School Cutoff Dates, the Timing of Births, and Heterogeneous Responses

Hitoshi Shigeoka[1]

Preliminary Draft: Do not cite without permission

Abstract

This is the first paper that documents that school entrance cut-off date affects the timing of births. Many countries require children to reach a certain age by a specified date in the calendar year in order to start primary school. There is a clear tradeoff for parents to time a birth either before or after the school cut-off date; births just *before* cut-off date benefit parents by avoiding a year of child care costs through sending their children to school at a relatively young age, while births just *after* cut-off date may benefit children from being in the oldest among the school cohort, which is shown to provide the children with academic advantage (relative age effects). Using the universe of birth during 1974-2010 in Japan with single school cut-off date of April 2, I reach three findings. First, I find that more than 1500 births are shifted roughly a week before the cut-off date. My finding suggests that relative age effects may dominate at least in Japanese setting. Second, I find that those mothers who are non-working mothers are more likely to delay births, which is consistent with the idea that opportunity cost story. However, interestingly among those working, mothers with low skilled jobs are more likely to shift births *before* the school cut-off dates. This result imply that financial burden of child cares may give incentives to time births earlier than school-cut off dates to avoid the additional one year of child care cost. Also I find that delay of birth is much more drastic for male birth than female births, which may be another form of son-preference. Finally, I examine the health outcomes of births. While birth after the cut-off date was slightly heavier, I do not find any change in infant mortality, which is plausible since hospitals anticipate the surge in the births. This study may have implications for growing literature that assumes births around the school cut-off dates are random. In fact, ongoing work uses the publically available Trends in International Mathematics and Science Study (TIMSS) 1995 and 1999, which report both test scores and exact date of births to examine whether there is academic advantage among those born after the cut-off date in Japan in a regression discontinuity framework and if so, whether such advantage is robust to controlling for mother's observable characteristics.

This project is supported by a research grant from the Ministry of Health, Labour and Welfare (H22-policy-033, Principle Investigator: Kenji Shibuya and co-investigator: Hideki Hashimoto). The use of data in this paper is approved by Ministry of Health, Labour and Welfare under this grant. I am grateful to Hideki Hashimoto, Andrew McGee for their suggestions and comments. All errors are my own.

[1] Department of economics, Simon Fraser University hitoshi_shigeoka@sfu.ca

1. Introduction

There is a small but growing literature which examines the impact of the incentives created by birth-related cut-off dates on the timing of births. Past studies have analyzed the timing of births in very different settings and institutions that rely on cut-off dates that were known to parents before delivery. For example, evidence suggests that parents have manipulated birth dates in order to avoid taxes in the US (Dickert-Conlin and Chandra 1999) and obtain monetary bonuses in Austrarila (Gans and Leigh 2009).[2]

In this paper, I analyze one of such cut-offs: school entrance date. Many countries require children to reach a certain age by a specified date in the calendar year in order to start primary school. Parents who plan to have children face a trade-off to time a birth before and after the school cut-off dates. The benefit of shifting birth *before* the school cut-off date is that parents can send their children to school at a relatively young age, and thus avoid a year of child care costs.[3] The benefit of shifting birth *after* the school cut-off date is that academic performance, and later labor outcome, is shown to be better for the older children within an academic cohort (relative age effects).[4] Whether parents react to the incentives, and if so which incentive dominates is an empirical question.

There are a few papers which examined this question: Dickert-Conlin and Elder (2010) in the US, McCrary and Royer (2010) in Texas and California in the US, McEwan and Shapiro (2008) in Chile, and Berlinski et al. (2011) in Argentine. However, no paper so far finds evidence of sorting around school entrance cut-off dates.

There are two key institutional features that make Japan a unique setting where the timing of birth is very important for parents. First, the delay of the entry into primary school is very rare in Japan. In fact, Kawaguchi (2012) documents that only 0.03% of primary school age children are exempted from the mandatory starting age in Japan. Therefore the timing of births indeed decides when the children start primary schools later. This setting is in contrast to the case in the US where significant fraction of American children defer school entry by a year, making them the oldest students (Datar 2006). Second, there is only one single school cut-off date that applies to all children in Japan, so it is impossible for parents to move to other prefectures which have different school cut-off dates unlike the US where each state has

[2] Tax incentives in the US (Dickert-Conlin and Chandra, 1999; Maghakian and Schulkind, 2012; LaLumia, Sallee, and Turner, 2013); tax incentives in Japan (Kurenishi and Wakabayashi, 2008); bonus payment in Australia (Gans and Leigh, 2009); parental leave benefit reform in Germany (Tamm, 2012); expansion of job-protection leave in Germany (Dustmann and Schonberg, 2012); extending the leave duration in Austria (Lalive and Zweimuller, 2009). Some papers find that shift in the timing of births, while others did not.

[3] There is some convincing evidence that availability of kindergarten affects mother's labor supply (see Berlinski and Galiani, 2007; Cascio, 2009; Gelbach, 2002; Schlosser, 2011). These findings suggest that kindergarten implicitly serve as child care centers.

[4] There is solid evidence that the older children perform better in school than younger children within an academic cohort (e.g., Bedard and Dhuey, 2006; Dobkin and Ferreira, 2010).

different school cut-off date.[5]

I use universe of birth certificate records 1974 - 2010 which reports exact date of births to assess whether parents systematically time childbirth before or after this eligibility cut-off date. I also examine the heterogeneous response by mother's observable characteristics. Finally, I examine the effect of the timing shift on the infant health. I find three main results.

First, I find that more than 1500 births are shifted roughly a week before the cut-off date to a week following the cut-off date, which is consistent with real shift in timing instead of manipulation. Since I observe a gradual decline and a gradual increase in the number of births roughly within a week of the cut-off date, this shift of births is more consistent with real shift instead of pure manipulation. This finding of delaying births suggests that the relative age effect dominates at least in Japanese setting. This is the first paper that documents the solid evidence that school cut-off date affects the timing of births.

Second, I examine the characteristics of mothers who shift the births, and find that those mothers who are non-working mothers are more likely to delay births, which is consistent with the idea that opportunity cost of non-working mothers is smaller than those of working mothers. However, interestingly among those working, mothers with low skilled jobs are more likely to shift births *before* the school cut-off dates. This result imply that financial burden of child cares may give incentives to time births earlier than school-cut off dates to avoid the additional one year of child care cost.

Third, I examine the characteristics of child including gender of births, birth weight, and infant mortality. The most interesting result is that male births are much more likely to be delayed than female births. This finding is striking since Japan is known to show little son preference in the prenatal stage, and therefore have normal sex ratio at births unlike many of Asian countries that shows elevated sex ratio at births (Sen, 1990, 1991). This result may imply a different form of son preference at postnatal stage instead of prenatal stage such as sex-selective abortion. Also consistent with the real shifts in timing of births instead of pure manipulation, I find the birth weight after the cut-off date is slightly heavier, and the probability of over weight is also slightly higher. Finally, I also examine the infant mortality. If the surge in the number of births right after the school cut-off date creates the congestion or overcrowding in hospitals, it could potentially harm the health of newborns. But it may not affect the infant health since hospitals can anticipate such a surge, and thus they are well prepared. Consistent with the latter view, I do not find that births born right after the school cut-off date show the excess infant mortality.

This paper is related to strand of the literature. First, this result provides evidence on the power that parents have on the timing of birth. Overall there is ample evidence that a certain

[5] For example, school entrance cut-off date for California is December 1, and that for Texas is September 1. These cut-offs are exploited in McCrary and Royer (2010) and Dobkin and Ferreira (2010). For school entrance cut-off dates in each state in the US, see Dickert-Conlin and Elder (2010). For international school entrance cut-off dates, see Bedard and Dhuey (2006).

number of deliveries are timed. For example, using our data from birth certificates I observe that the number of births taking place on weekends or holidays is lower by around 21% than on regular days. Yet, it is generally not clear whether this timing is due to doctors and hospitals or due to parents.[6] Since doctors/hospitals certainly prefer not to have congestions, this surge in the number of births right after the school entrance cut-off dates suggest that parents has some power vis-`a-vis doctors/hospitals on the timing of the delivery.

Second, in addition to the literature on strategic timing of birth, this paper also contributes to the growing literature that relies on the identification strategy that assumes that births around the school entrance cut-off dates are random. In fact, many studies combine this fact with the compulsory school law to instrument for educational outcome (e.g., McCrary and Royer, 2011; Black, Devereux, and Salvanes, 2011). In fact, Bedard and Dhuey (2006) exploit this school cutoff date among OECD countries, which *does* include data from Japan, and showed that younger cohorts within the academic cohort do perform worse than older children.) This paper adds to the literature that has an implication on the validity of such instruments in some occasions (e.g., Buckles and Hungerman, forthcoming).[7]

Also this paper is closely linked to the literature as to bolts and nuts in a regression discontinuity (RD) design. Verhoogen and Urquiola (2009) show that schools in Chile at the class-size cap adjust enrollments to avoid adding an additional classroom, which generates discontinuities in the relationship between enrollment and household characteristics, violating the underlying assumptions of RD designs. I also find that age and working status of mothers, and type of mother's job discretely change right after the cut-off dates. This paper also shows that precise control of the running variable can invalidate the crucial assumption of the RD design. This paper shows the importance of checking the distribution of observations around the threshold as suggested by McCrary (2008), and also smoothness of the observable characteristics (Lee 2008; Imbens and Lemiux 2008; Lee and Lemieux 2010).

The remainder of this paper is organized as follows. Section 2 provides background information on the school system. Section 3 describes the data used herein, and the identification strategy. Section 4 shows the main results and section 5 discusses the implications of the findings. Section 7 concludes.

2. Background

In this section, I briefly describe the school system, and birth registration system in Japan. This school entrance cut-off dates in Japan has been April 2 since 1947, and it has not

[6] Chandra et al.(2008) documents that more births in the weekends than weekdays, but also notes that it is not clear whether they are driven by hospitals/physicians or patients.

[7] For the instruments to be valid, instruments have to satisfy two conditions: exclusion restrictions and relevance. Past literature questions the relevance, i.e., weak instrument, such as Bound, Jaeger, and Baker (1995). Here the issue is about exclusion restrictions.

changed since then. The school system in Japan is legally defined in the School Education Law (SEL) enacted in 1947. SEL article 22 mandates parents to send their children to primary schools as soon as their children turn age six before the school starting day, which is April 1 in Japan. According to Japanese law, people reach the additional age a day before their birthday. This means that children born on April 1 enter primary schools on their 6th birthday, while those born on April 2 enter primary schools on the day before their 7th birthday. Children whose birthdates fall right after April 2 must wait until the next year to start school. So there is about a 1-year age difference at the maximum among primary school students in the first grade.

This rule is strongly enforced and thus students rarely delay or start primary school earlier than scheduled date in Japan. Japan employ social promotion system, where automatic promotion from one grade to the next. Indeed, SEL Article 23 allows a delay in school entry due to a child's illness or underdevelopment, but this exception is rarely applied. According to Kawaguchi (2010), the percentage of exemption is 0.03%.[8] Also the SEL Article 23 does not prohibit students from learning in the grade above the scheduled grade, but it is also very rare.[9] The fact that almost all children start attending school without delay or advancement contrasts with the situation in the US, where postponing school attendance has become popular among educated parents (Elder and Lubotsky, 2009, Cascio and Schanzenbach, 2012; Dobkin and Ferreira, 2010).

Also unlike the US, compulsory schooling is not defined by the age when students can leave, but by the length of the years; 9 years of education (6 year in primary school and 3 year in junior high school) is uniformly required for all children.[10] Therefore there is no systematic variation in years of schooling based on the timing of births. This means parent in Japan do not face a well-known tradeoff in the US where though students who are the youngest in their school cohort typically have poorer academic performance, on average, they have slightly higher educational attainment. In Japan, latter effect is not mechanical as in the US. That is, the Japanese institutional setting does not create a variation in the number of years of schooling by birth month unlike the case in Angrist and Kruger (1992) or McCrary and Royer (2011). Therefore, if there is a variation in the years of schooling depending on the birth date in Japan, the variation is induced by individual choice (Kagaguchi, 2010).

This strict enforcement of school entrance cut-off is the source of the important tradeoff that parents face in Japan. There is trade-off for parents to time a birth before and after April 2 (or ask physicians to manipulate the birth dates if possible). The benefit of shifting birth

[8] In 2004, 7,200,933 children at the primary school age (ages 6–12) attended primary schools, while 2261 did not (Kagaguchi, 2010).

[9] According to Kagaguchi (2010), in court cases, judges have ruled against allowing students to do so, at least during compulsory school years (i.e. primary and junior high school, which is grade 1 to grade 9).

[10] SEL article 39 requires parents to send their children to junior high school by the end of the school year in which they turn age 15.

before the school cut-off date is that parents can send their children to school at a relatively young age, and thus avoid a year of child care costs. The benefit of shifting birth *after* the school cut-off date is that academic performance, and later labor outcome, is shown to be better for the older children within an academic cohort (relative age effects). For example, Bedard and Dhuey (2006) shows that using OECD countries, including the data in Japan, those older within the grade perform significantly better in mathematics and science in 4th and 8th grade.

3. Data and Identification Strategy

3.1 Data

The primary data for this analysis are the universe of birth record that covers universe of the births occurred in Japan during 1974-2010 compiled by Ministry of Welfare. I drop those born outside of Japan, missing with any of the birth dates information. Combining the 1974-2010 birth data provides me with information on over 50 million births. Our main interest of outcome is the number of births in each day. Also we examine the heterogeneous response by mother's and child characteristics. Unfortunately, the information on mother's socioeconomics (SES) characteristics is limited in the birth certificates in Japan.[11] I also examine the newborn characteristics to investigate whether the shits in the timing of births are indeed real instead of pure manipulation by looking at the birth weight of newborns. I also examine the gender of child, and parity of child.[12]

The birth certificates in Japan collect every five years the working status of mothers at the time of delivery, and roughly 10 categories of types of mother's job for those working mothers. The information about the mothers' job is only collected every five years with 0 or 5 in the last digit of the year. I divide the 10 categories of types of jobs into high skilled jobs, medium skilled jobs and low skilled jobs. Appendix table 1 summarizes the occupational categories.

I also use the death certificates to examine the infant mortality. The death certificates contain a unique record of each death occurring in the Japan, which includes information about the decedent's exact date of death, exact date of birth, gender, place of residence, and cause of death. We can simply calculate the death within certain days from birth by combining these exact date of death, exact date of birth. The birth death data is not directly linked to death data, but the death data report exact date of births among those dead within a year. The birth and death data are not linked in Japan, but it is not an issue since the death certificates include exact date

[11] Unfortunately, birth certificates in Japan do not collect education of mothers/fathers, number of prenatal checkups, delivery method (such as C-section and inducement), and complications of births.
[12] Also since 1992, mothers' exact date of birth is reported. Setting aside the selection issue, we examine whether mothers date of birth show the same patterns as we see in the birth data. I also find that mother's birth date is also concentrated right after the school cut off dates (not shown).

of birth, and exact date of deaths. I count the number of infant deaths by each birth date, and merge this information by birth date to calculate the infant mortality rate. Thus I can count the number of births in each exact date of births, and infant deaths of the births born exactly on that date to calculate the infant mortality rate for each day.

3.2 Estimation equation

Let $birth_{dy}$ be counts of deaths for day *d* in year *y*. Days are organized in relation to the April 2. Given this structure for the data, the econometric model I estimate is:

$$birth_{dy} = \alpha + \beta After_{dy} + \sum_{j=1}^{6} DOW(j)_{dy}\gamma_j + \sum_{k=1}^{N} Holiday(k)_{dy}\delta_k + \theta_y + \varepsilon_{dy} \quad (1)$$

$$\ln(birth_{dy}) = \alpha + \beta After_{dy} + \sum_{j=1}^{6} DOW(j)_{dy}\gamma_j + \sum_{k=1}^{N} Holiday(k)_{dy}\delta_k + \theta_y + \varepsilon_{dy} \quad (2)$$

where $After_{dy}$ takes one if the birth day *d* is after April 2 in each year *y*. *DOW(j)* is one of six dummy variables for the different weekdays (the reference weekday is Saturday), and $Holiday(k)$of *K* dummy variables for holidays throughout the year.[13] The variables θ_y capture year effects, and $\varepsilon_{dy}$is an idiosyncratic error term. The year indicators are included to account for time trends in the overall number of births.[14] We change the windows around the April 2, from 7 days to 28 days following Gan sand Leigh (2008).[15] Using the log number of births provides a measure of the proportion of births shifted, that is, it relates the number of shifts with the number of births overall.

I also examine the child characteristic around the school entrance cut-off date. Here I use the individual birth data instead of counts at each birth date. The equation I estimate is :

$$Y_{idy} = \alpha + \beta After_{idy} + \sum_{j=1}^{6} DOW(j)_{idy}\gamma_j + \sum_{k=1}^{N} Holiday(k)_{idy}\delta_k + \theta_y + \varepsilon_{idy} \quad (3)$$

for each outcome *Y* for individual birth *i* born in year *y*, and day *d*. To account for common characteristics within the same birth date cells, the standard errors are clustered at the birth date, following Lee and Card (2008).

[13] Some holidays do not fall on the same day. I include all public holidays, plus special holidays.

[14] I also tried to include day of week*year fixed effect to allow each week day to have differential impact by each year. The results are very similar.

[15] Widening the window has two purposes. First, it allows for births to have been moved by more than one week even though as I show later, birth shifting is concentrated within a week from the cut-off date. Second, it accounts for the possibility that some parents may have attempted to delay their child's birth until April 2, but instead only moved the birth date from mid-March to late-March. Such 'unsuccessful moves' would attenuate the estimates derived from focusing on a narrow window.

4. Results: the timing of births

4.1 Timing of births

Before running formal statistical analysis, the simple histogram of the number of birth by day of the year reveals the striking pattern. Figure1 shows the birth distribution throughout the year using the pooled 1974-2010 birth data. The markers with cross sign correspond to the holidays. Note once again that school cut-off date is April 2nd instead of April 1st. To my knowledge, nothing other than school cut-off dates lies on this specific day.

Figure 1 shows that there is clearly a heaping on April 2, and relatively high number of births on subsequent days. In fact, the April 2 is the day with the highest number of births throughout the year, and April 1st, a day before is the lowers number of births except for holidays. Table 1 reports the day of the year and corresponding mean number of births, and the relative number of births on a particular day, computed as the average births on a given day divided by the average birth across all days. Thus, a value of 1.1 represents a 10 percent increase in the daily births compared to the average in the year. April 2, and April 3 are 20 and 10 percent more births than average, while April 1, a day before the cut-off date, is 15 percent less than average. This graph shows the importance of controlling the holidays in the estimation. There is also variation in the weekdays vs. weekends, but pooling many years of data smooth out such an effect. In the regression, I will include the day of the week fixed effects to control for the fluctuations.[16]

In Figure 2, I graph the mean daily number of births around April 2 using pooled 1974-2010 birth data. To provide symmetry, we report the 28 days prior to the April (March 4 -April 1), and the 28 days after April 2nd (April 2-April 29). Again, the markers with cross sign correspond to the holidays.[17] Panel A simply plot the mean daily number of births. Starting about 10 days before the April 2, daily number of births decline slowly, and fall to roughly 2800 per day at April 1, a day before the school cut-off date. Birth then increase on April 2 to roughly 4,500 per day. The difference between a day before and after the school entrance cut-off date is as much as 1700 births per day per year with an average of 3,777 births per day on average throughout the year. Note that other dips around March 20 and April 29 are the result of holiday, Spring Equinox Day (either March 20 or 21), and Green day, respectively. Panel B accounts for weekend, and holidays by plotting the residual of regressions of number of birth on weekday and holiday fixed effects. This graph shows the similar dip and surge around school cut-off date of April 2.

Table 2 summarizes the formal statistical test estimating equation (1) and (2). First row in

[16] Holidays in Japan are: Jan 1, Jan 15 (till 1999), Feb 11, March 20 or Mach 21 (during 1974-2010, 14 years on Mach 20, and 23 years on March 21), April 29, May 3, May 4, May 5, July 29 (till 2002), Sep 15 (till 2002), Sep 23 (Sep22 for 1975, and 1979), Oct 10 (till 1999), Nov 3, Nov 23, and Dec 23.

[17] The holidays included in this graph is Spring Equinox Day or *shubun-no-hi* (March 20 or Mach 21), and Greenery Day or *midori-no-hi* (April 29).

Panel A restricts the sample to the last 7 days and first 7 days around April 2, and it shows that roughly 1,835 births are shifted within 7 days from the April 2. In the remaining columns, I progressively widen the window of analysis to see the timing of birth shifts. As I widen the window, the number of birth shifted does not substantially change in 14 and 21 days around the cut-offs. This result implies that most of the shift in timing of birth is concentrated within the first and last 7 days from the school cut-off date. Panel B now use natural log of the mean daily birth as an outcome. The first column shows that roughly 7.0 percent of births are shifted from a week before to a week after April 2. This pattern is not just limited to a certain period. Appendix Figure A1 shows the mean daily number of birth around April 2 by different time period. While the magnitude of the abrupt change is larger in the early years, I still find the large shift in birth in the recent decade as well.

Since I observe the gradual decline before April 2, it seems unlikely that manipulation of reported birth date account for all the differences [18] Further evidence against pure manipulation story is shown later when I examine the birth weight, and gestational length of mothers. This delaying of births is pretty surprising since medical literature documents that it is more difficult to delay the births than bring forward.

4.2 Heterogeneous responses

Exploiting the characteristics of mother and newborns, I shed the incentive behind the shift of timing of birth. Figure 3-6 plots the number of births by parity of child, by mother's age, by mother's working status, and gender of child within 28 days before and after the school entrance cut-off date. Table 3 and 4 summarizes the results from running equation (3) where outcome is log of the mean daily number of births separately for each sub-groups.

Figure 3A show that births at higher parity is more likely to be delayed to fall behind the school cut-off date. This is apparent in Figure 3B which plot the share of 2^{nd} + parity birth among all births. Figure 3B shows that share of high parity birth increase right after April 2. Panel C in Table 3 shows the result of formal statistical analysis. While 8.6 percent of birth at parity above 2^{nd} child are delayed within 7 day window, that for 1^{st} birth is 5.3 percent, implying that mothers may learn from the previous experience of first child that it is probably beneficial for forthcoming kids to fall behind the school cut-off date so that the kid can perform better in school later in one's life.

Figure 4A show that relatively younger mothers with less than 30 years old show a larger

[18] This result is not driven by the manipulation of birth date among births deliveded at homes since 99 % of birth occur either at hospitals or clinics based on pooled 1974-2010 data. Once the child is born in either hospitals or clinics, the basic characteristics of newborns such as birth weight are collected at the hospitals or clinics, and the hospitals write down the confirmation form of the births. In case of deliveries at home, midwives take care of it. Then the parents bring the form to the near-by public health center (hokenjyo), and register the birth. Therefore if the manipulation of reported birth date happens, it may happen at the delivery stage at medical institutions or home rather than reporting stage at the public health center.

dip and surge around the April 2, compared to relatively older mothers. Because of this differential pattern by mother's age group, Figure 4B shows a decline in mean mother's age at birth right after the school cut-off date. The more delay of birth among younger mothers may contradict with the learning story, however, since the delay of birth can be potentially harmful to the mother's health conditions, the delays of births for older mothers may be difficult, and physicians/hospital may not agree on the mother's request.

The most striking and interesting results is the differential results by the gender of births. Figure 5A plots the mean daily number of births around the cut-off date by gender. Figure 5A clearly shows that male births are more likely to be shifted than female births. Figure 5B plot the male/female ratio on each day, and the share of male birth is substantially larger after the school cut-off date.

This finding is striking since Japan is known to show little son preference in the prenatal stage, and therefore have normal sex ratio at births unlike many of Asian countries that shows elevated sex ratio at births (Sen, 1990, 1991). This result may imply a different form of son preference at postnatal stage instead of prenatal stage such as sex-selective abortion. Appendix figure A2 shows the ratio of male/female births by each period. The figure suggests that the son preference is persistent across different period.[19]

4.3 Working status of mothers

Here I examine the differential response by mothers working status and type of jobs. Since the opportunity cost of those not working is lower than those working if the mothers need to provide one additional year of child care, non-working mothers may be more likely to delay the births. To examine this hypothesis, I divide the sample into working and non-working mothers. Mother's working status is collected every five years ending with last digit of 0 and 5.

Figure 5A clearly shows that non-working mothers are more likely to shift than working mothers. Panel A in Table 4 shows that while non-working mothers shifts 11.3 percent of births within 7 days of school entrance cut-off date, the number is only 3.5 percent for working mothers.

However, the results for working mothers may mask the heterogeneous response by the different job type of mothers. Figure 5B shows the mean daily number of birth by job type of mothers only among those working. Interestingly, mothers with low skilled jobs are more likely to shift births *before* the school cut-off dates. This result imply that financial burden of

[19] The birth certificates also include information in which type of institution the birth has happened: either hospitals or clinics or home. In Japan, roughly 99 % of births occur either hospitals or clinics, where hospitals are those with more than 20 beds, and clinics are those with less than 20 beds or no bed. I find that births are more likely to shifter at clinics than hospitals, consistent with the view that smaller hospitals has more scope for physician's discretion. Also if some of the births shifts reflect the pure manipulation of reported birth date, it may be easier to manipulate in clinics than hospitals, where there are more stuffs, and thus more difficult to coordinate.

child cares may give incentives to time births earlier than school-cut off dates to avoid the additional one year of child care cost. In fact, Panel B in Table 4 shows that while roughly 20 % of births are shifted forward for those with high and medium skilled jobs, the mothers with low skilled jobs (or low income) shifts birth forward by roughly 18 percent of births within 7 days of school cut-off date, probably reflecting the fact that the low income mothers may not be able to afford for the additional child care cost, and thus prefer to give birth *before* the cut-off date.

Appendix Figure A3 shows the same graphs as Figure 5A and Figure 5B in the main text, by the different period.[20] Panel B in Appendix Figure A3 shows that the reversal of the patterns among mothers with low skilled jobs became obvious in late 1990s, and it gets much more accelerated in the most recent year of 2005. While speculative, this result may be the result of the fact the wage disparity became more severe in Japan in later period.

4.4 Child outcomes[21]

Since I observe the gradual decline before April 2, it seems unlikely that manipulation of reported birth date account for all the differences. Here I show further evidence against pure manipulation story by examining the birth weight, and gestational length of mothers. Birth weight is of particular importance as there is evidence that health at birth has consequences for medium and long-term outcomes of children (e.g. Black et al., 2007; Oreopoulos et al., 2008; Royer, 2009; Johnson and Schoeni, 2011). I am aware of only two previous papers by Gans and Leigh (2009) and Tamm (2012) analyzing the impact of cut-off induced birth timing on health of newborns.

Figure 7A plot the mean birth weight around April 2.[22] The graph clearly shows that birth after the school cut-off dates are heavier than those before April 2. Figure 7B plot the probability of birth more than 4000 grams, and show similar patterns as mean birth weight.[23] Table 5 presents the results of estimating equation (3) using the individual birth as a unit of observation. Panel A in Table 5 shows that birth weight is roughly 2-5 gram heavier for those born after school cut-off date. Panel B shows that birth after school cut-off date is *** percent more likely to be over 4000 grams.

Figure 7A plot the mean birth weight around April 2.[24] The graph clearly shows that birth

[20] Here I combine the medium and high skilled jobs into one category since they shows very similar trend.

[21] I am also currently collecting the health insurance claim data which report the delivery method of birth. Planned C-sections and inducement of births may increase after the school cut-off date.

[22] The birth weight is collected with 100 grams interval till 1995 in Japan, and therefore I stick with this measure and divide the birth weight collected in grams after 1995 by 100.

[23] While most of the literature on birth weight focuses on low birth weight, some studies also focus on high birth weight and sometimes also on length at birth. For example, The et al. (2010) find that babies with more than 4,000 g are more likely to become obese in adolescence and Pietilainen et al. (2001) show that height in adolescence is related to length and weight at birth.

[24] The birth weight is collected with 100 grams interval till 1995 in Japan, and therefore I stick with

after the school cut-off dates are heavier than those before April 2. Figure 7B plot the probability of birth more than 4000 grams, and show similar patterns as mean birth weight. Table 5 presents the results of estimating equation (3) using the individual birth as a unit of observation. Panel A in Table 5 shows that birth weight is roughly 2-5 gram heavier for those born after school cut-off date. Panel B shows that birth after school cut-off date is 0.05 percent more likely to be over 4000 grams. Figure 7C instead plots the probability of birth delivered after more than 42 weeks of gestation. The figures show the same patterns as birth weight.

After having shown that there were sizeable shifts in deliveries, I now analyze health outcomes. One the one hand, if the surge in the number of births right after the school cut-off date creates the congestion or overcrowding in hospitals, it could potentially harm the health of newborns. On the other hand, it may not affect the infant health since hospitals can anticipate such a surge, and thus they are well prepared. Consistent with the latter view, Figure 7D plots the infant mortality rate around April 2 does not indicate that there is a change in infant mortality. Panel D in Table 5 confirms that births born right after the school cut-off date do not show the excess infant mortality.

5. Discussion

This paper so far shows that school entrance cut-off dates affect the timing of births. Since birth shifts gradually from a week before the cut-off date, and also birth weight as well as gestation of mothers increase after the school cut-off date, the pure manipulation cannot fully account for this shift.

The results have implication for the growing literature that relies on the identification strategy that assumes that births around the school entrance cut-off dates are random. A seminal paper by Angrist and Krueger (1991) showed that individuals born in the 1st quarter of the year have lower education attainment than individuals born in the 4th quarter of the previous year. Such difference was arguably due to the interaction of compulsory schooling laws with school entry laws, which makes individuals born in the first quarter more likely to start school later and therefore more likely to quit formal education before completing a high school degree. Since then quarter of birth is used as instrument for education in many papers. Recent papers use more precise data on the day of the births, and use the day of birth combined with the compulsory school law to instrument for education. [25]

In fact, Bedard and Dhuey (2006) show that using Trends in International Mathematics and Science Study (TIMSS) data among OECD countries *including* Japan the youngest

this measure and divide the birth weight collected in grams after 1995 by 100.

[25] For example, see Bedard and Dhuey (2006), Cascio and Schanzenbach (2007), Dobkin and Ferreira (2007), and Elder and Lubotsky (2009), McCrary and Royer (2011), Black, Devereux, and Salvanes (2011).

members of fourth and eighth grade classes have standardized test scores that are 2–12 percentiles lower than the oldest students in the same cohort. Similarly, Kawaguchi (2010) uses TIMSS 2003, and lead to similar conclusion.[26] However, both use the month of births instead of day of birth as their running variable, which could potentially mask the change in characteristics of child and mothers around the school cut-off date.

However the underlying assumption for this instrument to be valid is that the birth at different quarters or neighborhood of school cut-off dates are random. Indeed, recent studies question the validity of such assumption. Notably, the recent paper by Buckles and Hungerman (forthcoming) shows that birth date may not be random.[27] But no paper has showed that birth around the school entrance cut-off dates is not random.

In ongoing work, I examine whether relative age effects in Japan shown by Bedard and Dhuey (2006) and Kawaguchi (2010) which relies on the month of birth variation instead using the exact date of birth information is still valid if I examine the data at the day of birth level and also controlling for the characteristics of mothers and children. Since I see the mother's characteristics as well as child characteristics discreetly changes around the school cut-off date, I will also examine whether the estimates are robust to controlling for mother's observable characteristics. If the estimate differs significantly among those controls and without controls, this study may caution against assuming the birth around the school entrance cut-off is random in a regression discontinuity design. I use the publically available TIMSS data, which report both exact date of births, and test scores for 4^{th} and 8^{th} grade. This is the same dataset used in Bedard and Dhuey (2006) for 1995, and 1999 and Kawaguchi (2010) for 2003.

6. Conclusion

Many countries require children to reach a certain age by a specified date in the calendar year in order to start primary school. There is a clear tradeoff for parents to time a birth either before or after the school cut-off date; births just *before* cut-off date benefit parents by avoiding a year of child care costs through sending their children to school at a relatively young age, while births just *after* cut-off date may benefit children from being in the oldest among the school cohort, which is shown to provide the children with academic advantage (relative age effects).

Using the universe of birth during 1974-2010 in Japan with single school cut-off date of April 2, I find that more than 1500 births are shifted roughly a week before the cut-off date.

[26] These papers cannot distinguish whether the cause of this academic disadvantage for young kids is due to their relative age to peers or due to their absolute age at which they are exposed to a material for the first time. See also Carlsson et al. (2012) that address this issue. See also Stipek (2002) for a review of this debate.

[27] Research documenting the nonrandomness of birthdate in other settings includes Buckles and Hungerman (forthcoming), Bound and Jaeger (2000), Dobkin and Ferreira (2010), Cascio and Lewis (2006), and Carlsson et al. (2012).

This finding suggests that relative age effects may dominate at least in Japanese setting. This is the first paper that documents that school entrance cut-off date affects the timing of births.

The question still remains as to why I find the shifts of birth in response to school cut-off date in Japan, while other attempts in US, Chile and Argentine do not find such behavioral response of mothers. Even though speculative, the strict enforcement of entry age in Japan, and social promotion education system without delays, and advancement, suggest that the stake of birth timing is very crucial consideration since it determines when the child start schools later in their life. Investigating this question in detail using other source of data that include information that influences the incentive structure, for example, wages of mothers, availability of the child care center, is the scope for the future research.

References

Angrist, J. D., & Krueger, A. B. (1991). "Does compulsory school attendance affect schooling and earnings?," Quarterly Journal of Economics, 106(4), 979–1014.

Angrist, J. D., & Krueger, A. B. (1992). The effect of age at school entry on education attainment: An application of instrumental variables with moments from two sample. Journal of the American Statistical Association, 87(418), 328–336.

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.

Berlinski, Samuel, and Galiani, Sebastian. (2007) "The effect of a large expansion of pre-primary school facilities on preschool attendance and maternal employment," *Labour Economics*, 14(3): 665–680.

Black, Sandra, Paul J. Devereux, and Kjell G. Salvanes. (2007). 'From the cradle to the labor market? The effect of birth weight on adult outcomes', Quarterly Journal of Economics, Vol. 122, pp. 409–439.

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

Bound, John; David A. Jaeger; and Regina Baker. (1995) "Problems with Instrumental Variables Estimation when the Correlation Between the Instruments and the Endogenous Explanatory Variables is Weak." *Journal of the American Statistical Association*, 90(430): 443-450.

Bound, J., and D. A. Jaeger (2000): "Do Compulsory School Attendance Laws Alone Explain the Association between Quarter of Birth and Earnings?," Research in Labor Economics, 19, 83 – 108.

Buckles, Kasy and Daniel M. Hungerman. (forthcoming) "Season of Birth and Later Outcomes: Old Questions, New Answers," *Review of Economics and Statistics*, forthcoming.

Carlsson, Magnus, Gordon B. Dahl, Björn Öckert, and Dan-Olof Rooth. (2012) "The Effect of Schooling on Cognitive Skills," *NBER Working Paper* No. 18484.

Cascio, Elizabeth. (2009) "Maternal labor supply and the introduction of kindergartens into American public schools," *Journal of Human Resources*

Cascio, E., and D. Schanzenbach. (2012) "First in the Class? Age and the Education Production Function," Discussion Paper, NBER working paper No. 13663

Chandra, A., Baker, L., Dickert-Conlin, S., and Goodman, D. C. (2004). Holidays and the timing of births in the United States, Mimeo.

Datar, Ashlesha. (2006) "Does Delaying Kindergarten Entrance Give Children a Head Start?" Economics of Education Review, 15: 43–62.

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

Dickert-Conlin, Stacy and Todd 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.

Dustmann, Christian, and Uta Schönberg. (2012) "Expansions in Maternity Leave Coverage and Children's Long-Term Outcomes," *American Economic Journal: Applied Economics*, 4(3): 190-224.

Elder, T., and D. Lubotsky. (2009) "Kindergarten Entrance Age and Children's Achievement," Journal of Human Resources, 44(3): 641–683.

Gans, Joshua S. and Andrew Leigh. (2009) "Born on the First of July: An (Un)natural Experiment in Birth Timing," *Journal of Public Economics*, 93 (1-2): 246-263.

Gelbach, J. (2002) "Public schooling for young children and maternal labor supply," *American Economic Review*, 92: 307–322

Imbens, Guido W., and Thomas Lemieux. (2008). Regression discontinuity designs: A guide to practice. Journal of Econometrics, 142, 615–635.

Johnson, R. and Schoeni, R. (2011). 'The influence of early-life events on human capital, health status, and labor market outcomes over the life course', The B.E. Journal of Economic Analysis & Policy, Vol.11 (Advances), Article 3, pp. 1–55.

Kawaguchi, Daiji. (2011) "Actual age at school entry, educational outcomes, and earnings," *Journal of Japanese International Economies*, 25(2): 64–80.

Kureishi, Wataru and Midori Wakabayashi. (2008) "Taxing the Stork," *National Tax Journal*, 61 (2): 167-187.

Lalive, R. and Zweimuller, J. (2009) "How does parental leave affect fertility and return to work? Evidence from two natural experiments," *Quarterly Journal of Economics*, 124: 1363–1402.

LaLumia, Sarah, James M. Sallee and Nicholas Turner. (2012) "New Evidence on Taxes and the Timing of Birth," *Mimeo*.

Lee, David. S. (2008). Randomized experiments from non-random selection in U.S. house elections. Journal of Econometrics, 142, 675–697.

Lee, David. S., and Card, David. (2008). "Regression discontinuity inference with specification error. Journal of Econometrics, 142(2), 655–674.

Lee, David. S., and Lemieux, Thomas. (2010). Regression discontinuity designs in economics. Journal of Economic Literature, 48: 281-355.

Maghakian, Teny and Lisa Schulkind. (2011) "What a Difference a Day Makes: A New Look at Child Tax Benefits and the Timing of Births," *Mimeo*.

McCrary, Justin. (2008) .Manipulation of the Running Variable in the Regression

Discontinuity Design: A Density Test, Journal of Econometrics, 142: 698.714.

McCrary, Justin, and Heather Royer. (2011) "The Effect of Female Education on Fertility and Infant Health: Evidence from School Entry Policies Using Exact Date of Birth," *American Economic Review*, 101(1): 158-195.

Oreopoulos, P., Stabile, M.,Walld, R. and Roos, L. (2008). 'Short-, medium-, and long-term consequences of poor infant health – a

Pietilainen, K., Kaprio, J., R¨as¨anen, M.,Winter, T., Rissanen, A. and Rose, R. (2001). 'Tracking of body size from birth to late adolescence: contributions of birth length, birth weight, duration of gestation, parents' body Size, and twinship', American Journal of Epidemiology, Vol. 154, pp. 21–29..

Royer, Heather. (2009). 'Separated by girth': US twin estimates of the effect of birth weight, American Economic: Journal Applied Economics, Vol. 1, pp. 49–85.

Schlosser, Analía (2011) "Public Preschool and the Labor Supply of Arab Mothers: Evidence from a Natural Experiment", *Mimeo*

Shigeoka, Hitoshi and Kiyohide Fushimi (2012) "Supply-Induced Demand in Newborn Treatment: Evidence from Japan," *Mimeo*

Tamm, Marcus. (2012) "The Impact of a Large Parental Leave Benefit Reform on the Timing of Birth around the Day of Implementation," *Oxford Bulletin of Economics and Statistics*.

Urquiola, Miguel and Verhoogen, Eric. (2009) "Class-size caps, sorting, and the regression discontinuity design," American Economic Review, 99: 179–215.

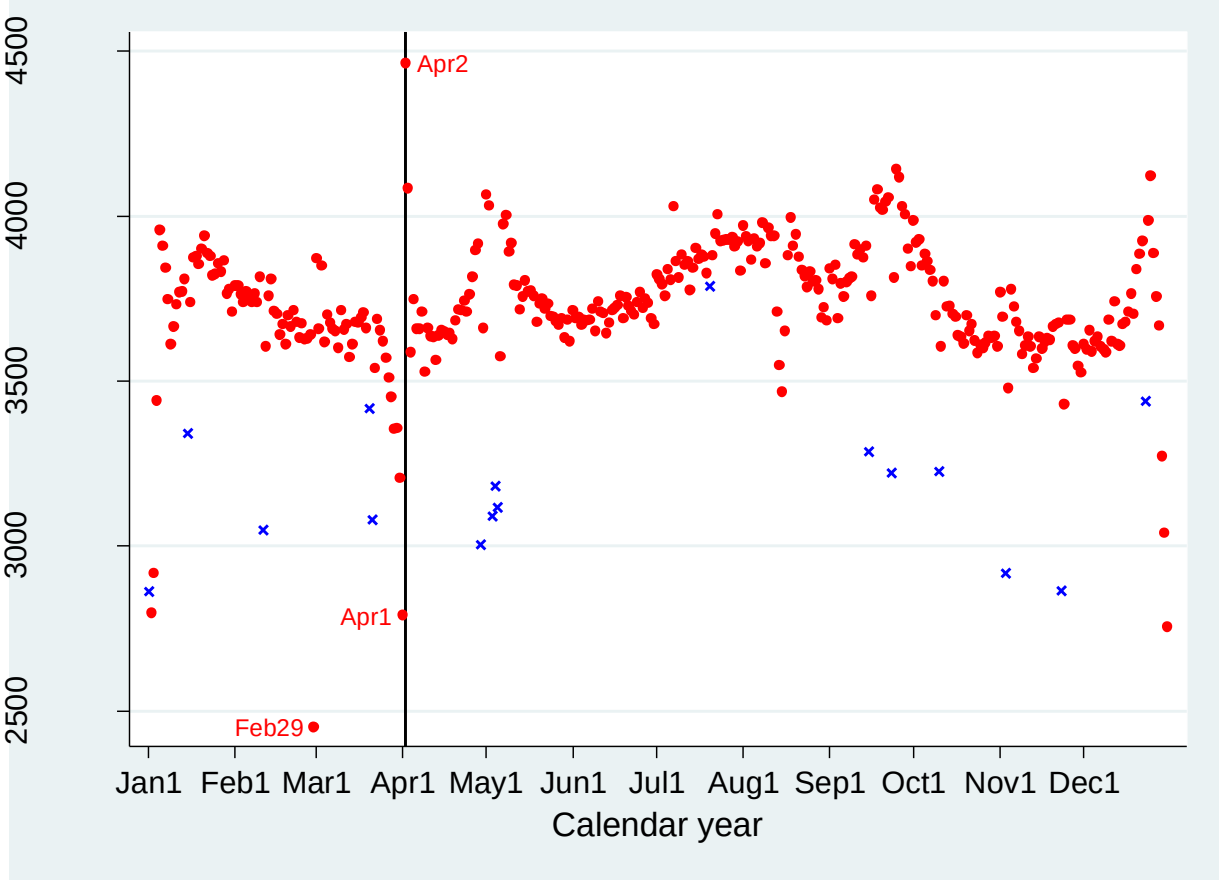
Sen, Amartya. (1992) "Missing Women." *British Medical Journal*, 304: 587–88.

Sen, Amartya. (1990) *More than 100 Million Women are Missing*. New York Review of Books, 37(20): 61–66. http://ucatlas.ucsc.edu/gender/Sen100M.html

Stipek, D. (2002). At what age should children enter kindergarten? A question for policy makers and parents. *Social Policy Report*, 16(2).

The, N., Adair, L. and Gordon-Larsen, P. (2010). 'A study of the birth weight-obesity relation using a longitudinal cohort and sibling and twin pairs', American Journal of Epidemiology, Vol. 172, pp. 549–557.

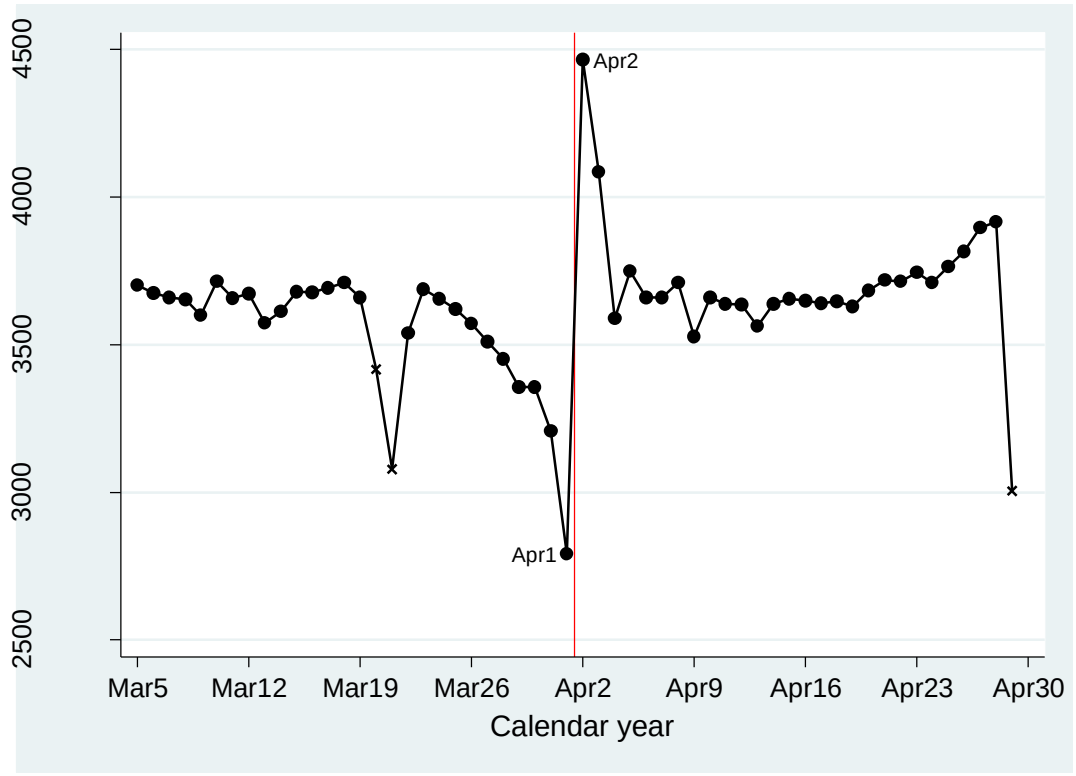
Fig.1 Mean daily number of births through the year



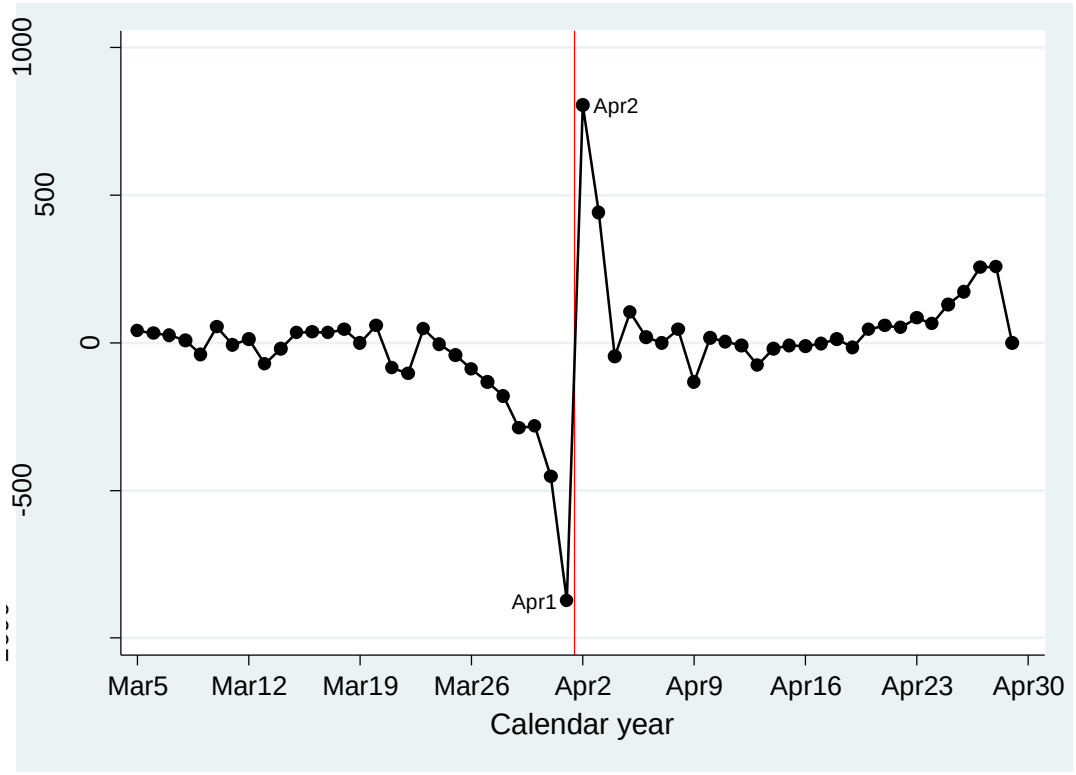
Note: The vertical line corresponds Aprils 2, which is the school cut-off day in Japan. The data come from 1974-2010 pooled birth data. The markers with cross sign in Panel A are holidays (see text for all the holidays in Japan).

Fig.2 Mean daily number of births around April 2

A. Raw



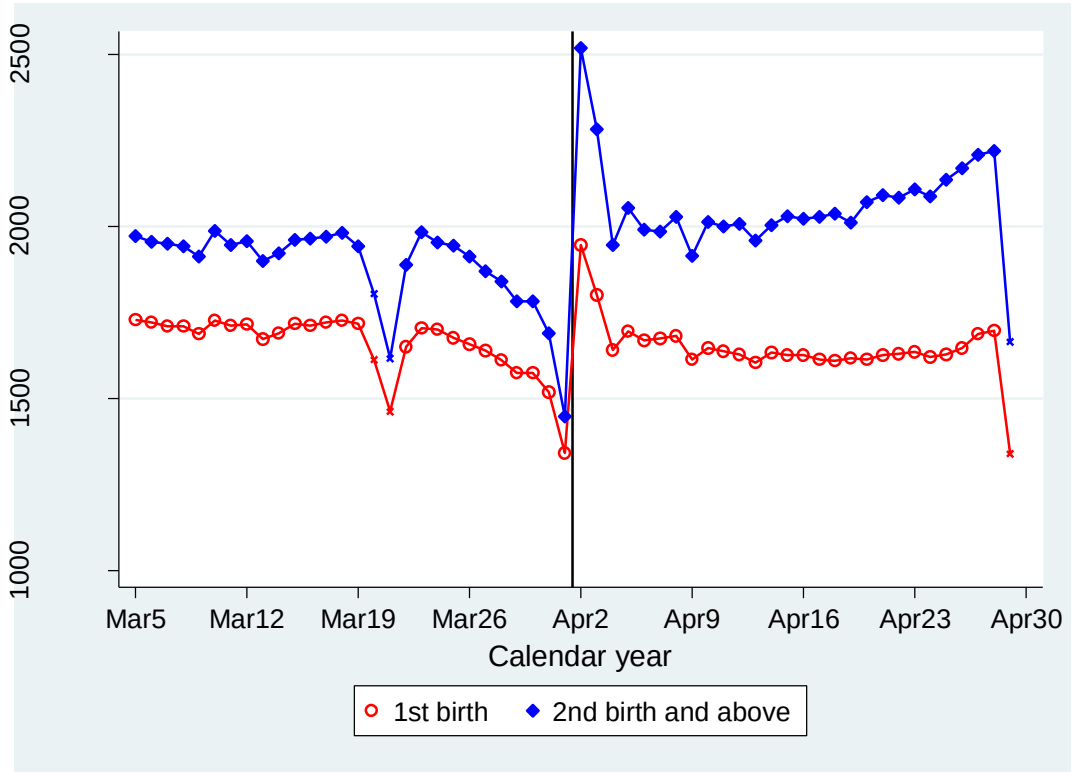
B. Adjusted



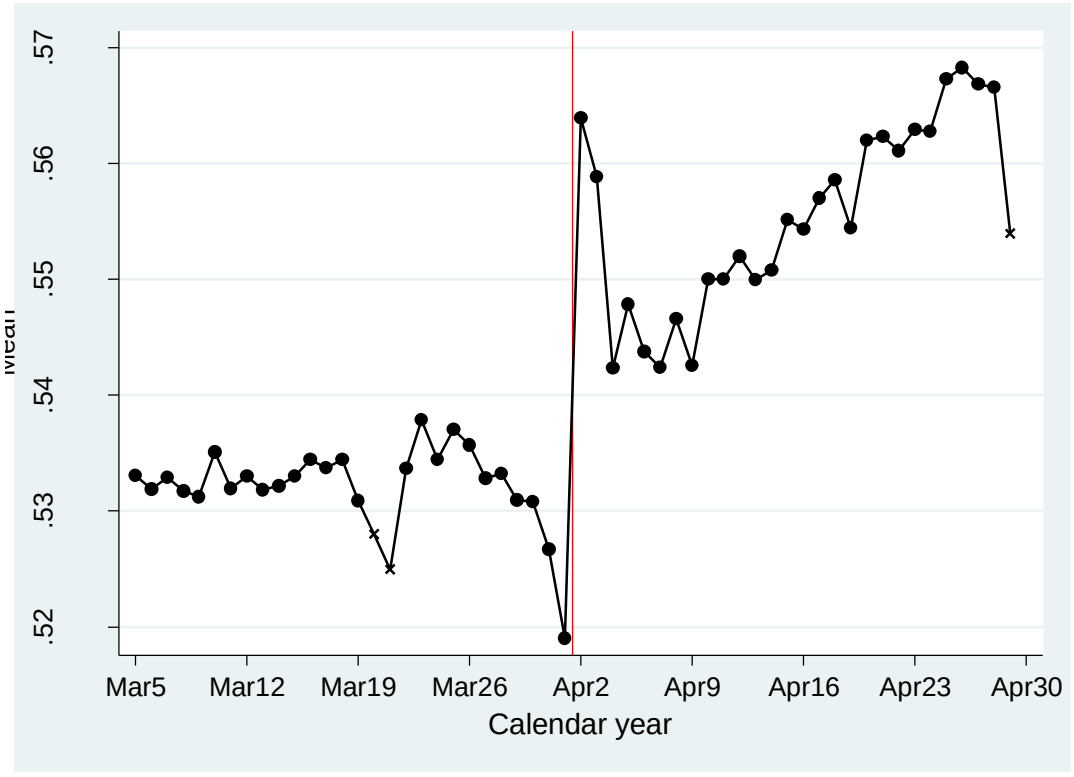
Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the mean daily number of birth. The markers with cross sign in Panel A are holidays (either March 20 or March 21 depending on the year, and April 29). Panel B adjusts for holidays, year and day of week fixed effects.

Fig. 3 Heterogeneous responses: Parity

A. Number of births by parity



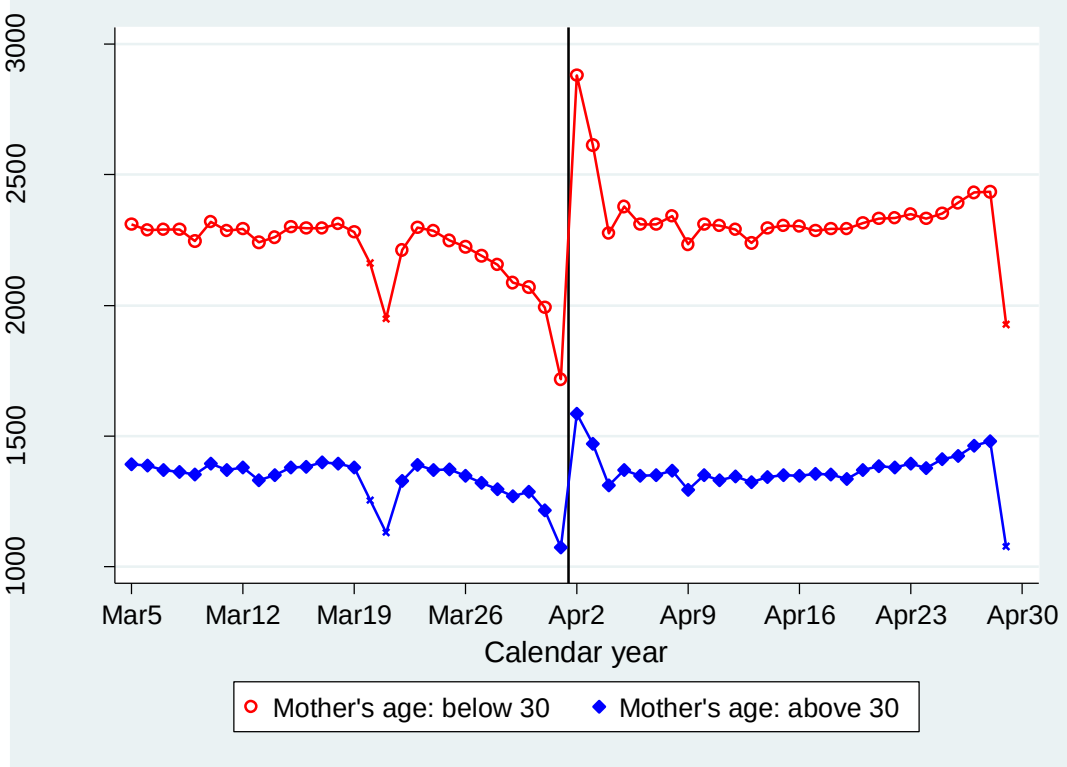
B. Ratio of 2nd+ births among all births



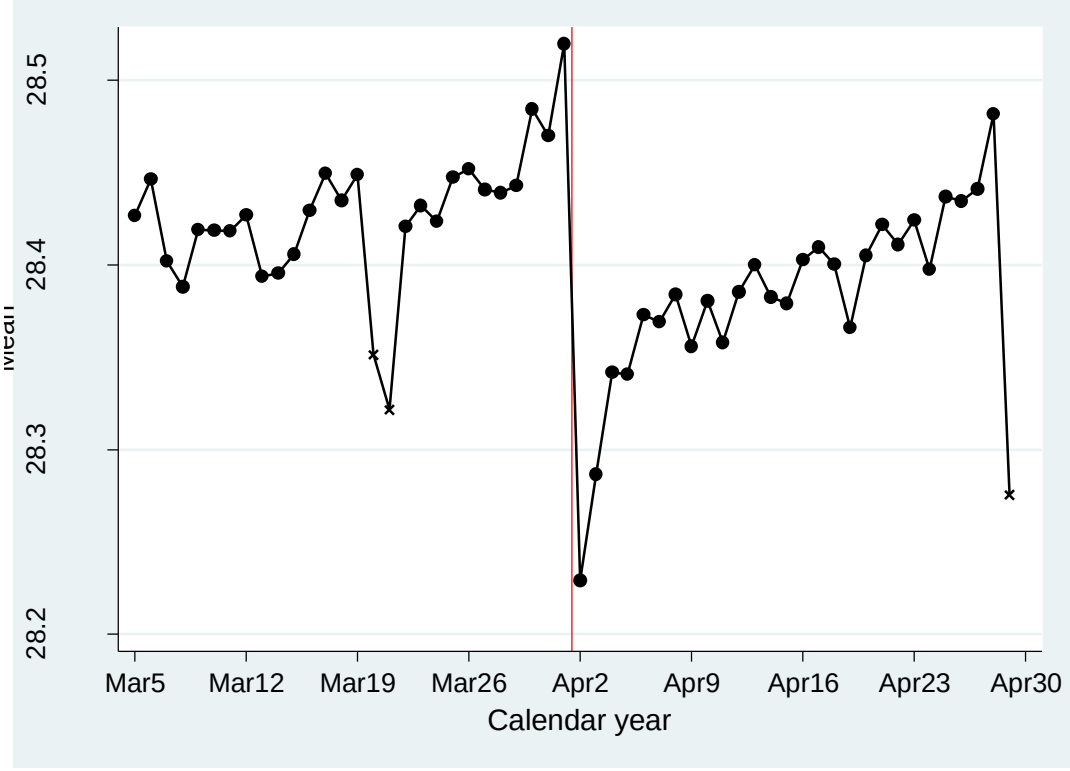
Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the number of births in each day.

Fig. 4 Heterogeneous responses: Mother's age

A. Number of births by mother's age



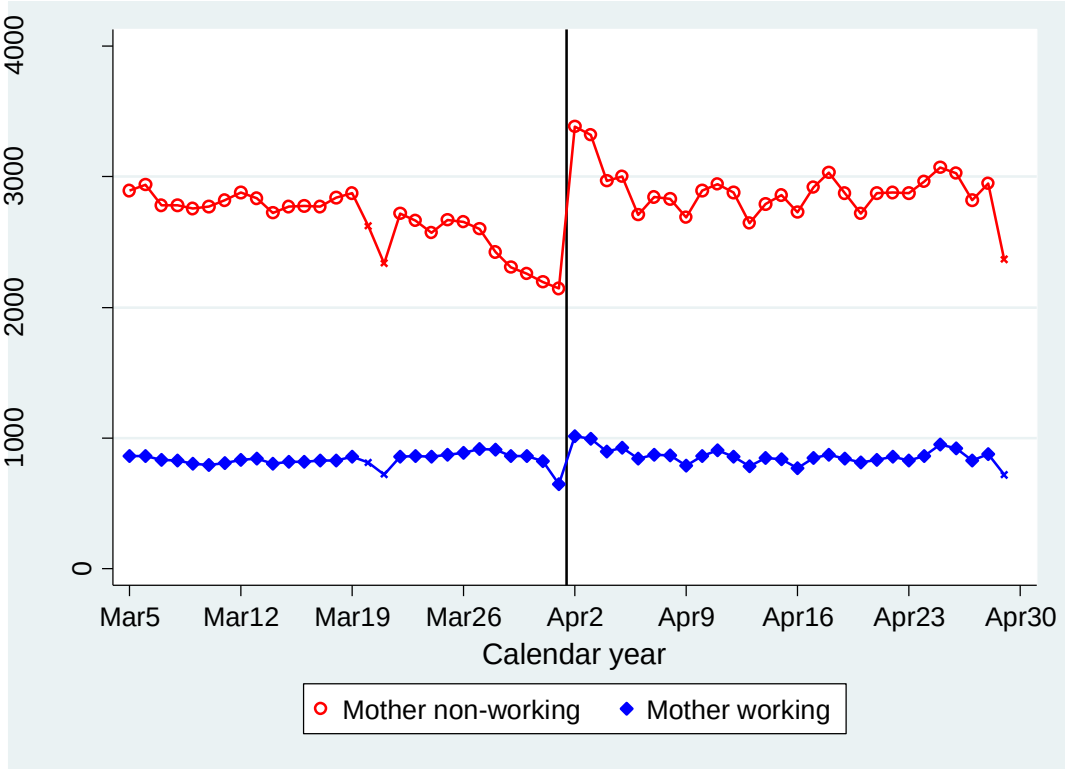
B. Mother's age



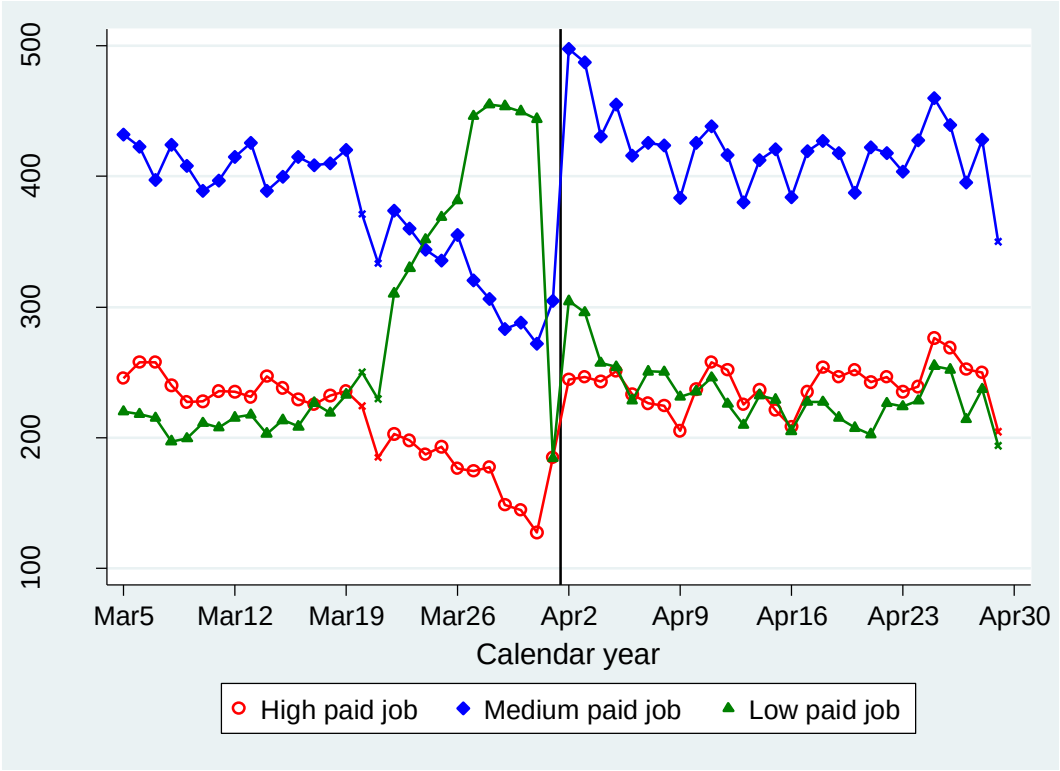
Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the number of births in each day.

Fig. 5 Heterogeneous responses: Mother's working status

A. Working vs Non-working mothers



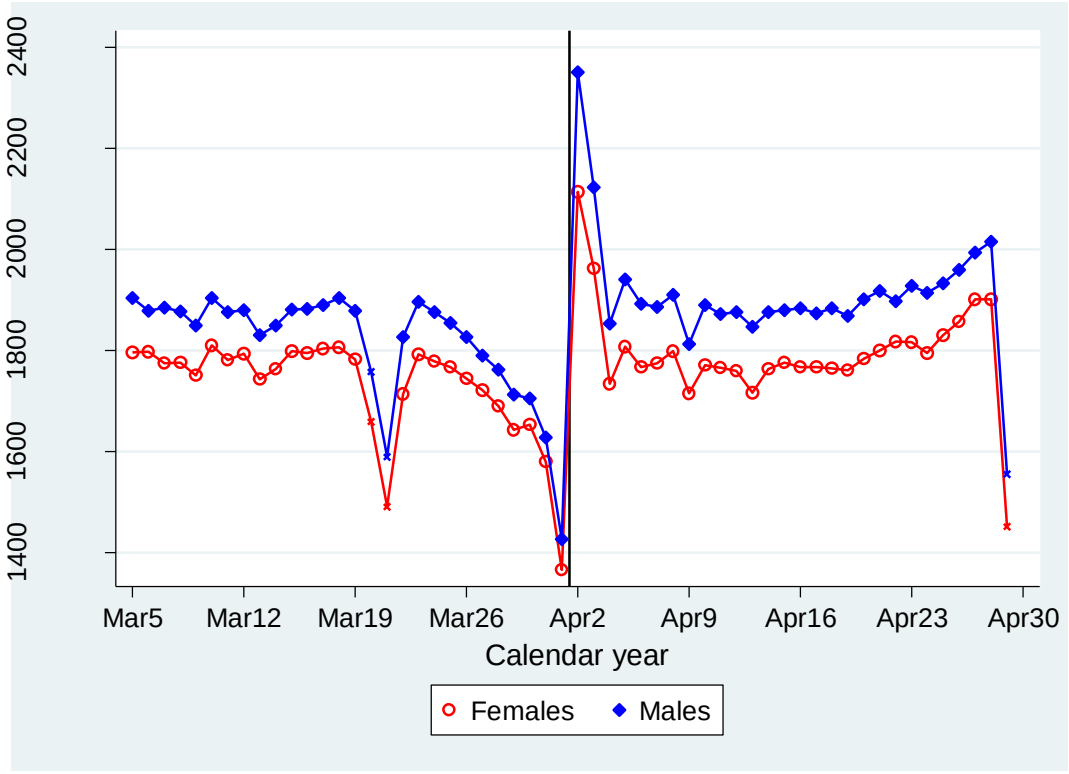
B. Among working mothers: Type of jobs



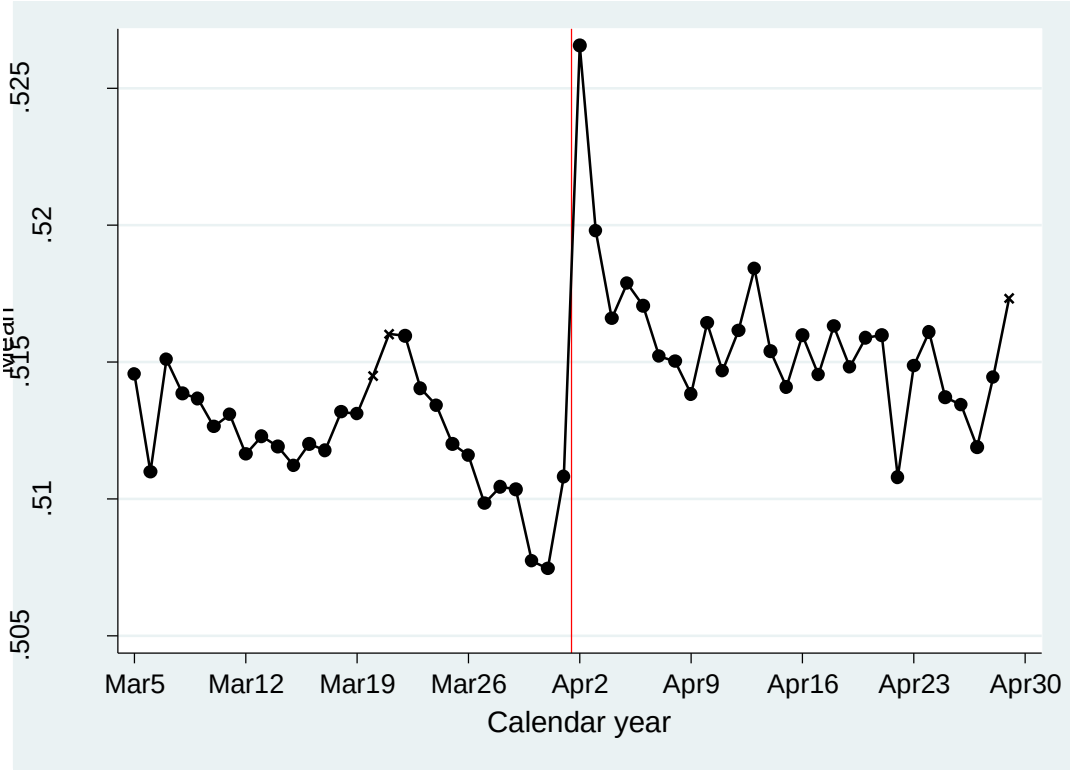
Note: The data come from 1975, 1980, 1985, 1990, 1995, 2000, and 2005 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the number of births in each day.

Fig.6 Heterogeneous responses: Gender

A. Number of births by gender



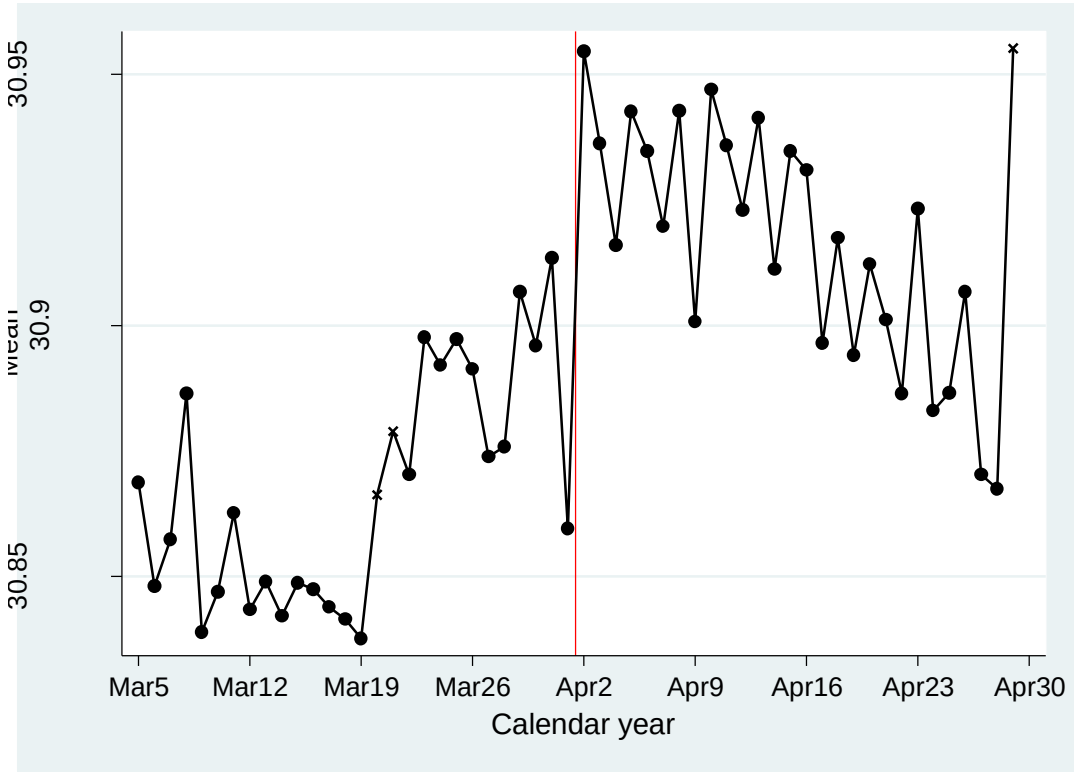
B. Ratio of male/female births



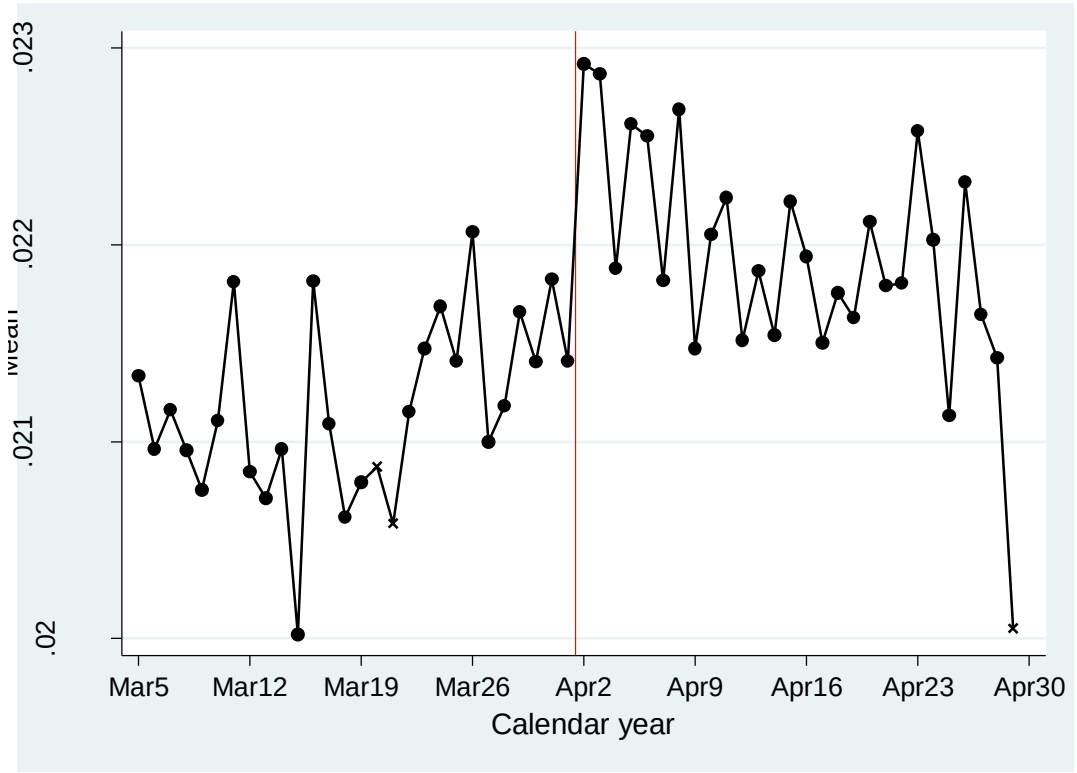
Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the mean daily number of birth. The markers with cross sign in Panel A are holidays (either March 20 or March 21 depending on the year, and April 29).

Fig. 7 Birth weight and gestational length

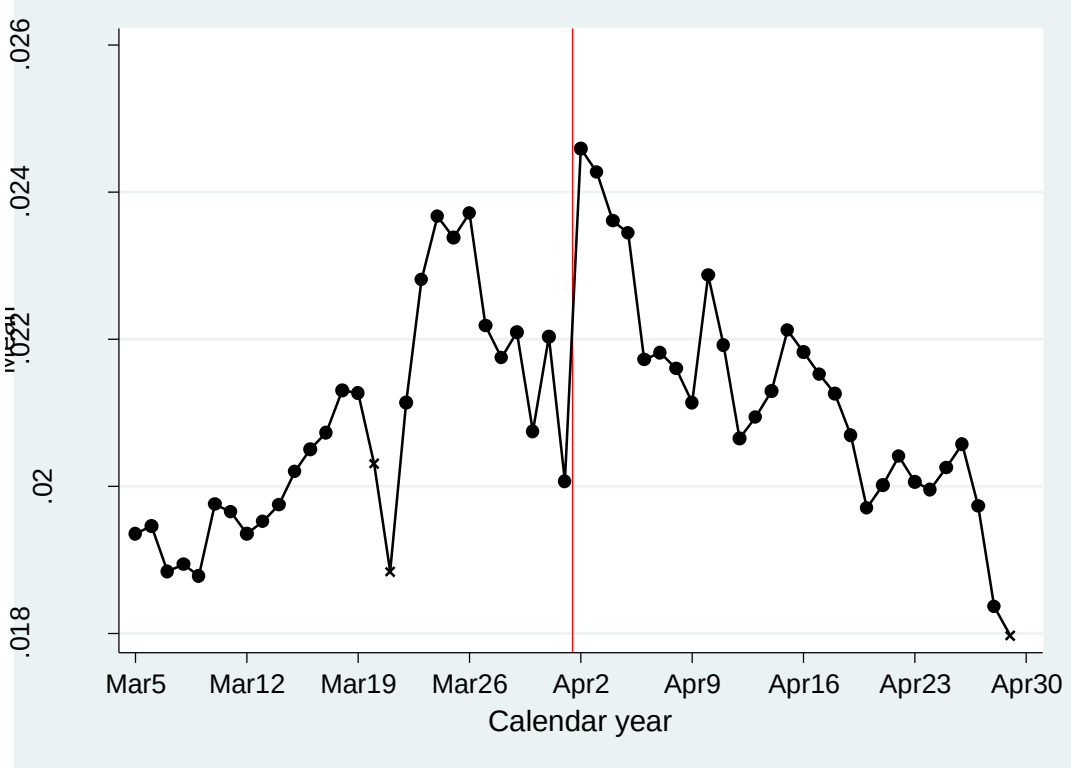
A. Mean Birth weight (100 grams)



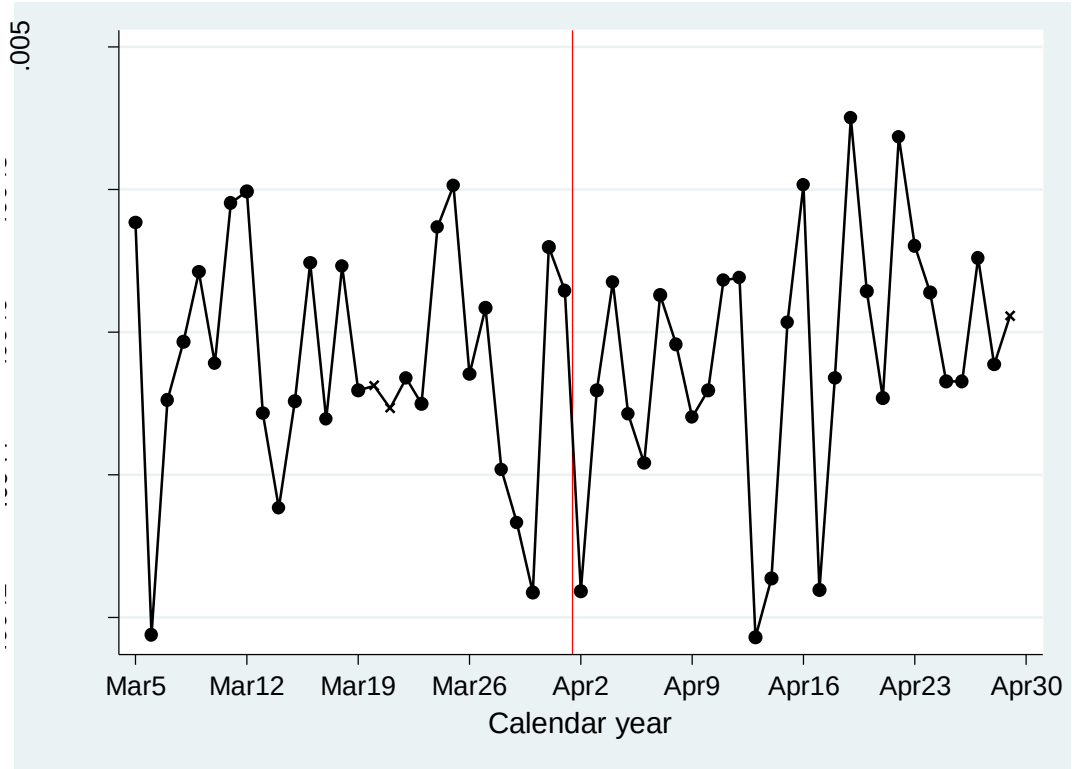
B. Ratio of above 4000 grams



C. Mean gestational length (weeks)



D. Infant mortality



Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the number of births in each day.

Table 1: Top 5 and bottom 5 of mean daily birth within a year

	Date	Mean daily births	Ratio to average daily birth
Top 5			
	April 2	**4,465**	**1.20**
	Sep 25	4,143	1.12
	Dec 25	4,122	1.11
	Sep 26	4,119	1.11
	April 3	**4,085**	**1.10**
Bottom 5			
	Feb 29	2,452	0.66
	Dec 31	2,757	0.74
	April 1	**2,791**	**0.75**
	Jan 2	2,798	0.75
	Jan 1	2,862	0.77

Notes: The ratio to the average is daily births divided by the mean daily births. Therefor a value of 1.1 represents a 10 percent increase in the daily births compared to the average in the year. Mean daily births during 1974-2010 are 3,711. Solid ones are within a week from April 2nd.

Table 2: Shift of Births in Days

	(1)	(2)	(3)	(4)
Windows	±7 days	±14 days	±21 days	±28 days
Panel A: Number of births				
After	524.2***	268.6***	178.9***	166.2***
	(55.1)	(30.0)	(20.4)	(16.5)
Number of births moved	*1,835*	*1,880*	*1,879*	*2,327*
N	518	1,036	1,554	2,072
R2	0.83	0.86	0.89	0.90
Panel B:ln(number of births)				
After	0.136***	0.070***	0.047***	0.043***
	(0.009)	(0.005)	(0.004)	(0.003)
Share of births moved	*7.0%*	*3.6%*	*2.4%*	*2.2%*
N	518	1,036	1,554	2,072
R2	0.86	0.88	0.90	0.91

Notes: Standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01 significant at 1%. Sample is daily births within the relevant window from 1974–2010. All specifications include public holiday, and year*day of week fixed effects. Window denotes the number of days before and after the April 2. For example, the ±7 day window covers the seven days prior to April 2, and the first seven days after April 2. Number of births moved is $W\beta/2$, where W is the number of days in the window. Share of births moved is $\exp(\beta/2)-1$.

Table 3: Heterogeneous response

			(1)	(2)	(3)	(4)
		Mean	±7 days	±14 days	±21days	±28 days
A. Parity						
1st child	After	1,645	0.1008***	0.0364*	0.007	-0.003
			(0.024)	(0.022)	(0.016)	(0.012)
	R2		0.952	0.889	0.890	0.895
	Share of births moved		*5.2%*	*1.8%*	*0.4%*	*-0.2%*
2nd child or above	After	1,938	0.1643***	0.0971***	0.0780***	0.0779***
			(0.033)	(0.028)	(0.020)	(0.015)
	R2		0.951	0.916	0.925	0.929
	Share of births moved		*8.6%*	*5.0%*	*4.0%*	*4.0%*
B. Mother's age						
Less than 30	After	2,253	0.1512***	0.0843***	0.0595***	0.0533***
			(0.029)	(0.025)	(0.018)	(0.013)
	R2		0.982	0.967	0.971	0.974
	Share of births moved		*7.9%*	*4.3%*	*3.0%*	*2.7%*
Above 30	After	1,330	0.1091***	0.0482**	0.0282*	0.0272**
			(0.028)	(0.024)	(0.017)	(0.013)
	R2		0.945	0.893	0.902	0.906
	Share of births moved		*5.6%*	*2.4%*	*1.4%*	*1.4%*
C. Gender						
Male	After	1,843	0.1534***	0.0813***	0.0560***	0.0495***
			(0.029)	(0.027)	(0.019)	(0.014)
	R2		0.952	0.899	0.909	0.917
	Share of births moved		*8.0%*	*4.1%*	*2.8%*	*2.5%*
Female	After	1,740	0.1179***	0.0588**	0.0373**	0.0348***
			(0.029)	(0.024)	(0.017)	(0.013)
	R2		0.948	0.909	0.918	0.923
	Share of births moved		6.1%	3.0%	1.9%	1.8%
	N		518	1,036	1,554	2,072

Notes: Standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01 significant at 1%. Sample is daily births within the relevant window from 1974–2010. All specifications include public holiday, and year*day of week fixed effects. Window denotes the number of days before and after the April 2. For example, the ±7 day window covers the seven days prior to April 2, and the first seven days after April 2. Share of births moved is $\exp(\beta/2)-1$.

Table 4: Heterogeneous response: Mother's working status

			(1)	(2)	(3)	(4)
		Mean	±7 days	±14 days	±21days	±28 days
A. Working status						
Not working	After	2,689	0.2146***	0.1400***	0.0989***	0.0822***
			(0.022)	(0.026)	(0.022)	(0.018)
	R2		0.950	0.909	0.904	0.906
	Share of births moved		*11.3%*	*7.2%*	*5.1%*	*4.2%*
Working	After	880	0.0697*	0.032	0.028	0.0343***
			(0.038)	(0.023)	(0.017)	(0.013)
	R2		0.731	0.714	0.733	0.758
	Share of births moved		3.5%	1.6%	1.4%	1.7%
B. Type of job						
High skilled	After	200	0.3775***	0.2565***	0.1750***	0.1355***
			(0.044)	(0.047)	(0.044)	(0.037)
	R2		0.864	0.670	0.560	0.530
	Share of births moved		*20.8%*	*13.7%*	*9.1%*	*7.0%*
Medium skilled	After	376	0.3741***	0.2576***	0.1697***	0.1329***
			(0.035)	(0.039)	(0.037)	(0.030)
	R2		0.938	0.872	0.836	0.836
	Share of births moved		*20.6%*	*13.7%*	*8.9%*	*6.9%*
Low skilled	After	333	-0.3842***	-0.3438***	-0.2129***	-0.1272**
			(0.104)	(0.065)	(0.074)	(0.061)
	R2		0.637	0.628	0.580	0.599
	Share of births moved		-17.5%	-15.8%	-10.1%	-6.2%
	N		98	196	294	392

Note: The data come from 1975, 1980, 1985, 1990, 1995, 2000, and 2005 pooled birth data.

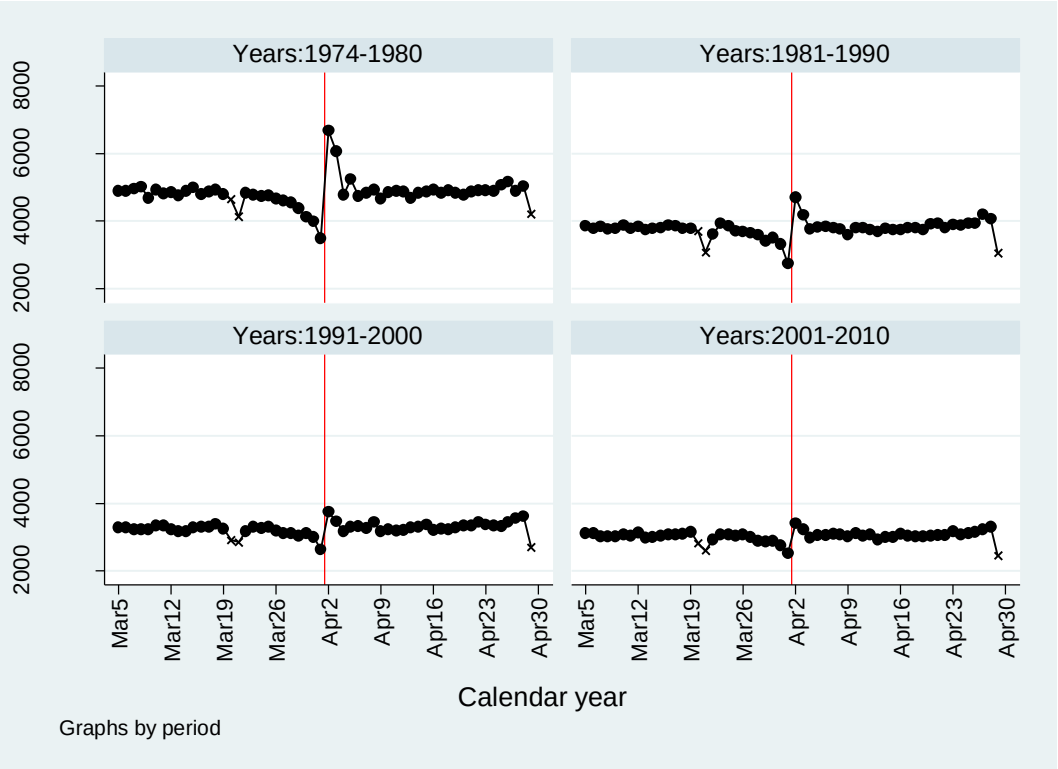
Table 5: Child's characteristics

		(1)	(2)	(3)	(4)
Windows	Mean	±7 days	±14 days	±21 days	±28 days
A: Birth weight (100 g)					
After	30.90	0.023***	0.038***	0.047***	0.045***
		(0.005)	(0.007)	(0.007)	(0.007)
N		1,847,984	3,689,329	5,579,356	7,477,055
R2		0.014	0.014	0.014	0.014
B: Birth weight>4000 g					
After	0.022	0.0005***	0.0006***	0.0007***	0.0007***
		(0.0002)	(0.0001)	(0.0001)	(0.0001)
N		1,847,984	3,689,329	5,579,356	7,477,055
R2		0.004	0.004	0.004	0.004
C: Gestation>42 wks					
After	0.023	0.0007***	0.0001	0.0003**	0.0005***
		(0.0002)	(0.0002)	(0.0002)	(0.0001)
N		1,846,441	3,686,276	5,574,761	7,470,764
R2		0.011	0.010	0.010	0.009
D: Mortality per 1000 births					
After	4.155	-0.090	-0.100	-0.030	-0.010
		(0.090)	(0.060)	(0.050)	(0.050)
N		518	1,036	1,554	2,072
R2		0.883	0.844	0.826	0.817

Notes: Standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01 significant at 1%. Sample is individual birth within the relevant window from 1974–2010. All specifications include public holiday, and year*day of week fixed effects. Window denotes the number of days before and after the April 2. For example, the ±7 day window covers the seven days prior to April 2, and the first seven days after April 2.

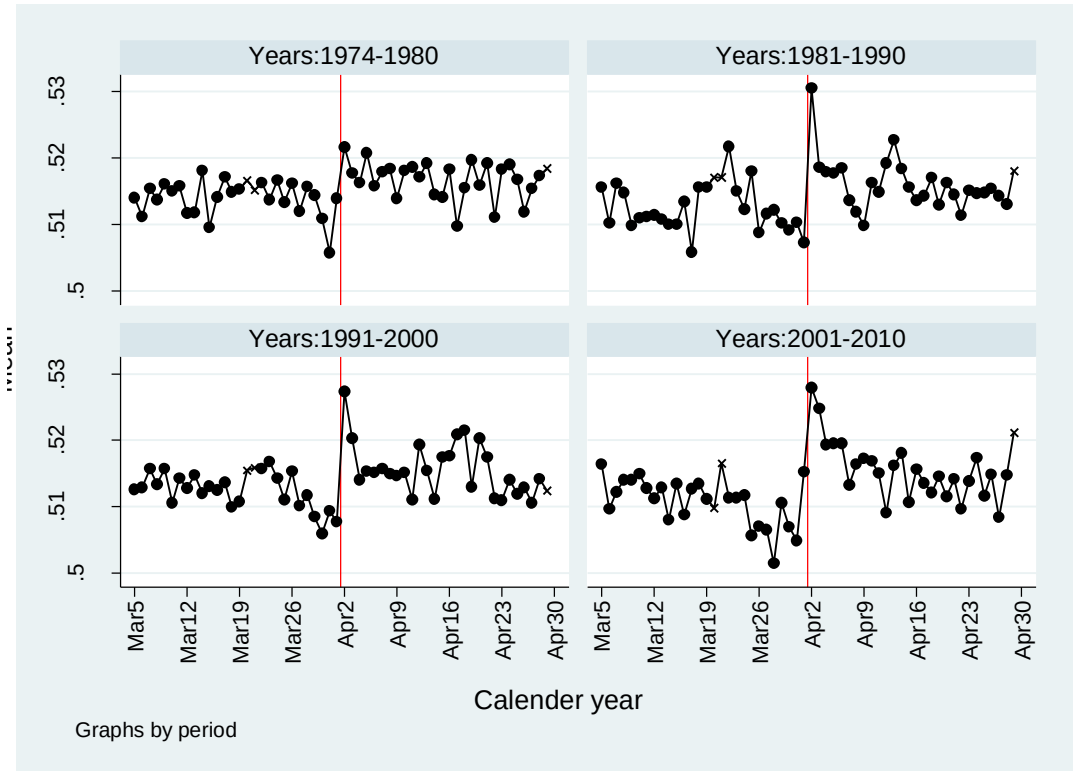
Appendix Figures and Tables

Fig.A1 Mean daily number of births around April 2, by period



Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the number of births in each day.

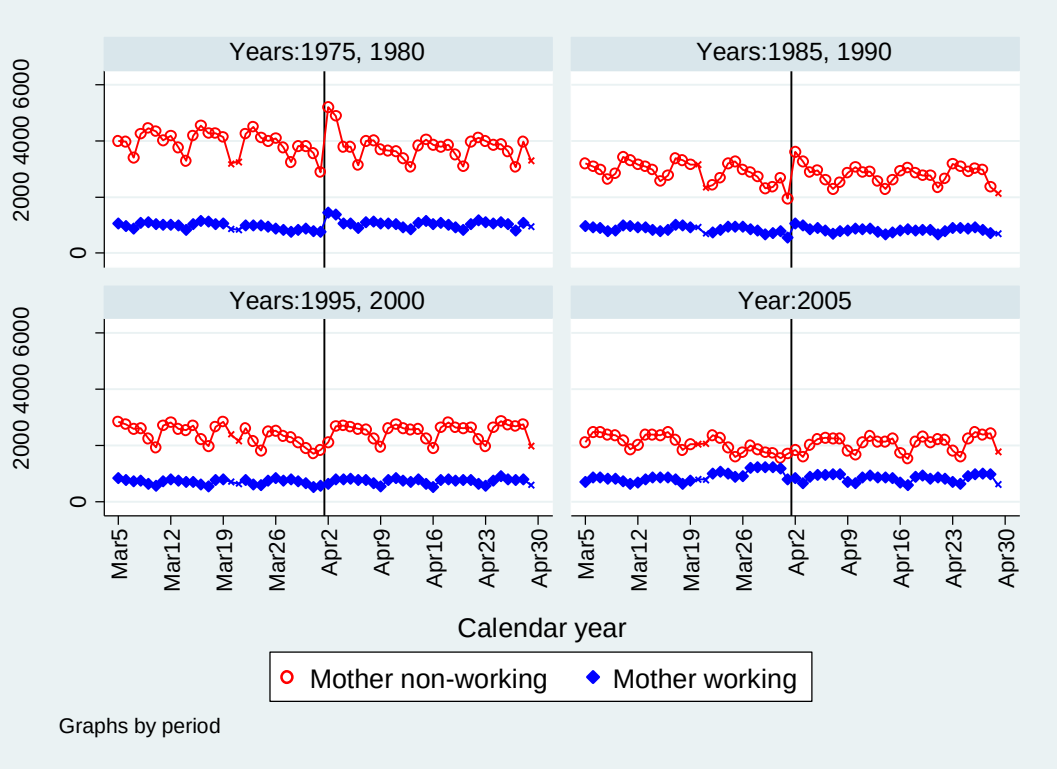
Fig.A2 Ratio of male/female births by period



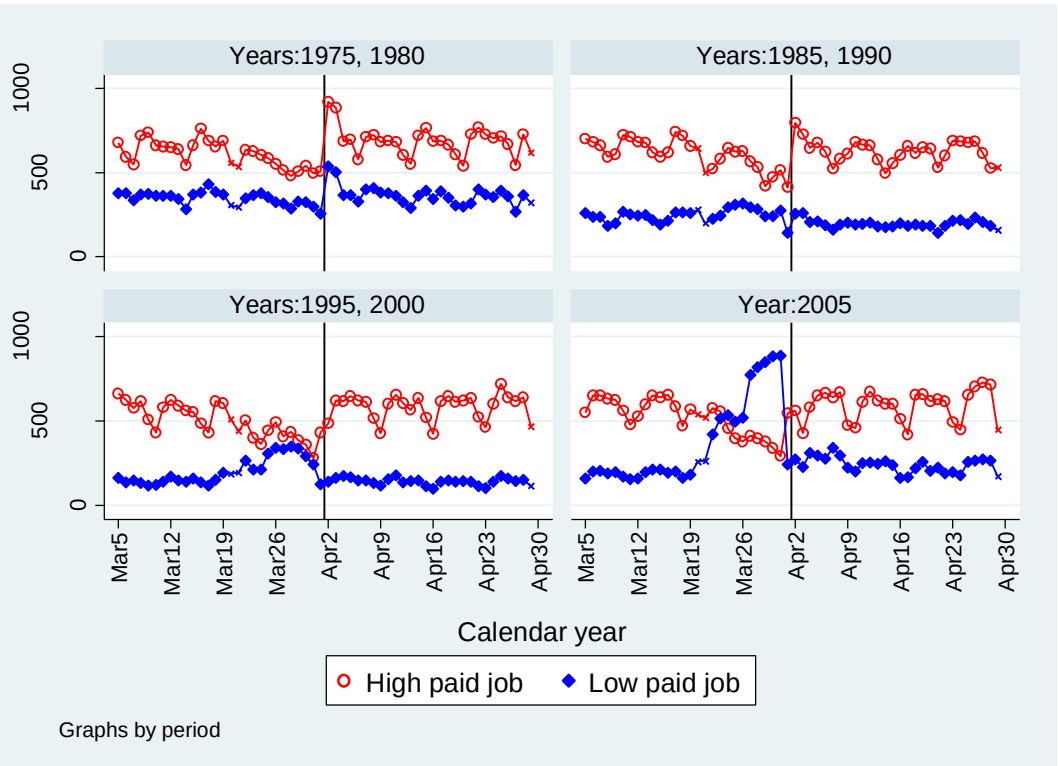
Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the number of births in each day.

Fig. A3Heterogeneous responses: Mother's working status, by period

A. Working vs. Non-working mothers



B. Among working mothers: Type of jobs



Note: The data come from 1974-2010 pooled birth data. The sold vertical line corresponds the Aprils 2, which is the school cut-off day in Japan. Each plot is the number of births in each day.

Table. A1 Type of mother's job

Skill level	Description
High skilled	Managers
	Professionals
Medium skilled	Clerical support workers,
	Service and sales workers
Low skilled	Skilled agricultural, forestry and fishery workers
	Craft and related trades workers
	Plant and machine operators, and assemblers
	Elementary occupations