Dragon Babies

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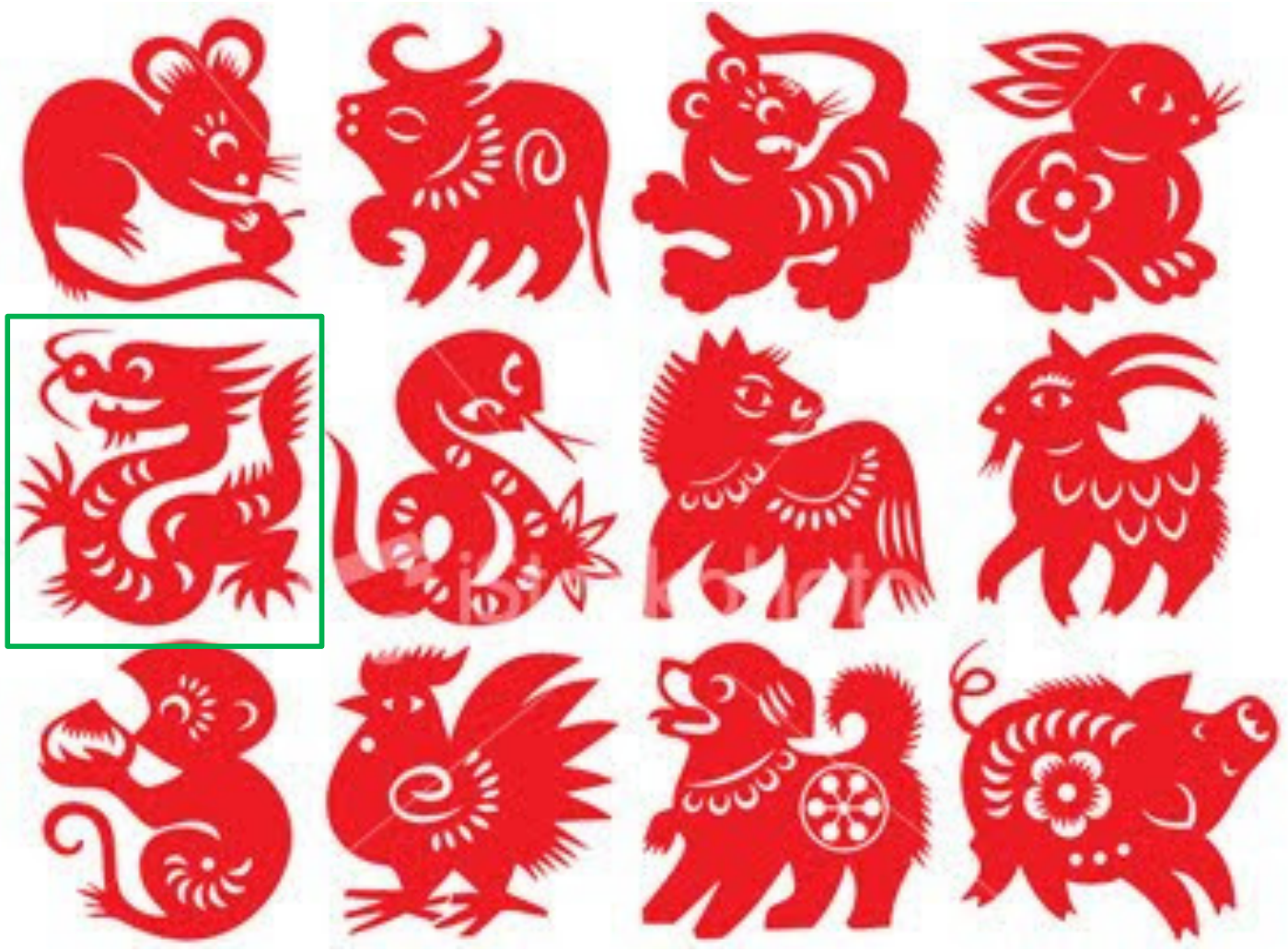
The Chinese Zodiac



The Dragon Story

- Chinese zodiacs follow a twelve-year cycle
- The Dragon year is considered an auspicious year for having children
  - "Dragons" are believed to have good character (noble, ambitious, fearless), good fortune and even good health
  - Correspond to calendar years 1964, 1976, 1988, 2000, etc.
- Such superstitious belief is prevalent in the Chinese culture
  - China, Singapore, Hong Kong, Korea, etc

Research Questions

1. Does zodiac birth timing produce larger cohorts in the year of the Dragon?
2. How does a larger cohort influence the economic well-being of the *exposed* group?
3. What are the economic channels of the superstition-induced cohort effect?
   - Selection?
   - Or, resource implications of a large cohort
     - Labor market
     - Education

Empirical Challenges

- Difficult to identify the effects of cohort sizes
- Confounding factors
  - Age
  - Time
  - Omitted variables/selection
- Limited ability to shed light on the economic channels

Existing Literature

- The literature suggests that individuals from larger birth cohorts have worse life outcomes
- They face more competition for resources and jobs, resulting in lower wages or lower employment (Welch 1979; Bloom, Freeman and Korenman, 1988)
- Cohort size induced stress:
  - Higher suicide rates (Ahlburg and Shapiro 1984)
  - Criminal behaviour (O'Brien 1989)

Existing Literature

- Another angle: Cohort effect on economic decision making
  - Cohort Experience affect preferences and expectation (Malmendier and Nagel, 2011, 2016)
  - Cohort exposure to macro conditions shape college enrollment decisions (Charles, Hurst, and Notowidigdo, 2016)

Our Setting

- Exploit the unique setting of the multi-cultural city state Singapore
  - Chinese majority (74%) and a large Malay and Indian minority (22%)
- Useful variations
  - Zodiac superstition applies only to Chinese
  - National Service creates another source of exogenous variation
- Multiple “treated” cohorts allow us to disentangle the age and year effects
  - Dragon years: 1964, 1976, 1988, 2000, and 2012

Our Contribution

- A significant negative income effect the group of population exposed to such superstitious belief
  - Direct impact: Chinese who are born in Dragon years
  - Indirect (externality) effect:
    - Non-Chinese who are born in Dragon years
    - Other non-Dragon Chinese who go to college and enter the labor market at the same time as Chinese Dragons
- Several economic channels associated with a larger cohort
  - Through (Inelastic) labor demand
  - Through educational experiences in earlier years (in spite of public resources' response to accommodate)
  - Public sector's response can only partially counteract the impact
- First to show: Superstition has a lasting and broad impact on a *wide* variety of life outcomes

Data

- Five distinct sources of administrative data
  - Aggregate monthly birth data from 1960:01 to 2007:12
  - Individual-level data on
    - Income, employment status, saving, and spending transactions of a representative sample of consumers from a leading Singapore bank (2010:04-2012:03)
    - Universe of the annual individual-level university admission data from two major universities in Singapore (1981-2015)
    - Universe of personal bankruptcies
    - Universe of property transactions

Empirical Methodology

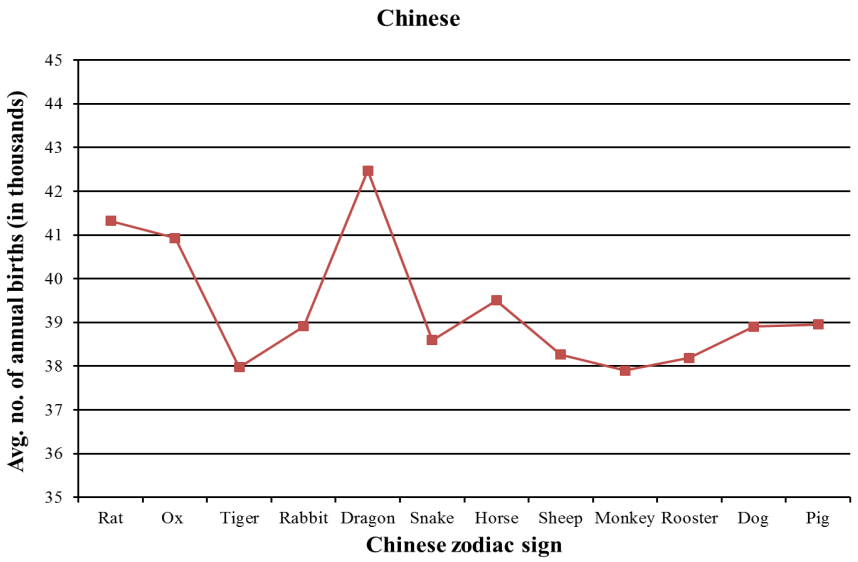
- Our difference-in-differences model is as follows

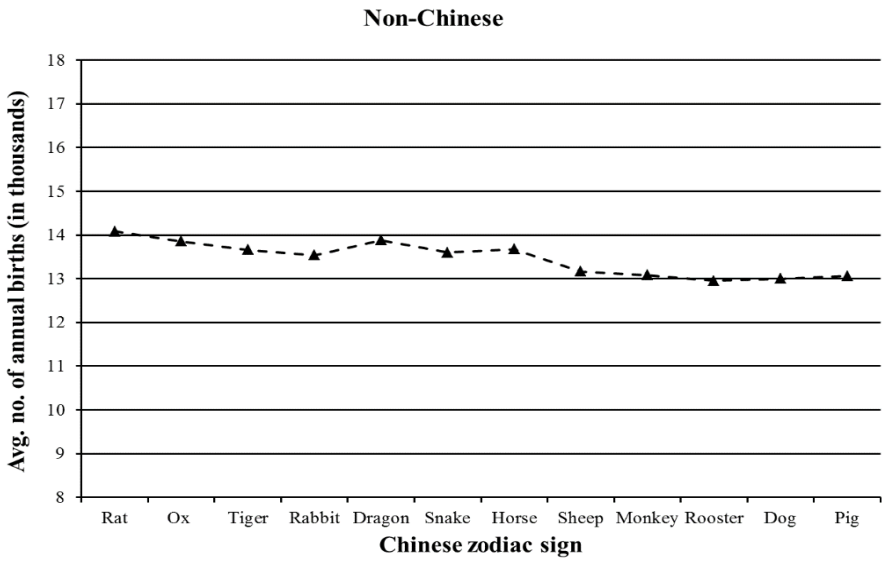
$$y_i = \alpha + \beta_1 \times Dragon_i + \beta_2 \times Dragon_i \times Chinese_i + controls + \mu_i$$

- We control for race/gender fixed effects, calendar year and month of birth fixed effects, and race-specific quadratic time (or age) trends.

- All errors are clustered by residential location (postal code) in the individual level regressions.

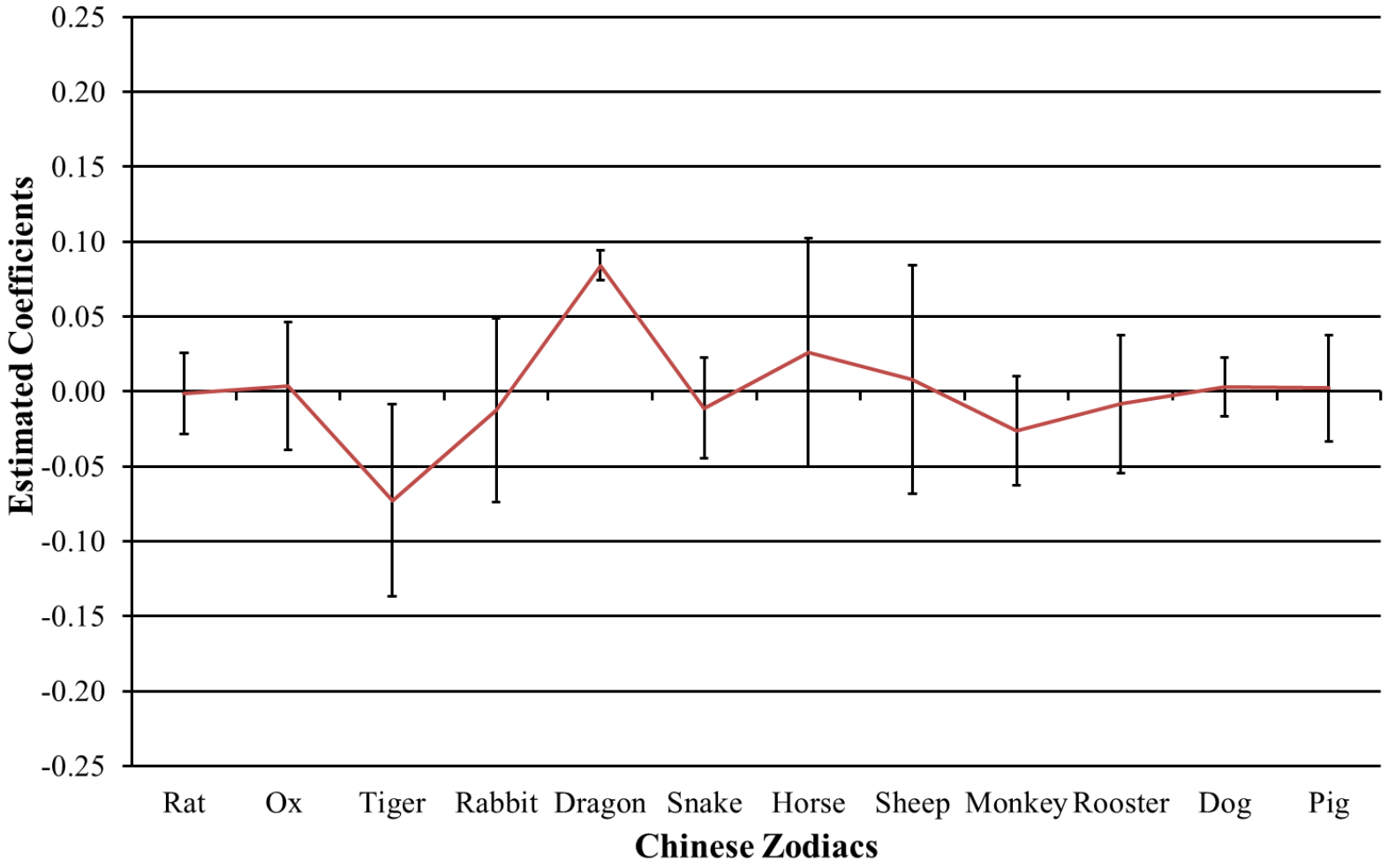
Births by Race and Zodiac (1960-2007)





This figure shows the average number of annual births by zodiac sign, controlling for linear time trends. Data are from Singapore Stats.

Diff-in-Diff Estimate



Diff-in-Diff Estimate

	(1)	(2)	(3)	(4)
	Ln(monthly births)			
Chinese Dragon	0.120**	0.120**	0.089***	0.089***
	(0.026)	(0.025)	(0.023)	(0.019)
Dragon	-0.001		0.017	
	(0.020)		(0.018)	
Constant	4.218***	4.330***	1,753***	0.912
	(0.013)	(0.038)	(128,441)	(1.120)
Gender fixed effects	Y	Y	Y	Y
Race fixed effects	Y	Y	Y	Y
Birth year & month fixed effects	N	Y	N	Y
Quadratic year trends	N	N	Y	Y
Chinese*Quadratic year trends	N	N	Y	Y
Observations	4,608	4,608	4,608	4,608
R-squared	0.940	0.957	0.953	0.966

Interpretation

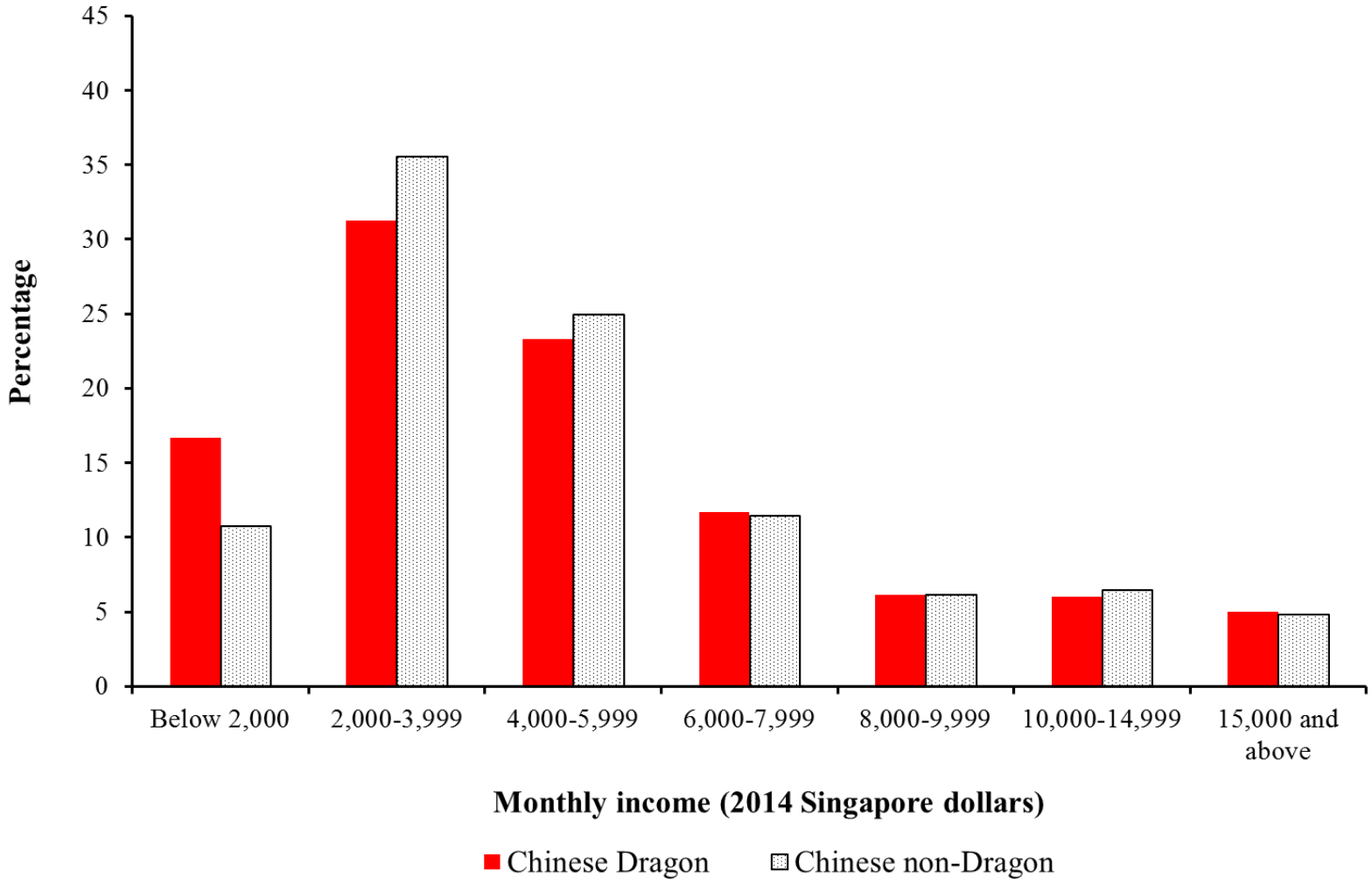
- First stage result
- Confirms a spike in the number of births for the Chinese subpopulation in Dragon years
- No change in births for the non-Chinese subpopulation in those years
- The spike in births for Chinese is statistically significant and economically large (9.3%)
- Birth timing driven by superstition
  - Consistent evidence if we use lunar year cutoffs

Labor Market Outcome

	(1) Ln(monthly income)	(2) Ever unemployed
Chinese Dragon	-0.062***	-0.000
	(0.021)	(0.008)
Race and gender fixed effects	Y	Y
Year and month of birth fixed effects	Y	Y
Quadratic age trends	Y	Y
Chinese*Quadratic age trends	Y	Y
Observations	104,080	94,737
R-squared	0.220	0.016

- Stale income Issue: may largely reflect the income at the time of account opening
  - Find no difference in account opening age for Chinese Dragons

Distribution of Income Difference



Interpretation

- Selection
  - Chinese born in the Dragon year are negatively selected
- Cohort effect
  - Large birth cohort due to zodiac timing *leads to* the negative labor market outcome
- Exploit various identification strategies

Spillover Effect

- Cohort effect applies not only to the group who practices superstition, but also to those unaffected by the superstitious belief but are exposed (due to the larger cohort)

- Non-Chinese who are born in the Dragon year
  - Their parents do not engage in birth timing
  - However, they go to school/college and enter the labor market at the same time as the Chinese Dragon babies

Non-Chinese Dragon Babies

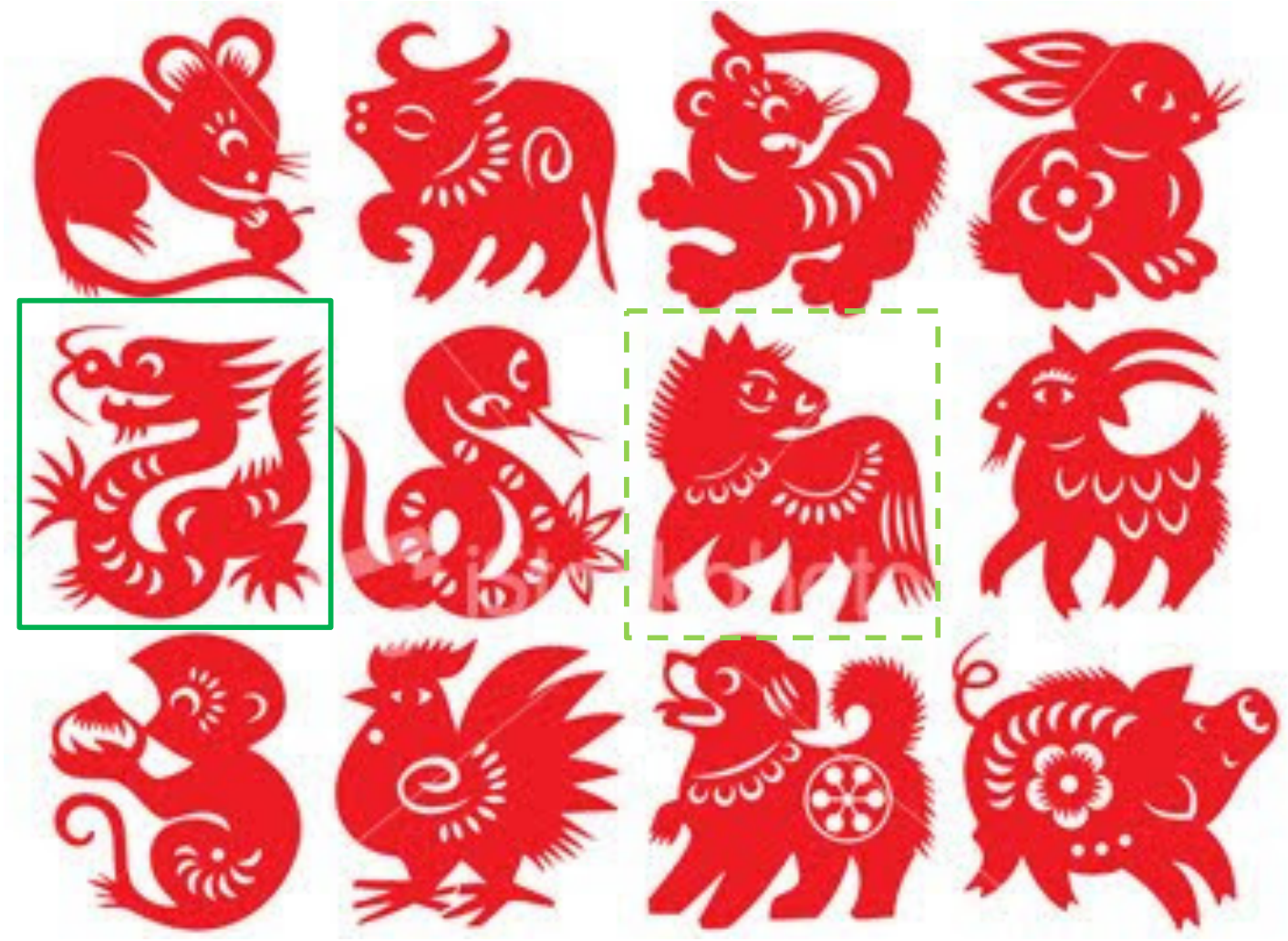
	(1)	(2)
	Ln(monthly income)	Ever unemployed
Dragon	-0.039**	0.009
	(0.019)	(0.007)
Gender fixed effects	Y	Y
Month of birth fixed effects	Y	Y
Quadratic age trends	Y	Y
Observations	13,745	12,401
R-squared	0.325	0.025

Income Dist.: Non-Chinese Dragons

Another Spillover Group

- All Singaporean males must perform two and a half years of National Service between age 19-22
- Dragon men enter university and labor market two years later than their female counterparts
- Thus, dragon men are paired with women two years younger (i.e., those born in Horse years)
- On the other hand, men born in Horse years will not be affected
  - falsification

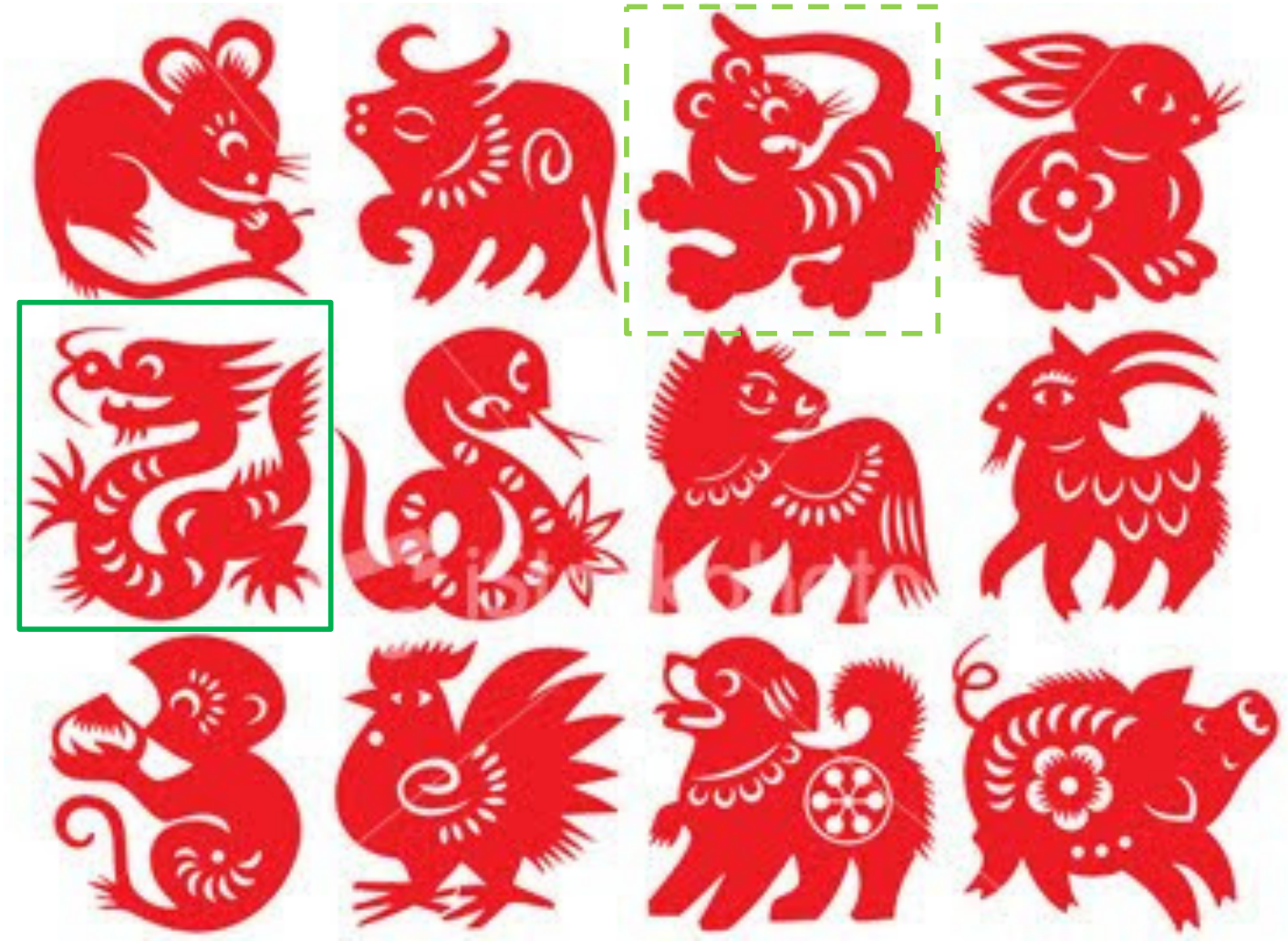
The Chinese Zodiac



Chinese Born in Horse Years

	(1)	(2)
	Ln(monthly income)	Ever unemployed
Horse	-0.032***	0.006
	(0.011)	(0.005)
Horse*Male	0.052***	-0.009
	(0.018)	(0.006)
Gender fixed effects	Y	Y
Month of birth fixed effects	Y	Y
Quadratic age trends	Y	Y
Observations	90,335	82,336
R-squared	0.175	0.013

The Chinese Zodiac



Chinese Born in Tiger Years

	(1)	(2)
	Ln(monthly income)	Ever unemployed
Tiger	0.019	-0.002
	(0.023)	(0.009)
Tiger*Male	-0.021	-0.004
	(0.018)	(0.006)

Note: The size of the Tiger cohort is significantly smaller (by 8%) , implying offsetting effects of their smaller cohort size and the larger cohort of Dragon women

Interpretation

- Externality of large Dragon cohorts
- Subpopulation without superstitious practice in birth timing but exposed to the large Chinese Dragon cohorts
- The negative income effect on these individuals *cannot* be due to selection
- Strong support for the cohort effect interpretation
- Remaining question
  - Can the income effect for Chinese Dragons still be partly attributable to negative selection effect?

Malaysian Chinese

- Malaysian Chinese also practice zodiac birth timing
- In Malaysia, Chinese are the minority group
  - 23% Chinese vs. 52% Malay
- Muted cohort size change due to zodiac birth timing among Malaysian Chinese
- We identify Malaysians from the bank's data and perform the same diff-in-diff analysis on income
  - Chinese vs. non-Chinese, Dragon vs. non-Dragon
  - No difference in the proportion of Dragon babies among Malaysian Chinese relative to the same proportion among Malaysian non-Chinese

Income Diff for Malaysians

	(1)	(2)
	Ln(monthly income)	Ever unemployed
Chinese Dragon	0.081	-0.013
	(0.078)	(0.017)
Gender and race fixed effects	Y	Y
Month of birth fixed effects	Y	Y
Quadratic age trends	Y	Y
Observations	13,150	12,633
R-squared	0.190	0.012

Interpretation

- The evidence is consistent with (weakly) positive selection, if any

- This is consistent with the literature
  - Find evidence consistent with positive selection among Asian-American, and Japanese and Vietnamese parents

- Further corroborates our cohort effect interpretation

Economic Channels?

- Previous findings suggest a causal interpretation of the cohort effect
- Mechanism
  - Resource implications of large birth cohorts
- Potential channels
  - Labor market competition
  - Inferior university education
  - Inferior early (pre-college) education

Which Channel?

- Recall the previous finding
  - Chinese Horse women share resources and interact with Chinese Dragon men only in university and when they first enter the labor market
- Suggest two potential channels
  - Labor market competition
  - Inferior university education
- We study non-Chinese women born in Horse years to differentiate the two hypotheses

Which Channel?

- Assumption
  - Labor market segmentation between Chinese and non-Chinese (e.g., due to language skill differences)

- Predictions
  - Labor market channel suggests no effect for non-Chinese Horse women
  - University education channel suggests lower income for non-Chinese Horse women as well

Labor Market Segmentation

Below are examples of job advertisements requiring specific language skills, showing potential racial segmentation of the labor market.

Example 1

Membership Officer
Joo Chiat
Handle membership-related matters e.g. queries, processing of membership applications and refunds
Job Requirements:
•Candidate must possess at least a diploma/ advanced graduate diploma/ post graduate /Bachelor's Degree/professional degree/marketing/business/
•mass communications or equivalent
•Bilingual in English and Chinese (to liaise with Chinese speaking associates)
•Customer-service oriented and enjoys meeting people
•Independent, self-motivated, with a desire to learn
•Applicants must be willing to work in Marina Bay Golf Course at 80 Rhu Cross
•Entry level applicants are welcomed
•Singaporeans are encouraged to apply

Example 2

TEACHER/ PRINCIPAL
[redacted] **KINDERGARTEN**
Kindergarten needs
Qualified TEACHER/ PRINCIPAL
* DECCE-T/ L/ CECCE
* 5-day week.
* Singaporean only
*** Liaise with Malay speaking students**

Non-Chinese Born in Horse Years

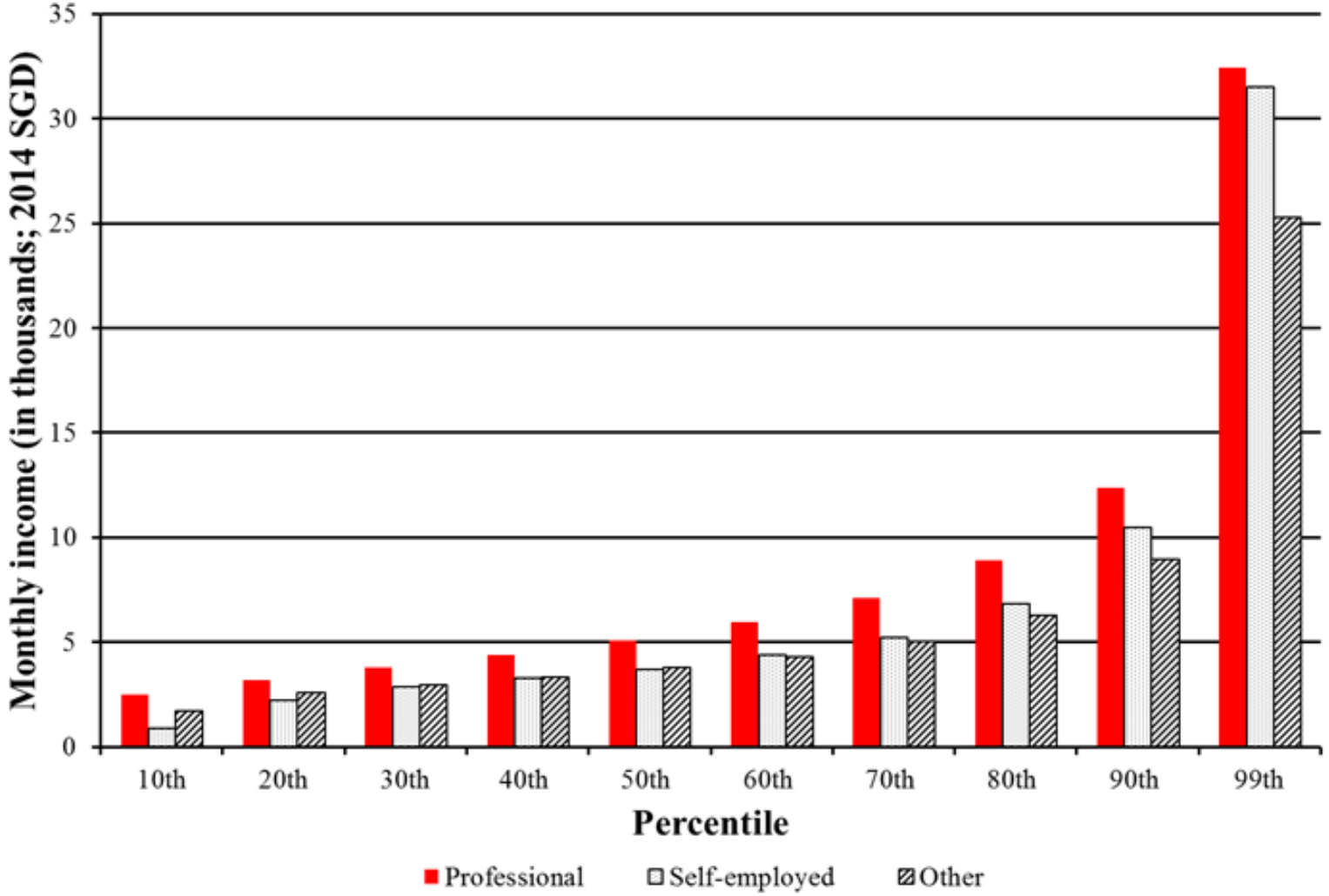
	(1)	(2)
	Ln(monthly income)	Ever unemployed
Horse	0.003	-0.017
	(0.032)	(0.014)
Horse*Male	0.034	0.008
	(0.045)	(0.015)
Gender fixed effects	Y	Y
Month of birth fixed effects	Y	Y
Quadratic age trends	Y	Y
Observations	13,745	12,401
R-squared	0.325	0.025

Occupation Distribution

- More evidence using the occupation distribution: inelastic labor demand more binding in competitive jobs requiring more skills

	(1)	(2)	(3)
	Professional	Self-employed	Others
Chinese Dragon	-0.034**	0.010*	0.025
	(0.016)	(0.005)	(0.016)

Income by Occupation



More on the Education Channel

- Previous findings suggest no difference in university education quality
- But, does the larger birth cohort size in Dragon years hurt their prospect of receiving university education?
- Micro-level university admissions data for the two main local universities, National University of Singapore (NUS) and Nanyang Technological University (NTU) between 1981 and 2015
  - Enroll over 98% of all university students in our sample period
  - 466,235 Singaporean applicants

University Admission Outcomes

	(1) Admitted	(2) Admitted to top third	(3) Admitted to middle third	(4) Admitted to bottom third	(5) Applicant score
Chinese Dragon	-0.023***	0.001	-0.008	-0.017***	-0.055***
	(0.008)	(0.006)	(0.008)	(0.006)	(0.019)
FE	Y	Y	Y	Y	Y
Observations	466,235	466,235	466,235	466,235	466,235
R-squared	0.201	0.052	0.036	0.050	0.111

Interpretation

- More Chinese Dragons applying?
  - No. The ratio of applicants to their respective birth cohort size remain stable for both races, regardless of Dragon years or not

- Lower human capital accumulated in the earlier years of education
  - Suggest income difference to be larger for Dragons ***without*** a college degree

Income Diff: By Education

Panel A: Chinese

	(1) Ln(monthly income)	(2) Ever unemployed
Dragon	-0.070***	0.005
	(0.016)	(0.006)
Dragon*College	0.029	-0.011
	(0.023)	(0.008)

Panel B: non-Chinese

Dragon	-0.057**	0.002
	(0.028)	(0.011)
Dragon*College	0.029	0.037*
	(0.052)	(0.022)

Short of Public Educational Resources?

- Primary/secondary schools adjust
  - student-teacher ratios do not increase for Dragon birth cohorts
- Universities also adjust
  - 7.2% more Chinese Dragon applicants admitted (than Chinese non-Dragon applicants)
  - Compared with an average of 10.7% increase in birth cohort size for Chinese during Dragon years (in our education data sample)
  - Admission probability is the same for Chinese Dragon applicants once applicant scores are controlled for
- Suggest the lower human capital arise from
  - (In)experience of newly employed teachers
  - Greater competition for (limited) private educational resources such as tutoring

Early vs. Later Dragon Cohort

- All Dragon years (except 1964) experience large increases in birth numbers for the Chinese subpopulation: 1976, 1988, 2000, and 2012
- We next study the labor market outcomes for the earlier Dragon cohorts (1964 and 1976) vs. the later Dragon cohort (1988)
  - Expect the cohort effect to dissipate over time as one gains more labor market experience

	(1)	(2)
	Ln(monthly income)	Ever unemployed
Chinese Dragon	-0.012	-0.001
	(0.035)	(0.009)
Chinese Dragon*1976 year	-0.013	-0.010
	(0.050)	(0.015)
Chinese Dragon*1988 year	-0.170***	0.032
	(0.054)	(0.029)

Other Outcomes

	(1)	(2)	(3)	(4)	(5)
	Ln(Credit Limit)	Spending /Income	Visible Spending /Income	Invisible Spending/Income	Condo Residence (%)
Chinese Dragon	-0.088***	0.058***	0.017*	0.041***	0.453**
	(0.025)	(0.020)	(0.010)	(0.012)	(0.181)
FE	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y
Observations	95,903	104,075	104,075	104,075	1,381,550
R-squared	0.309	0.026	0.025	0.021	0.018

Interpretation

- Chinese Dragons have lower income and lower credit limits, but they spend more for their income level
- They spend a *higher* proportion of their income on conspicuous items, consistent with economic theory on status signalling behavior (Corneo and Jeanne 1997)
- They are also more likely to opt for the more expensive type of housing service—condominiums (as opposed to government subsidized public housing)

Additional Analyses

- Results are robust to use of lunar calendar year, and when sample is restricted to surrounding cohorts born within three years of Dragons
- Results are similar for men and women Dragons
- Flip side: Tiger babies
  - A smaller birth cohort in Tiger years for Chinese only
  - Find higher income for Tiger women but effect is not statistically significant
    - Recent phenomenon—only one cohort with labor market outcome and thus low test power
    - Alternatively the effect may be asymmetric

Concluding Remarks

- We document strong zodiac timing practice, resulting in large birth cohorts
- Dragon cohorts earn significantly lower income
- The negative cohort size effect spillovers to other exposed groups of population
- Mechanism(s)
  - Inelastic labor demand
  - lower human capital accumulation in earlier education
- Non-standard beliefs such as superstition can have a persistent and far-reaching impact

Implications

- Results have direct bearing to societies with Chinese (influenced) cultures
- More broadly, suggest herding of individual decisions can lead to large and persistent negative outcomes in aggregate through the cohort effect channel
- Even the best attempts to accommodate the large cohort size may have limited efficacy