Auspicious Birth Dates among Chinese in California

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Abstract

The number eight is considered lucky in Chinese culture, e.g. the Beijing Olympics began at 8:08 pm on 8/8/2008. Given the potential for discretion in selecting particular dates of labor induction or scheduled Cesarean section (C-section), we consider whether Chinese-American births in California occur disproportionately on the 8th, 18th, or 28th day of the month. We find 2.3% "too many" Chinese births on these auspicious birth dates, whereas Whites show no corresponding increase. The increase in Chinese births is driven by higher parity C-sections: the number of repeat C-sections is 6% "too high" on auspicious birth dates. Sons born to Chinese parents account for the entire increase; daughter deliveries do not seem to be timed to achieve "lucky" birth dates. We also find avoidance of repeat C-section deliveries on the 4th, 14th, and 24th of the month, considered unlucky in Chinese culture. Finally, we replicate earlier work finding that Friday the 13th delivery dates are avoided and document a particularly large decrease among Chinese. For Whites and Chinese in California, mothers with <u>higher</u> levels of education are particularly likely to avoid delivering on the 13th.

Highlights:

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- Number 8 is considered lucky in Chinese culture.

- In California, "too many" births to Chinese occurring on the 8th, 18th, and 28th of month.

- The increase is driven by male births delivered by cesarean section.

- There is no corresponding increase on the 8th, 18th, and 28th of month for White births.

- Chinese in California may also avoid delivering on the 4th, 14th, and 24th of month.

1. Introduction

Cultural preferences can exert a persistent effect on the fertility decisions of Asian immigrants to the West (Dubuc and Coleman, 2007; Almond and Edlund, 2008; Abrevaya, 2009). Following earlier work on sex selection in Asian countries, excess males births were found among Asian immigrants to Britain, particularly at higher parities (Dubuc and Coleman, 2007). In the US, excess male births among Asian sibships is driven by families where the first birth(s) are exclusively female (Almond and Edlund, 2008; Abrevaya, 2009). In the 2000 US Census 5% sample, having a son is 50% more likely than the biological norm after two daughters when parents are of Chinese, Korean, or South Asian race (Almond and Edlund, 2008). The authors interpret these patterns as driven by conscious decision making by parents (Dubuc and Coleman, 2007; Almond and Edlund, 2008; Abrevaya, 2009).

A potentially more benign cultural preference concerns auspicious dates of birth. For reasons expounded elsewhere (Fortin et al., 2014), the number eight is considered lucky by many Chinese, and 4 unlucky. Birth dates falling on the 8th, 18th, or 28th day of the month can readily be achieved through a

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variety of means, including choosing the date of labor induction and C-section (or postponement thereof). Likewise scheduling C-sections (or inductions) on the 4th, 14th, or 24th might be declined by parents in favor of adjacent dates. To our knowledge, it has not previously been considered whether births by Chinese are skewed to achieve an eight (or avoid a four).

Previous work has considered whether births are timed *vis a vis* auspicious birth years according to the Zodiac calendar (Kaku and Matsumoto, 1975; Goodkind, 1996; Rohlfs et al., 2010; Do and Phung, 2010). Conception timing and abortion play a large role in governing the effects for birth year, but cannot reliably achieve the "fine tuning" of birth date considered in this paper. Thus, the mechanisms and consequences may differ. Additionally, whereas the superstitions regarding birth years are thought to be gender specific ("girls born in a specific astrological year are regarded as less desirable" (Do and Phung, 2010), usually the 1966 birth year), the Chinese eight and four superstitions *per se* should be gender neutral. Manifestation of these superstitions, however, may be gender-specific in the context of son preference among some Chinese Americans, which we consider below. Additionally, birth frequency and birth outcomes have been shown to vary by season (Lam and Miron, 1991; Currie and Schwandt, 2013; McKinnish et al., 2014) in developed countries.

By considering short-term changes in the probability of delivery method among Chinese, Lo (2003)'s analysis of births in Taiwan in 1998 is closest to our own. Lo (2003) found that the C-section rate was 14% higher on "auspicious dates", where "auspicious" was *not* defined using 8s as here but rather "traditional cosmology and astrology" for determining dates "suitable for marriage". The extent to which the number of births were skewed to occur on such dates was not explicitly considered. Lin et al. (2006) found C-section deliveries were reduced in Taiwan during the "ghost month" of lunar July, when major surgical procedures may be considered inauspicious. To our knowledge, it has not been considered whether Asian immigrants to the West show a preference for delivering on specific auspicious birth dates.

Previous research has found short-term manipulations to achieve desired

dates of delivery among non-Chinese. Births drop 2-4% during obstetrics con-
ferences (Gans et al., 2007), suggesting accommodation of physician schedules. Date discretion is also observed near the end of the calendar year, which confers a tax advantage for parents relative to birth in early January (Dickert-Conlin and Chandra, 1999). Likewise, births were delayed in Australia to receive a tax bonus (Gans and Leigh, 2009). Additionally, previous work has considered whether certain dates considered unlucky in Western cultures are avoided. In Australia, there are 7.7% too few births on Friday the 13th (Gans and Leigh, 2012). In the US, the number of births fell 11% on Halloweens from 1996-2006 and increased 5% on Valentine's Days (Levy et al., 2011). Additionally, environmental factors may also affect birth timing in the absence of deliberate behavior, e.g. Bauer et al. (2013) on sunspot activity.

There is an extensive literature documenting variation in medical treatments that depart from clinical indication, including elective C-section (Minkoff and Chervenak, 2003) or cesarean delivery on maternal request (CDMR). One motivation for CDMR is the "desire to plan/time delivery" (Ecker, 2013). Among these non-clinical determinants of delivery method or delivery timing, achieving "auspicious" birth dates may be particularly difficult to rationalize from the perspective of public health. That said, if there is an increase in the number of C-sections and births on auspicious dates, it is not clear whether it is the health care provider or the parents who drive such an increase (Gans and Leigh, 2012). To address this point, we will consider whether fetal gender affects the likelihood of having an auspicious birth date. Often through prenatal diagnostic ultrasound, gender is routinely revealed to parents prior to delivery in the US. Is achieving an auspicious date more likely when that child is male? Given previous findings of parental preferences for sons among Asian immigrants to the US, parents may be more keen to achieve auspicious dates for their sons. Unless healthcare providers likewise seek to deliver males (but not females) on auspicious dates, it might suggest that it is parents (not providers) who are

behind the skewed birth dates.[1]

2. Methods

We conducted a population-based cohort study using microdata from individual vital statistics natality records covering all live births in California from years 1991-2002, collected and maintained by the California Office of Statewide Health Planning and Development (OSHPD). The data we analyze are the same as those in Almond and Doyle (2011). We chose California for the analysis because national natality data produced by National Center for Vital Statistics suppress exact date of birth (beginning in 1989). In addition, California has the largest population of Chinese Americans in the United States. Thirty six percent of all Chinese Americans live in California. Chinese mothers delivering in California were more likely to have attended college than Chinese mothers delivering in other states (1995-2002 CDC Wonder Online Database).

OSHPD's research database includes hospital discharge records linked to birth (and death) certificate records. The birth certificate data report pregnancy and birth characteristics, including pregnancy and birth complications, birth weight and gestational age, as well as parents' age, educational attainment, and place of birth. While race of the newborn will be considered, Hispanic births were not separately identified after 1995. Approximately 96 percent of all births in the vital statistics records were successfully linked to discharge information, which includes admission, discharge date, as well as additional treatment measures described in Almond and Doyle (2011) (measures not analyzed here). Hospital admissions up to one year after delivery are matched to the birth record for both mothers and infants.

The initial dataset contains 6,762,921 births. We restrict the analysis to those births where the mother's race is White or Chinese (82% and 2% of Cali-

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[1]Unfortunately, physician race is not available in the data and we will not be able to explore to what extent Chinese providers are driving the skewed birth dates.

fornia births, respectively). 1% of records have missing mother's race, and 5% of records have missing baby's gender. We exclude both from our analysis.

2.2. Statistical Analysis

For each date, we calculate the number of births by baby's gender, mother's race (White or Chinese), and mother's education. We do this for four categories of births: all births, births by primary C-section (mother's first C-section), births by repeat C-section (mother's subsequent C-section), and births where there was an induction of labor. For each date (defined by month, day, and year), we calculate the number of births by baby's gender, mother's race (White or Chinese), and mother's education. We do this for four categories of births: all births, births by primary C-section (mother's first C-section), births by repeat C-section (mother's subsequent C-section), and births where there was an induction of labor. Our data spans 1991-2002, so we calculate the number of births on 4,383 different dates (365 dates for 9 years and 366 dates for 3 leap years). We conduct multivariate regression analysis to test for date shifting. In all analyses we include year (y), month (m), and day of the week (DoW) fixed effects and main holidays effects (New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving, Christmas, Christmas Eve and New Year's Eve) in regressions of the form:

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\begin{aligned}
Log\#births_{y,m,DoW} =& \beta_1 + \beta_2 Contains8_{y,m,DoW} + \beta_3 Contains4_{y,m,DoW} \\
& + Holiday_{y,m,DoW} + \gamma_y + \theta_m + \kappa_{Dow} + \varepsilon_{y,m,DoW}
\end{aligned}
\tag{1}
$$

We are interested in estimates of β_2 and β_3, the coefficients on variables for whether day of month contains an 8 or 4 (respectively). We run separate regressions for Whites and Chinese.[2]

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[2]In alternate specifications, we define the dependent variable to be the number of births. The results are qualitatively similar and reported in Appendix Tables A1 and A2.

3. Results

We begin by plotting the fraction of births that are C-sections by the day of the month (1-31), removing holiday effects, for Chinese and Whites in Figures 1 and 2 below. Overall, about 22% of deliveries are by C-section for Chinese and Whites. Repeat C-Sections are roughly 6.5% of Chinese deliveries and 8.5% of White deliveries: the mean difference emerges for repeat C-sections because Chinese fertility is lower (and thereby higher parity birth less likely). For Chinese, we see that the 8th, 18th, and 28th days of the month are each associated with an increase in the rate of repeat C-sections (vertical lines). We see no corresponding pattern of increases on these 8 dates for Whites. For both Whites and Chinese, we see a large drop in the fraction of repeat C-section births falling on the 13th of the month (dash-dot vertical lines), a pattern previously found elsewhere (Gans and Leigh, 2012; Levy et al., 2011; Miller, 2014). Our hypothesis does not explain all of the day-to-day variation shown in the figures (e.g. the increase in Chinese repeat C-section deliveries on the 15th of the month). In addition, we lose some precision for the 31st since it is identified by seven, rather than twelve, months.

To assess the statistical significance of these patterns, we report regression results in Table 1 (while controlling for the time effects described above). These regression results likewise indicate that Chinese births in California disproportionately occur on the 8s and furthermore that this skewing is statistically significant. Column 1 shows a 2.3% excess in births falling on the 8s. Interestingly, this behavior is concentrated among male births. Column 2 shows a 4.1% excess in male births on dates with an 8. We also see a larger magnitude response for deliveries by C-section. There are approximately 7% "too many" repeat male C-sections on the 8s (column 4). There is also some evidence of too few repeat C-sections on the 4s (roughly a 5% drop). Repeat C-sections for girls do not show corresponding pattern. Turning to the 13th, there is substantial evidence of avoidance among Chinese for male and female births alike. There are about 14% too few C-section births on 13th for both boys and girls, and suggestive

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evidence of an additional effect of the 13th when it falls on a Friday.[3]
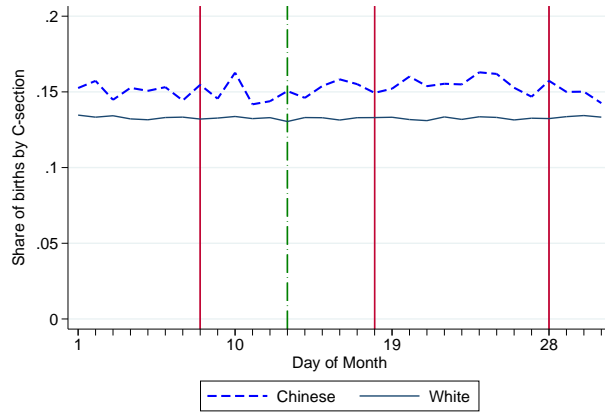
Note: Red lines correspond to lucky days (8, 18, 28) and green line corresponds to the 13th.

Figure 1: Share of births by C-section, by day
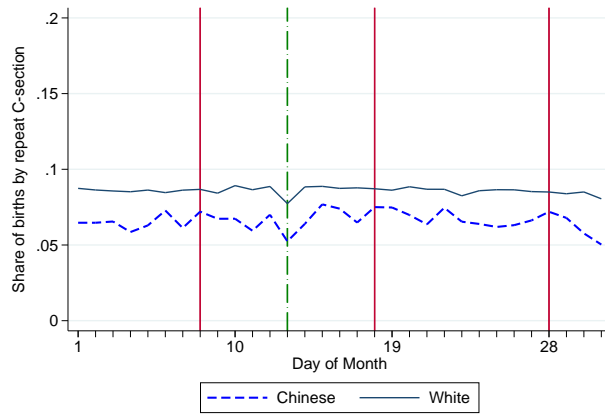
Note: Red lines correspond to lucky days (8, 18, 28) and green line corresponds to the 13th.

Figure 2: Share of births by repeat C-section, by day

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[3]We also check the robustness of these results by clustering the standard errors at the digit level following wild cluster bootstrap. The results under this clustering lead to smaller p-values. Results are available upon request.

Table 1: Regression Estimates: Log Number of Chinese Births by Day

	(1)	(2)	(3)	(4)	(5)
Contains8	0.023**	0.041***	0.007	0.069**	0.016
	(0.010)	(0.014)	(0.015)	(0.029)	(0.029)
Contains4	-0.016	-0.001	-0.024	-0.052*	-0.033
	(0.010)	(0.014)	(0.015)	(0.031)	(0.032)
Thirteen	-0.062***	-0.047*	-0.062**	-0.137**	-0.138**
	(0.018)	(0.025)	(0.026)	(0.055)	(0.058)
Friday13	-0.037	-0.099	-0.001	-0.154	-0.245
	(0.047)	(0.067)	(0.070)	(0.161)	(0.175)
Observations	4,383	4,383	4,382	2,813	2,684
Number of births	141,541	72,519	67,005	4,952	4,493
R-squared	0.255	0.147	0.142	0.075	0.061
Mother	Chinese	Chinese	Chinese	Chinese	Chinese
Birth	All Births	Boys	Girls	Repeat CS-Boy	Repeat CS-Girl

All models include year, month, and day of the week fixed effects and main holiday effects.

Robust standard errors in parentheses.

***p<0.01, **p<0.05, *p<0.1

For Whites, there is no corresponding pattern with respect to the 8s and 4s. None of the point estimates reported in first row in Table 2 are distinguishable from 0 (and are under 1% in magnitude). There is, however, a consistent reduction in births on the 13th of the month. There also seems to be an even stronger avoidance of Friday the 13th among deliveries that were repeat C-section. We find a 20-25% drop in C-sections for Friday the 13th (combing coefficients for the 13th and Friday the 13th), an aversion which appears to be shared by males and females alike.

Table 2: Regression Estimates: Log Number of White Births by Day

	(1)	(2)	(3)	(4)	(5)
Contains8	0.002	0.002	0.004	-0.008	0.008
	(0.002)	(0.004)	(0.004)	(0.010)	(0.010)
Contains4	0.004*	0.003	0.008*	0.003	0.011
	(0.003)	(0.004)	(0.004)	(0.010)	(0.010)
Thirteen	-0.022***	-0.018**	-0.025***	-0.101***	-0.110***
	(0.004)	(0.007)	(0.008)	(0.017)	(0.017)
Friday13	-0.022*	-0.025	-0.024	-0.158***	-0.088*
	(0.016)	(0.020)	(0.020)	(0.046)	(0.046)
Observa-tions	4,383	4,383	4,383	4,383	4,382
Number of births	5,377,308	2,643,160	2,540,842	239,447	225,445
R-squared	0.915	0.781	0.775	0.855	0.870
Mother	White	White	White	White	White
Birth	All Births	Boys	Girls	Repeat CS-Boy	Repeat CS-Girl

All models include year, month, and day of the week fixed effects and main holiday effects.

Robust standard errors in parentheses.

***p<0.01, **p<0.05, *p<0.1

In Table 3 we show that most of the 13 avoidance is concentrated among mothers with greater than a high school education. The coefficient on the interaction term of mother having more than a high school education and birth occurring on the 13th is consistently negative and large in magnitude (second row from bottom of Table 3). In contrast, 8-seeking (4-avoidance) does not seem to be concentrated among more or less educated Chinese.

The California natality data also report the individual hour and minute of birth, which national data on births from NCHS data do not. In results not included, we do not find any evidence of shifting of the time of day of the birth for either the hour or minute of birth (relative to Whites). Such precise birth timing might be more difficult for parents to control than birth date.

We also run a similar regression to 1, but augmented with a coefficient for month8xday8. However, we do not see a consistent pattern in the point

estimates and for the Chinese, they are imprecise.

₁₈₀   Finally, we investigate whether male Chinese births are mainly driven by Chinese-Chinese couples. We find no evidence of this pattern. We cannot, for example reject the hypothesis that the coefficients on *Contains8* using the main sample (presented in Table 1) and only Chinese-Chinese couples are the same for subsample of sons. We also looked for heterogeneity by whether the mom

₁₈₅ was born in China and we did not find a substantial difference. It appears that China-born moms respond just as strongly (if not more strongly) to the 13th, but not anymore strongly to the 8th/4th.

Table 3: Regression Estimates: Log Number of Births by Day and Maternal Education

	(1)	(2)	(3)	(4)
Contains4	-0.015	0.004	-0.016	0.002
	(0.025)	(0.004)	(0.054)	(0.012)
Contains8	0.039	-0.000	-0.022	-0.006
	(0.024)	(0.004)	(0.048)	(0.012)
Thirteen	-0.007	-0.008	0.102	-0.040*
	(0.044)	(0.008)	(0.094)	(0.021)
Friday13	-0.154	-0.025	-0.212	-0.120**
	(0.116)	(0.021)	(0.138)	(0.056)
MotherHs	0.517***	-0.214***	0.062***	-0.186***
	(0.012)	(0.002)	(0.022)	(0.006)
Hs×Contains4	-0.015	0.001	-0.013	0.001
	(0.034)	(0.006)	(0.068)	(0.017)
Hs×Contains8	-0.041	-0.003	0.016	0.002
	(0.034)	(0.006)	(0.062)	(0.017)
Hs×Thirteen	-0.069	-0.009	-0.113	-0.044
	(0.061)	(0.011)	(0.118)	(0.030)
Hs×Friday13	0.304*	-0.002	0.014	-0.051
	(0.161)	(0.029)	(0.228)	(0.079)
MotherGths	1.921***	-0.028***	0.488***	-0.069***
	(0.012)	(0.002)	(0.019)	(0.006)
Gths×Contains4	-0.001	0.000	-0.001	0.011
	(0.034)	(0.006)	(0.061)	(0.017)
Gths×Contains8	-0.011	0.009	0.077	0.017
	(0.034)	(0.006)	(0.055)	(0.017)
Gths×Thirteen	-0.072	-0.036***	-0.330***	-0.159***
	(0.061)	(0.011)	(0.107)	(0.030)
Gths×Friday13[a]	0.107	0.011	–	0.042
	(0.161)	(0.029)		(0.079)
Observations	12,952	13,149	5,549	13,149
Number of births	140,380	5,327,738	9,479	468,932
R-squared	0.756	0.822	0.253	0.815
Mother	Chinese	White	Chinese	White
Birth	All Births	All Births	Repeat CS	Repeat CS

All models include year, month, and day of the week fixed effects and main holiday effects.

MotherHs indicates whether the mother has 12 years of education and MotherGths whether she has more than 12. The omitted education category is less than 12 years of education.

Robust standard errors in parentheses.***p<0.01, **p<0.05, *p<0.1

[a]The coefficient in column 3 is dropped due to the few number of observations for this category.

4. Discussion

Superstitious preferences have also been shown in other "life" decisions among Chinese, including residential address choice in British Columbia (Fortin et al., 2014). Shifting in birth timing might be worrisome in light of recent work finding negative health consequences for the newborn from accelerating deliveries, including short-term movements within "full-term" pregnancies (Tita et al., 2009; Schulkind and Shapiro, 2014). An irony of the birth date shifting being concentrated on Chinese-American sons is that Chinese-American daughters may be protected from its health consequences. That said, we do not detect systematic differences in birth weight associated with 8s or 4s. The birth weight metric has been criticized for not consistently capturing newborn health (Almond et al., 2005) and heterogeneous birth weight effects maybe be offset if some parents delay delivery and others accelerate it in response to lucky (unlucky) numbers. We did not detect significant changes in the rate of infant readmission to hospital; because readmission is rare, our readmission estimates for lucky (unlucky) dates among Chinese are imprecise. Whether these birth date shifts harm health or not, their observance suggests a previously undocumented dimension of cultural persistence among some Chinese Americans. That female Chinese newborns show no skewing towards 8s in birth dates argues against delivery date effects being steered by health care providers.

It is unclear to what extent *switching* into C-section delivery accounts for the effect we find. While we do observe whether delivery is vaginal and non-induced versus C-section, we cannot distinguish births that would have been by C-section on a nearby date (absent the four and eight superstitions). Because effects are largest after a primary C-section and the Vaginal Birth After Caesarean (VBAC) procedure is uncommon, a large part of the date-shifting effect is presumably from C-sections whose dates were "merely" relocated in time (and the delivery method unchanged). Thus, we do not think our application allows us to identify the causal effect of C-section on newborn health. Likewise, it is unlikely that observance of lucky dates substantially increased the direct

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financial costs incurred by having a (repeat) C-section versus vaginal delivery.

To our surprise, mothers with more education were more likely to avoid Friday the 13th delivery. On one hand, we may expect more educated mothers to be less superstitious. However, all else being equal, more educated mothers maybe more likely to request and obtain specific dates for scheduled C-sections if they are more likely to be aware of the ability to make such requests, have greater rapport with their physicians, or have more flexible health insurance coverage. Nevertheless, we do not know whether maternal education has a causal effect on adherence to this superstition, or instead something correlated with education (e.g. rapport with obstetrician) accounts for the heterogeneity.

The magnitude of the effects we estimate suggest that the vast majority of Chinese in California do <u>not</u> time births to have auspicious birth dates. Likewise, the literature on sex preference among Asian immigrants finds most do not select sex. That said, Chinese sons delivered by repeat C-section in California are particularly likely to have their delivery date skewed by cultural superstition.

Finally, the magnitude of date shifting among boys underestimates the magnitude of son preference to the extent that not all Chinese parents subscribe to birth date superstition, know that birth dates can be shifted, find an obstetrician who will implement their shifting request, etc. That said, the various manifestations of son preference that parents find more costly than date shifting would tend to show a smaller response than date shifting, other things equal.

An excellent venue for future research is to analyze whether the difference in birth timing for boys and girls exist even in earlier years when ultrasounds to determine gender were not common. Unfortunately our CA data do not stretch back that far. Future research will explore whether the early years of the national natality data report exact date of birth in order to analyze this hypothesis.

Appendix

Table A1: Regression Estimates: Number of Chinese Births by Day

	(1)	(2)	(3)	(4)	(5)
Contains8	0.801***	0.692***	0.115	0.208***	0.0881*
	(0.308)	(0.216)	(0.209)	(0.0557)	(0.0532)
Contains4	-0.460	-0.00735	-0.386*	-0.104*	-0.0758
	(0.316)	(0.222)	(0.214)	(0.0572)	(0.0546)
Thirteen	-1.883***	-0.740*	-0.991***	-0.174*	-0.274***
	(0.552)	(0.388)	(0.374)	(0.0999)	(0.0953)
Friday13	-1.450	-1.304	-0.167	-0.566**	-0.573**
	(1.476)	(1.037)	(1.000)	(0.267)	(0.255)
Observations	4,383	4,383	4,383	4,383	4,383
R-squared	0.256	0.158	0.148	0.105	0.087
Mother	Chinese	Chinese	Chinese	Chinese	Chinese
Birth	All Births	Boys	Girls	Repeat CS-Boy	Repeat CS-Girl

All models include year, month, and day of the week fixed effects and main holiday effects.

Robust standard errors in parentheses.

***$p<0.01$, **$p<0.05$, *$p<0.1$

Table A2: Regression Estimates: Number of White Births by Day

	(1)	(2)	(3)	(4)	(5)
Contains8	2.827	1.137	2.116	-0.289	0.384
	(2.780)	(1.747)	(1.673)	(0.473)	(0.456)
Contains4	6.118**	2.079	4.363**	0.402	0.608
	(2.853)	(1.793)	(1.717)	(0.486)	(0.468)
Thirteen	-27.37***	-11.31***	-14.94***	-6.019***	-5.578***
	(4.983)	(3.131)	(2.999)	(0.848)	(0.818)
Friday13	-31.49**	-17.21**	-16.25**	-10.46***	-6.265***
	(13.32)	(8.372)	(8.019)	(2.268)	(2.186)
Observations	4,383	4,383	4,383	4,383	4,383
R-squared	0.915	0.868	0.867	0.822	0.828
Mother	White	White	White	White	White
Birth	All Births	Boys	Girls	Repeat CS-Boy	Repeat CS-Girl

All models include year, month, and day of the week fixed effects and main holiday effects.

Robust standard errors in parentheses.

***p<0.01, **p<0.05, *p<0.1

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