the estimation results, and Section 6 provides concluding remarks.

II. Background

2.1. Birth Registration in South Korea

In South Korea, birth registration should be made within one month of a baby's birth. When registering a baby, parents are asked to report the place of birth: hospital, home, or other. To register a baby as hospital-born, parents must submit a birth certificate issued by a doctor. That is, doctors issue a certificate, and parents, not doctors, submit it to the government. However, if a child is born at home, the parents are exempt from this obligation. Instead, people involved in the birth (e.g., families or friends) can provide birth information—such as birth date, weight, and gestational length—when registering the child. Therefore, parents who intend to manipulate their child's birth date will falsely report a home birth to be exempt from this duty.[9] Lastly, the false registration is illegal in South Korea and subject to a criminal charge.

[8] South Korea's age culture and its age-reckoning method are described in subsection 2.2.

[9] Japan also exempts a home-born child from this duty, which is described in the following website of Japanese Ministry of Justice. http://www.moj.go.jp/ONLINE/FAMILYREGISTER/5-1.html

2.2. South Korean Age Reckoning and Age Culture

Although every person worldwide becomes one year older on his or her birthday, South Korean individuals calculate their age differently, as follows: South Korean age = the current year – birth year + 1. Therefore, a person born in 1980 is 36 years old at any time in 2015. This is because South Koreans become one year old immediately upon being born and become an additional year older in January 1 of each year. In this way, a baby born on December 31, 2010 becomes two years old on January 1, 2011 and three years old on January 1, 2012, while another baby born on January 1, 2011—one day later than the first baby—becomes one year old on January 1, 2011 and two years old on January 1, 2012.

People often want to learn others' age and ask questions about it, as they are expected to be polite and show respect to older people and may choose to be less polite to younger people: This culture is considered to originate from Confucianism, which has long influenced the daily lives of South Koreans, although its influence has weakened recently. The failure to do so to older individuals could result in some form of punishment, such as ostracism. Older people are expected to behave as leaders, by making decisions on certain issues or taking care of younger people, for example. Clearly, in South Korea, there is an age-based hierarchy that dictates social etiquette; for this reason, South Koreans more readily become friends with someone of the same South Korean age as themselves. People of different ages more or less keep their distance from each other and thus do not become friends easily.

2.3. School Cutoff Date and Birth Report

In South Korea, the school year begins on March 1. Parents are expected to send their children to elementary school the following year, when the child becomes six years old in terms of *international age*. The school cutoff date was previously March 1, but starting in 2010, it has changed to January 1.[10] Therefore, starting in 2010, those born in January have been the oldest in the class, and those born in December have been the youngest. This means that parents may have an incentive, in terms of their children's education, to avoid a December birth and to manipulate the birth date if they fail to do so.

In South Korea, redshirting is allowed; this means that parents of a December child can send him or her to school one year later without manipulating the birth date. However, parents of a December child do not want to do this, because a redshirted student is one year older in South Korean age, while his or her classmates are all the same (South Korean) age. As mentioned, people of different South Korean ages do not easily become friends, and older people are obliged to perform

[10] The change in school cutoff date was announced in 2008.

certain duties. That is, a redshirted student born in December is unlikely to form close friendships with his or her classmates, and the student is unlikely to be welcomed to join clubs, study groups, and student organizations, possibly leading to lower satisfaction in school and lower academic performance. This is a situation parents do not want. Therefore, parents of a December child, although they are allowed to redshirt, have incentives to manipulate their child's birth date. *That is, South Korean parents want their child to be biologically older than those of the same South Korean age, or those born in the same year*.

Even before 2010—when the school cutoff date was March 1 and thus a February child was (biologically) the youngest in his or her class—the parents of a December child still had an incentive to manipulate the birthday. This was because December-born children were actually the youngest in the class, as many parents of January and February children chose to redshirt at that time: In 2008, about 82,000 students delayed school entry, while about 490,000 students entered on time (Korean Educational Development Institute, 2017). Redshirted students in 2008 are considered to have been largely born in January and February, as they were the youngest group. Unlike parents of a December child, the parents of this group did not avoid redshirting, possibly because doing so did not make their child one year older in South Korean age than their peers—that is, they were born in the same year.

III. Data

The present study's analytical data are drawn from two sources: birth registry data from the National Statistical Office, and hospital data from the National Health Insurance Review & Assessment Service.[11] Birth registry data are based on birth registrations and contain information pertaining to both children—namely, birth year and month, the place of birth, birth region, gender, birth order, gestational length, and weight at birth—and their parents (i.e., parental age, education level, and employment status). The place of birth consists of three choices: hospital, home, and other. Therefore, it is possible to know whether a baby was born at his or her home, although the real place of birth could be different than reported. In addition, the birth regions consist of seven large cities, including Seoul and Busan, the two largest cities, and nine provinces including Gyeonggi-do surrounding Seoul; a province consists of small or mid-sized cities.[12]

[11] The data can be downloaded and obtained by request at the following sites: https://mdis.kostat.go.kr/index.do; http://opendata.hira.or.kr/home.do

[12] Dividing the country into 16 regions is a standard means of division. See Appendix Figure 1 for a map of South Korea.

The hospital data provide information about the treatment of patients. These data are based on insurance claims made by hospitals and provide information about treatments that have been administered since 2009; thus, the data contain information on hospitals, patients, and medical professionals. One of them is the monthly number of delivery patients, and this allows us to determine how many pregnant women gave birth in each year/month. The data contain only patients covered by the national health insurance; the data do not contain patients who avail medical aid provided by the government.

The aim of this study is to calculate the number of children born in the month of December during the 2006–2015 period of ten years who were falsely reported as being home-born in the following January (i.e., January 2007–2016). Let us examine the 2006–2016 birth registry data: About 4.6 million were born in 2006–2015, while in 2007–2016 about 4.5 million were born. While the number of new-born babies had been decreasing, in 2006 448,153 babies were born and in 2016 406,243 babies were born. In addition, as Figure 1 shows, January has the largest number of babies, whereas December has the smallest number: In January, a daily average of 1,412 babies were registered, while the number for December is 1,095.

Regarding the hospital data, although the 2006–2015 data should also be used to compare with the number of registered children, this study uses data covering the 2009–2015 period of seven years, as the first year of hospital data is 2009. The number of delivery patients throughout 2009–2015 was approximately 3.1 million; in January, the most popular month, there was a total of 0.3 million patients, while the number for December, the least popular month, was 0.2 million.

IV. Empirical Strategy

4.1. Estimating False Reports: Estimation Based on Home-born Ratio

This study conducts the following analysis to estimate the number of children born in each December of 2006–2015 and who were falsely registered as born in January of the following year. Let $p_{t+1}^{home,Jan}$ be the proportion of home-born babies among babies who were *actually* born in January of year $t+1$. We can define equation (1–1) as follows:

$$p_{t+1}^{home,Jan} = \frac{n_{t+1}^{home,Jan} - n_t^f}{n_{t+1}^{Jan} - n_t^f} \qquad (1\text{–}1)$$

where n_{t+1}^{Jan} and $n_{t+1}^{home,Jan}$ are the numbers of all children and home-born children reportedly born in January of year $t+1$, respectively. In addition, n_t^f is the number of babies born in December of year t and who were falsely reported as being born in January of year $t+1$. When n_t^f is zero (i.e., there are no false reports), $p_{t+1}^{home,Jan}$ is equal to $n_{t+1}^{home,Jan}/n_{t+1}^{Jan}$, but when n_t^f is greater than zero, they are not equal. Using equation (1–1), one can derive the following equation (1–2).

$$n_t^f = \frac{1}{1-p_{t+1}^{home,Jan}}(n_{t+1}^{home,Jan} - p_{t+1}^{home,Jan} n_{t+1}^{Jan}) \qquad (1\text{–}2)$$

To estimate n_t^f, it is necessary to know n_{t+1}^{Jan}, $n_{t+1}^{home,Jan}$, and $p_{t+1}^{home,Jan}$. The first two can be calculated using the birth registry data, but it is impossible to know the third of these. To address this, we use the proportion of home-born babies born in February of year $t+1$ and the proportion of home-born babies born in February–December of year $t+1$, respectively. These ratios can also be calculated using the birth registry data and are provided in Appendix Table 2. The assumption inherent in equation (1–2) is that there is no great difference between the January and February proportions and between the January and February–December proportions. The January and February proportions are especially likely to be so because they are adjacent months, belong to the same season, and are the earliest months of a year. Therefore, our preferred estimate is the estimate based on the February proportions. Using n_t^f estimated in equation (1–2), one can estimate p_t^f in equation (1–3), the proportion of falsely reported children born in December of year t.

$$p_t^f = \frac{n_t^f}{n_t^{Dec} + n_t^f} \qquad (1\text{–}3)$$

In equation (1–3), n_t^{Dec} is the number of children registered as born in December of year t, which can also be calculated by using the birth registry data.

4.2. Estimating False Reports: Estimation Based on Hospital Data

We also estimate the number of false registrations as follows, by comparing the number of children in the birth registry data to the number of delivery patients in the hospital data. We first estimate regression equation (2) to obtain the predicted number of hospital-born December children. The subscript m and t in the equation indicate the year/month and year, respectively.

$$n_{mt}^{hospital} = \alpha_0 + \alpha_1 P_{mt} + \tau_t + \upsilon_{mt} \qquad (2)$$

For the estimation of equation (2), the January–November 2009–2015 data are used, while December data are not used. Therefore, the number of observations for the estimation is 77 (= 7 years × 11 months). The dependent variable is the number of children registered as being hospital-born, and the independent variable P is the number of delivery patients; these are drawn from the birth registry data and hospital data, respectively. τ and υ are the year fixed effect and residual term, respectively. There are three reasons as to why the variables n and P can differ in a certain birth year/month. First, when twins are born, the number of babies registered as hospital-born is greater than one, but the number of delivery patients is one. Second, as mentioned, delivery patients are limited to those covered by the national health insurance. Third, in some cases, babies are not registered—for example, when babies have foreign parents or when the parents intend to manipulate their child's birthday. The first two reasons make the variable n larger, whereas the last reason makes the variable P larger.

The estimated $n^{hospital}$ for December of year t, or $\widehat{n_t^{hospital,Dec}}$, is used to calculate n_t^f, the number of false reports, in equation (3–1).

$$n_t^f = \widehat{n_t^{hospital,Dec}} - n_t^{hospital,Dec} \qquad (3\text{–}1)$$[13]

where $n_t^{hospital,Dec}$ is the number of December children registered as hospital-born in year t. The p_t^f is also estimated, in equation (3–2).

$$p_t^f = \frac{n_t^f}{n_t^{hospital,Dec} + n_t^f} \qquad (3\text{–}2)$$

In equation (3–2), if n_t^f is zero, p_t^f is zero, but if n_t^f is larger than zero, p_t^f is also larger than zero. Of note is the fact that since only the data from the 2009–2015 period are used in the estimation of regression equation (2), the method suggested in this subsection cannot estimate the number of falsely reported children born in December 2006–2008. Therefore, our preferred method is that suggested in subsection 4.1, and we examine how the numbers obtained in subsection 4.1 differ from those derived in subsection 4.2.

[13] Equation (3–1) does not consider falsely reported children born outside of a hospital. A total of 2,606 children were reported to have been born outside of hospitals in December 2009–2015; the largest number was in 2010 (585 children), and the smallest was in 2015 (216 children). Applying the proportions of falsely reported December-born children in Table 2, we find that only 112 of them were falsely reported. Additionally, although the dependent variable of equation (2) could be any registered child—and not merely the children registered as hospital-born—doing so reduces the explanatory power of the model.

4.3. Characteristics of Falsely Reported Children

We analyze the characteristics of December-born children who were falsely reported as having been born in January of the following year. For this analysis, this study compares home-born children born in January 2007–2016 to home-born children born in other months of the same years, because a falsely reported December child, as described earlier, is likely to be registered as home-born in January of the following year. In making comparisons, we use the same year, by controlling for the year fixed effect: that is, comparisons are made among children whose registered birth year is the same. Equation (4) is estimated for this analysis, and in it, the subscript i, r, m, and t are a baby, birth region, year/month, and year, respectively.

$$C_{irmt} = \beta_0 + \boldsymbol{Month}_i \boldsymbol{B}_1 + \eta_r + \nu_m + \gamma_t + \varepsilon_{irmt} \tag{4}$$

The dependent variable C includes seven dummy variables indicating maternal education level, whether the mother is employed, maternal age, premature birth (less than 37 weeks of pregnancy), low birth weight (less than 2,500 g), whether the baby is a girl, and whether the baby is the eldest in the family. The independent variables include a vector $\boldsymbol{Month}$ consisting of 11 dummy variables indicating the birth month of each baby, excluding June.[14] In addition, η, ν, and γ are region fixed effects, time trends, and year fixed effect, respectively. Lastly, ε is the residual term. By including η, we compare the characteristics of children born in the same region. For the time trends, the number 1 is assigned to January 2007, the first year/month of the analysis, and the value increases by one each month. Its square and cube terms are also included. In addition, the standard errors are calculated by clustering within the region/year.[15]

Regression equation (4) is estimated by ordinary least squares. The coefficient (vector) of interest is $\boldsymbol{B}_1$, which shows the difference between June and the other months. For example, if the coefficient on the January dummy variable is, say, 0.1 when the dependent variable is a dummy variable indicating whether the mother has a college degree, this means that the mothers of January home-born children are 10 percentage points more likely to have a college degree than the mothers of June home-born children. When the characteristics of January home-born children are significantly different from those of home-born children born in other months, and the characteristics of the latter are not different from each other, we can conclude that some children registered as home-born in January were not actually born at

[14] June is excluded, simply because it is in the middle of a year. Another month could be excluded instead of June, which should provide the same result.

[15] The number of clusters is 160 (= 16 regions × 10 years).

home in January: It is quite possible that they were December-born children.[16]

V. Results

5.1. Number of False Reports, Based on Analysis in Subsection 4.1

Table 1 contains the results derived from the method described in subsection 4.1—namely, the numbers and proportions of children born in December of 2006–2015 who were falsely registered as born in January of the following year. Columns (1) and (2) use the February home-born ratio as an estimate for $p^{home,Jan}$, and columns (3) and (4) use the February–December home-born ratio, as shown in Appendix Table 2. Column (1) of Table 1 indicates that a total of 12,951 babies born in December of 2006–2015 were reported as having been born in January of the following year; this number is equivalent to 3.7% (=12,951 / (339,424 + 12,951)) of December-born children, as 339,424 children had been registered as being born in December during this 10-year period. December 2007 had the largest number of false reports, followed by December 2010; December 2015 had the

[Table 1] False reporting of December-born children (based on analysis in subsection 4.1)

	February home-born ratio used		February–December home-born ratio used	
	Number	Proportion (%)	Number	Proportion (%)
	(1)	(2)	(3)	(4)
Total	12,951	3.7	13,266	3.8
Year 2006	1,295	3.6	1,377	3.8
2007	2,019	5.3	2,027	5.3
2008	1,711	4.7	1,706	4.7
2009	1,431	4.1	1,447	4.1
2010	1,994	5.3	2,057	5.5
2011	1,405	4.0	1,491	4.2
2012	1,286	3.6	1,309	3.7
2013	766	2.3	776	2.4
2014	604	1.8	634	1.9
2015	440	1.4	442	1.4

Notes: This analysis is as described in subsection 4.1. Columns (1) and (2) use the February home-born ratio as an estimate for $p^{home,Jan}$, while columns (3) and (4) use the February–December home-born ratio as the estimate.

[16] As an alternative specification, this study removes the time trends and adds the dummy variables indicating seasons. The results did not change and are available upon request.

smallest number. The numbers and proportions in columns (3) and (4) using the February–December home-born ratio are similar to those in columns (1) and (2): in all, a total of 13,266 December children were falsely reported, and the proportion is 3.8%.

5.2. Number of False Reports, Based on Analysis in Subsection 4.2

Table 2 shows the numbers and proportions derived by using the method described in subsection 4.2. In equation (3–1), the number of falsely reported December children is the estimated December hospital-born children, as estimated by regression equation (2), minus those registered as December hospital-born children. The estimation results of regression equation (2) are presented in Appendix Table 3. The table shows that the coefficient on the number of delivery patients is 1.025; this means that if the number of delivery patients were to increase by one, the number of hospital-born children would increase by 1.025—a number greater than 1.0, possibly due to twin births or births covered by the medical aid.

[Table 2] False reporting of December-born children (based on analysis in subsection 4.2)

	Number	Proportion (%)
	(1)	(2)
Total	8,939	3.7
Year 2009	1,540	4.4
2010	2,152	5.8
2011	1,613	4.6
2012	1,275	3.6
2013	1,187	3.6
2014	712	2.1
2015	460	1.4

Notes: This analysis is as described in subsection 4.2.

As shown in Table 2, 8,939 children hospital-born in December of 2009–2015 were falsely registered as having been born in January of the following year. Among the seven years, December 2010 had the largest number of children (i.e., 2,152), and December 2015, the smallest (i.e., 460). Column (2) of the table indicates that the number 8,939 is equivalent to 3.7% (= 8,939 / (231,264 + 8,939)), as 231,264 babies were registered as having been born in hospitals in December of these seven years.

In comparing the numbers for the same study years (i.e., 2009–2015), in Tables 1 and 2, one can see that the numbers in Table 1 are slightly smaller, with the proportion difference being less than 0.6 percentage points (save for 2013)—that is, the estimates derived from the methods discussed in subsections 4.1 and 4.2 do not differ significantly.

As Tables 1 and 2 show, the number of false reports has been on the decline since 2010.[17] One possible explanation for this is a general decrease in the number of newborn babies, from 470,000 in 2010 to 410,000 in 2016. When the first child is less likely to be falsely reported as noted in Table 4, the recent decrease in the number of newborns would increase the proportion of first children, thus leading to a decrease in the number of false reports.

One could speculate that some November children could be falsely reported. However, the likelihood does not appear to be high, because to do so, parents must leave their children unregistered for more than a month, but as described in Section 2, birth registration must be made within one month of a baby's birth. In addition, if some November children had been falsely reported, the estimates derived in subsection 4.1 would have been larger than the estimates derived in subsection 4.2. It is because the estimates obtained in subsection 4.1 are supposed to include falsely-reported babies born in other months as well as December, while the estimates obtained in subsection 4.2 consider only the December-born children. However, as described, the estimates obtained in these subsections do not differ significantly. This study also estimated regression equation (2) without November (and December). If some of the November-born children were not registered as such, the exclusion should increase the estimate. However, excluding November reduces the estimate from 1.025 to 1.020, which implies that November-born children were not falsely reported.

5.3. Characteristics of Falsely Reported Children

Before analyzing the characteristics of falsely reported children, let us look at Table 3, which presents the descriptive statistics of children home-born in 2007–2016. Columns (1) and (2) present the full sample of home-born children, while columns (3) and (4) are limited to January home-born children.[18] In columns (1) and (2), 49.9% of children are girls, and the proportions of children born with a low birth weight and prematurely are 4.9% and 6.2%, respectively. In addition, 65.9% of the mothers have a college degree. As the numbers in the columns (3) and (4) indicate, January home-born children are less likely to have a low birth weight or be born prematurely, and are more likely to have mothers with a college degree.

In sum, Table 3 indicates that January home-born children differ from the children home-born in other months in terms of various children and parental characteristics.

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[17] Shigeoka (2015) also found that the number of delayed births had declined over time. The study attributes the decline to lower childcare costs and the general aging of mothers.

[18] Appendix Table 4 shows the characteristics of children born outside of their homes.

[Table 3] Descriptive statistics of home-born children and their mothers

	All		January-born child	
	Mean (1)	Standard deviation (2)	Mean (3)	Standard deviation (4)
Child				
Girl (%)	49.9	50.0	47.2	49.9
First born (%)	50.0	50.0	46.7	49.9
Birth weight (gram)	3,188	444	3,220	416
Low birth weight (%)	4.9	21.5	3.7	19.0
Gestational length	38.9	1.7	39.0	1.5
Preterm birth (%)	6.2	24.0	4.4	20.5
Mother				
College degree (%)	65.9	47.4	79.4	40.5
Employed (%)	31.7	46.5	37.5	48.4
Age	32.5	5.3	31.9	4.1
Less than 25 years old (%)	6.2	24.0	3.9	19.3
Maximum Number of observations	45,398		16,257	

Notes: This table shows the descriptive statistics of home-born children in 2007–2016 and their mothers. "Low birth weight" means weighing less than 2,500 g at birth; "preterm birth" means being born before 37 weeks into pregnancy.

Table 4 shows the estimation results from using equation (4). Columns (1)–(3) contain the mother's characteristics, which are dependent variables; columns (4)–(7), meanwhile, contain the child's characteristics, as dependent variables. The findings within the table indicate that the mothers of January home-born children were not only less likely to be under 25 years of age, but also more likely to be a college graduate and to be employed than the mothers of June home-born children. In column (1), the January mothers' probability of having a college degree is 22.0 percentage points higher than that of June mothers. In column (1) of Table 3, one can see that 65.9% of mothers have a college degree; the estimate is equivalent to 33.4% (= 0.220/0.659). In addition, column (1) of Table 4 indicates that the coefficients for the other months are not statistically significant, save for February: The February coefficient of 0.036 is only 16% of the January coefficient. Although not shown in Table 4, the January mothers are more likely to live in large cities. In all, 47% of children born in January were so in one of the seven largest cities; for all other months, this number is 40%. The largest differences occur in Seoul and Gwangju: 22% of the January children were born in Seoul, while 17% of children born in other months were born in the city. In addition, the numbers for Gwangju are 6% and 3%, respectively.

The picture for the children characteristics is similar. January home-born children are less likely to be born prematurely or to have a low birth weight: the coefficients of these are –0.030 and –0.020, respectively, which means that the January children are 48.4% (= 0.030/0.062) and 40.8% (= 0.020/0.049) less likely to be so, respectively. The better birth outcomes of the January children appear to be driven by the better socioeconomic backgrounds of their mothers. Again, the coefficients for the other months are not statistically significant, which implies that children born in other months are not overly different from each other—that is, only the January children and their mothers stand out among home-born children.

If parents want their children to be older than their peers, children born in February or March should also have better family backgrounds and birth outcomes than children born in later months. However, this is not the case, according to Table 4. That is, home-born children have similar family backgrounds and birth outcomes, except for January home-borns. The implication is that the parents of home-borns generally do not have different preferences for education, and the findings in Table 4, i.e., the fact that January stands out, are driven by the fact that some of the children registered as home-born in January were not actually home-born in January.

Columns (6) and (7) of Table 4 show that January home-born children are less likely to be girls and to be the first child: the respective coefficients are –0.050 and –0.057, which mean that January home-born children are 10.0% (= 0.050/0.499) and 11.4% (= 0.057/0.500) less likely to be so, respectively. Although son preference has almost disappeared in South Korea,[19] people still may have the notion that boys should receive more education than girls, given their expected household role as breadwinners. That is, because regardless of the degree of son preference men are considered to play a role as breadwinners, parents appear to be more likely to manipulate boys' birth date. Regarding the results in column (7), this is possibly driven by the smaller number of first-born children in December. However, 54.8% of babies born in the month of December 2006–2015 were the first child, and 51.6% of babies born in other months were the first child. Therefore, this hypothesis is not supported. Another possible explanation is the degree of parental experience. When giving birth to the first child, one may not think of manipulating the birth date, due to having had less parental experience. However, at the time of giving birth to the second child, parents may have acquired sufficient experience to consider it. If so, January home-born children are less likely to be the first child, as seen in Table 4.[20]

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[19] Between 2007 and 2016, the sex ratio at birth, i.e., the number of newborn boys per 100 girls, ranged from 105.0 to 106.9; these are all within the normal range. For more information about the disappearance of the preference for boys in South Korea, see How South Korea Learned to Love Baby Girls (2017).

[20] The second child accounts for 41.7% of January home-born children and for 31.3% of home-born children in other months. The third or later child accounts for 11.5% and 16.8%, respectively, which implies that the second child is more likely to have a manipulated birthday. While the mothers of the third or later child have enough parental experience, the child is the least likely to be falsely reported, possibly because mothers having more than two children are less concerned about the child's

[Table 4] Characteristics of home-born children

	Dependent variable =						
	College graduate	Employed	Less than 25 years old	Preterm birth	Low birth weight	Girl	First born
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
January	0.220*	0.097*	−0.047*	−0.030*	−0.020*	−0.050*	−0.057*
	(0.012)	(0.011)	(0.007)	(0.006)	(0.006)	(0.010)	(0.011)
February	0.036*	0.011	−0.015*	−0.003	−0.007	−0.017	0.000
	(0.014)	(0.012)	(0.008)	(0.007)	(0.006)	(0.014)	(0.012)
March	0.028	0.023	−0.013	−0.007	−0.001	0.002	−0.002
	(0.015)	(0.012)	(0.008)	(0.008)	(0.006)	(0.015)	(0.012)
April	−0.001	−0.009	−0.014	−0.004	0.000	0.003	−0.017
	(0.014)	(0.013)	(0.008)	(0.008)	(0.007)	(0.014)	(0.013)
May	−0.023	−0.008	−0.006	−0.000	0.002	−0.007	0.001
	(0.016)	(0.013)	(0.007)	(0.008)	(0.006)	(0.013)	(0.014)
July	0.011	0.000	−0.020*	−0.009	0.003	−0.013	−0.007
	(0.014)	(0.015)	(0.008)	(0.008)	(0.007)	(0.014)	(0.014)
August	−0.001	−0.001	−0.005	0.002	−0.001	−0.004	−0.014
	(0.016)	(0.015)	(0.007)	(0.007)	(0.006)	(0.014)	(0.014)
September	0.015	−0.005	−0.003	−0.003	−0.004	−0.034*	0.009
	(0.015)	(0.013)	(0.008)	(0.008)	(0.007)	(0.014)	(0.014)
October	0.000	−0.006	−0.014	−0.012	−0.010	0.005	0.001
	(0.017)	(0.013)	(0.008)	(0.007)	(0.007)	(0.014)	(0.015)
November	0.009	−0.007	−0.001	−0.003	−0.002	−0.020	0.012
	(0.015)	(0.013)	(0.009)	(0.008)	(0.007)	(0.014)	(0.015)
December	−0.006	−0.014	−0.001	0.016	0.000	−0.012	0.022
	(0.016)	(0.013)	(0.009)	(0.009)	(0.007)	(0.015)	(0.013)
Adjusted R^2	0.081	0.030	0.013	0.004	0.002	0.003	0.009
Number of observations	43,364	43,103	43,526	44,453	44,750	45,398	44,079

Notes: Standard errors are in parentheses, and are clustered at the region/year level. These regressions also include a constant, region fixed effect, year fixed effect, and time trends. * denotes significance at the 5% level.

The findings in Table 4 are consistent with the results of other studies. Studies on redshirting report that parents with better socioeconomic backgrounds are more likely to redshirt their children (Deming and Dynarski, 2008; Dobkin and Ferreira, 2010); Bassok and Reardon (2013) and Schanzenbach and Larson (2017) each found that boys are more likely to be redshirted than girls. Finally, Shigeoka (2015) reports that parents are more likely to postpone the delivery date of boys and the second or later child.

education than other mothers. About 53% of the former have a college degree, while the number is 71% for the latter.

[Table 5] Characteristics of children born not at home

	Dependent variable =						
	College graduate	Employed	Less than 25 years old	Preterm birth	Low birth weight	Girl	First born
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
January	0.009*	0.006*	−0.005*	−0.004*	−0.003*	0.001	0.014*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
February	0.008*	0.003*	−0.005*	−0.005*	−0.003*	0.001	0.011*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
March	0.010*	0.003*	−0.007*	−0.006*	−0.003*	−0.000	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
April	0.013*	0.004*	−0.007*	−0.005*	−0.003*	−0.001	−0.004*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
May	0.007*	0.002	−0.004*	−0.004*	−0.003*	0.000	−0.006*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
July	−0.000	0.002	−0.001	0.001	0.000	−0.000	0.013*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
August	0.004*	0.005*	−0.001	−0.000	−0.001	0.001	0.026*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
September	0.012*	0.010*	−0.003*	−0.006*	−0.002*	0.001	0.023*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
October	0.008*	0.011*	−0.003*	−0.004*	−0.002*	0.002	0.024*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
November	0.004*	0.006*	−0.001	−0.002*	−0.000	0.002	0.029*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
December	−0.004*	0.002	0.004*	0.002*	0.003*	0.003*	0.044*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Adjusted R^2	0.031	0.025	0.010	0.001	0.000	0.000	0.006
Number of observations	4,473,488	4,453,639	4,490,715	4,487,805	4,489,904	4,492,633	4,482,247

Notes: Standard errors are in parentheses, and are clustered at the region/year level. These regressions also include a constant, region fixed effect, year fixed effect, and time trends.
* denotes significance at the 5% level.

This study also examines the characteristics of children born outside of their homes (e.g., in a hospital). If the picture is similar to that given in Table 4 (i.e., January home-born children stand out), it may not be true that some January home-born children were not actually born in January. Table 5 presents the results, which appear to differ from those in Table 4. First of all, the April mothers, and not the January mothers, are the most likely to have a college degree, and the October mothers are the ones most likely to be employed. In addition, the March and September children are the least likely to be born prematurely. The results in Table 5 indicate that the results in Table 4 were not driven by the characteristics of children actually born in January, and they support the assertion that at least some of the January home-born children had not in fact been born in January.

VI. Discussion and Conclusion

If parents have an incentive to change their child's delivery date for any reason, they could also have an incentive to manipulate their child's birthday. While the literature finds evidence with regards to moving the delivery date, it does not examine birthday manipulation. As such, this study is the first to analyze this topic, and found that approximately 3.7% of babies born in South Korea in the month of December in 2006–2015 were registered as having been born in January of the following year. The rationale for this estimation is that the proportion of home-born children is unusually large in January, and there are too few children registered as having been hospital-born in December (i.e., relative to the number of delivery patients in that month). In addition, the characteristics of January home-born children are significantly different from those of home-born children in other months.

Although this study provides evidence that some babies registered as January-born were not actually born in January and hence, the actual difference between December and January is likely to be smaller than the observed difference, it is not likely that most of the observed difference is not real, because a large difference, as described in Section 3, is also observed in the hospital data: according to the data, the most common birth month is January, in which 286,410 delivery patients gave birth during the 2009–2015 period, while in December, the least common birth month, the number was 236,228. In addition, as described in Section 1, even in the 1920s, giving birth in the earlier months of a year was preferred to giving birth in the later months.

This study does not consider the case of doctors falsely recording dates of birth, although doctors could possibly do this. Including such cases would increase the number of false reports; therefore, one should be aware that the estimate found in this study is limited to false reports of children registered as home-born. In addition, one assumption used in subsection 4.1 is that the proportion of January home-born babies are similar to the proportion of February home-born babies: this assumption is used because it is impossible to know the proportion of babies who were actually born at home in January. Therefore, if this assumption is violated, the estimate is likely to have bias.

As described in subsection 2.2, unlike South Koreans, every person worldwide becomes one year older on his or her birthday, and the rest of the world, especially Western countries, does not share an age-based social etiquette as South Korea does.

However, parents in other countries also want their children to perform academically better than their peers. As described in Section 1, Japanese parents delay their children's birth dates beyond the school cutoff date, and in the United States, 15% of the children born one month before the school cutoff date are redshirted. This fact implies that although cultural differences exist across countries—and a South Korean setting is a unique one—parental response to the school cutoff date does not differ by country. That is, they want their children to be older than their peers, and this study contributes to the literature by providing such evidence in a country with social etiquette strongly influenced by age.

In what ways does a student benefit (or suffer) from entering school late on account of false reporting? One obvious benefit, as described in Section 1, is that a student is likely to perform better in terms of both school and the labor market, because he or she is (biologically) older than his or her peers.[21] This is why many parents manipulate their child's birthday. On the other hand, a student could be hurt by a late school entry, in the form of a loss in wages due to a late entry into the labor market. Black, Devereux, and Salvanes (2011) analyzed Norwegian data and found that those who entered schools late tended to have lower incomes in their mid-twenties. While parents are likely to know about this loss, they may think that their children's reduced income during their twenties can be compensated for. In addition, some parents, even knowing about the loss, still may want their children to perform well academically and to go to selective colleges because education levels or colleges attended are closely associated with social status. Lastly, the parents of late-entry children incur a cost—that is, parents will need to pay for an additional year of childcare if they send their child to school one year later on account of false reporting.

As Table 4 shows, falsely reported children have better family backgrounds. Considering that family backgrounds are an important factor determining one's education level and social status,[22] birthday manipulation is likely to contribute to reducing the intergenerational mobility of education because it makes a student older than his or her peers, leading to better academic performance. While, as subsection 5.2 shows, the number of false reports has declined, the government should implement effective policies to prevent birthday manipulation and, as a result, enhancing more equal opportunity in education.

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[21] Although this may not apply to the South Korean situation, using U.S. data, Dobkin and Ferreira (2010) found that biologically older children in the class were less likely to graduate from high school, because they reach an age where they are allowed to leave high school prior to graduation.

[22] Cho (2017) finds that fathers employed in large firms are more likely to know about their children's whereabouts and activities, which may lead to better educational outcomes.

Appendix

[Appendix Table 1] Test of uniform distribution

	January included		January not included	
	Pearson statistic (1)	p-value (2)	Pearson statistic (3)	p-value (4)
Year 2007	4,000	0.00	42.57	0.00
2008	8,000	0.00	24.29	0.01
2009	5,900	0.00	9.13	0.52
2010	4,000	0.00	12.79	0.24
2011	8,000	0.00	48.86	0.00
2012	4,900	0.00	163.06	0.00
2013	5,300	0.00	16.76	0.08
2014	2,400	0.00	17.29	0.07
2015	2,000	0.00	53.79	0.00
2016	1,300	0.00	28.28	0.00

Notes: This analysis examines whether the monthly proportion of home-born children in each year follows a uniform distribution. Columns (1) and (2) include January, whereas columns (3) and (4) do not.

[Appendix Figure 1] Map of South Korea

[Appendix Table 2] Proportions of home-born babies in February and February–December of 2007–2016 (%)

	February	February–December
	(1)	(2)
Year 2007	0.99	0.80
2008	0.88	0.86
2009	0.91	0.92
2010	0.99	0.95
2011	1.02	0.88
2012	0.97	0.78
2013	0.62	0.57
2014	0.52	0.49
2015	0.49	0.42
2016	0.34	0.34

Notes: "Proportion of home-born babies" means the proportion of babies registered as home-born, as a share of all registered babies.

[Appendix Table 3] Relationship between the number of delivery patients and the number of hospital-born children (equation (2))

	Dependent variable = Number of children registered as hospital-born
Number of delivery patients	1.025* (0.012)
Adjusted R^2	0.99
Number of observations	77

Notes: Standard errors are in parentheses. The regression also includes a constant and year fixed effect.
* denotes significance at the 5% level.

[Appendix Table 4] Descriptive statistics of children born not at home and their mothers

	Mean	Standard deviation
Child		
Girl (%)	48.6	50.0
First born (%)	51.9	50.0
Birth weight (gram)	3,215	464
Low birth weight (%)	5.3	22.4
Gestational length	38.7	1.7
Preterm birth (%)	6.2	24.1
Mother		
College degree (%)	69.6	46.0
Employed (%)	32.9	47.0
Age	31.0	4.1
Less than 25 years old (%)	8.4	27.8
Maximum number of observations	4,492,633	

Notes: This table shows the descriptive statistics of children born not at home in 2007–2016 and their mothers. "Low birth weight" means weighing less than 2,500 g at birth; "preterm birth" means being born before 37 weeks into pregnancy.

References

Attar, I., and D. Cohen-Zada (2018), "The Effect of School Entrance Age on Educational Outcomes: Evidence Using Multiple Cutoff Dates and Exact Date of Birth," *Journal of Economic Behavior & Organization*, 153, 38–57.

Barreca, A., O. Deschenes, and M. Guldi (2018), "Maybe Next Month? Temperature Shocks and Dynamic Adjustments in Birth Rates," *Demography*, 55(4), 1269–1293.

Bassok, D., and S. F. Reardon (2013), "Academic Redshirting in Kindergarten: Prevalence, Patterns, and Implications," *Educational Evaluation and Policy Analysis*, 35(3), 283–297.

Bedard, K., and E. Dhuey (2006), "The Persistence of Early Childhood Maturity: International Evidence of Long-run Age Effects," *Quarterly Journal of Economics*, 121(4), 1437–1472.

Black, S. E., P. J. Devereux, and K. G. Salvanes (2011), "Too Young to Leave the Nest? The Effects of School Starting Age," *Review of Economics and Statistics*, 93(2), 455–467.

Buckles, K. S., and D. M. Hungerman (2013), "Season of Birth and Later Outcomes: Old Questions, New Answers," *Review of Economics and Statistics*, 95(3), 711–724.

Cho, H. (2017), "The Effects of Fathers' Working Hours on Youth Behavior: Evidence from a Change in the Standard Workweek," *Korean Economic Review*, 33(2), 295–324.

Datar, A. (2006), "Does Delaying Kindergarten Entrance Give Children a Head Start?" *Economics of Education Review*, 25(1), 43–62.

Deming, D., and S. Dynarski (2008), "The Lengthening of Childhood," *Journal of Economic Perspectives*, 22(3), 71–92.

Dickert-Conlin, S., and A. Chandra (1999), "Taxes and the Timing of Births," *Journal of Political Economy*, 107(1), 161–177.

Dickert-Conlin, S., and T. E. Elder (2010), "Suburban Legend: School Cutoff Dates and the Timing of Births," *Economics of Education Review*, 29(5), 826–841.

Dobkin, C., and F. Ferreira (2010), "Do School Entry Laws affect Educational Attainment and Labor Market Outcomes?" *Economics of Education Review*, 29(1), 40–54.

Du, Q., H. Gao, and M. D. Levi (2012), "The Relative-age Effect and Career Success: Evidence from Corporate CEOs," *Economics Letters*, 117(3), 660–662.

Elder, T. E., and D. H. Lubotsky (2009), "Kindergarten Entrance Age and Children's Achievement Impacts of State Policies, Family Background, and Peers," *Journal of Human Resources*, 44(3), 641–683.

Fredriksson, P., and B. Öckert (2014), "Life-cycle Effects of Age at School Start," *The Economic Journal*, 124(579), 977–1004.

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(1), 246–263.

How South Korea Learned to Love Baby Girls (2017), *The Economist*, Retrieved from https://www.economist.com/news/international/21714982-aborting-girls-simply-because-they-are-girls-has-become-unthinkable-how-south-korea-learned

Kawaguchi, D. (2011), "Actual Age at School Entry, Educational Outcomes, and Earnings," *Journal of the Japanese and International Economies*, 25(2), 64–80.

Kim, T. (2011), "The Effect of Age at School Entry on Long-term Educational Attainment in Korea," *Korean Journal of Labor Economics*, 34(1), 1–32.

Korean Educational Development Institute (2017), 2017 Education Statistics (written in Korean). Retrieved from https://kess.kedi.re.kr/publ/view?survSeq=2017&publSeq=43&menuSeq=0&itemCode= 02&language=#

LaLumia, S., J. M. Sallee, and N. Turner (2015), "New Evidence on Taxes and the Timing of Birth," *American Economic Journal: Economic Policy*, 7(2), 258–293.

Laws, P. J., N. Grayson, and E. A. Sullivan (2006), Australia's Mothers and Babies 2004. Perinatal Statistics Series no. 18. AIHW cat. no. PER 34. Sydney: AIHW National Perinatal Statistics Unit.

McEwan, P. J., and J. S. Shapiro (2008), "The Benefits of Delayed Primary School Enrollment Discontinuity Estimates Using Exact Birth Dates," *Journal of Human Resources*, 43(1), 1–29.

Neugart, M., and H. Ohlsson (2013), "Economic Incentives and the Timing of Births: Evidence from the German Parental Benefit Reform of 2007," *Journal of Population Economics*, 26(1), 87–108.

Schanzenbach, D. W., and S. H. Larson (2017), "Is your Child Ready for Vindergarten?" *Education Next*, 17(3).

Schulkind, L., and T. M. Shapiro (2014), "What a Difference a Day Makes: Quantifying the Effects of Birth Timing Manipulation on Infant Health," *Journal of Health Economics*, 33, 139–158.

Shigeoka, H. (2015), School Entry Cutoff Date and the Timing of Births (No. w21402). National Bureau of Economic Research.