# The Impact of Fertility Relaxation on Female's Labor Market Outcomes

Sumit Agarwal[1]    Keyang Li[2]    Yu Qin[1]    Jing Wu[2]
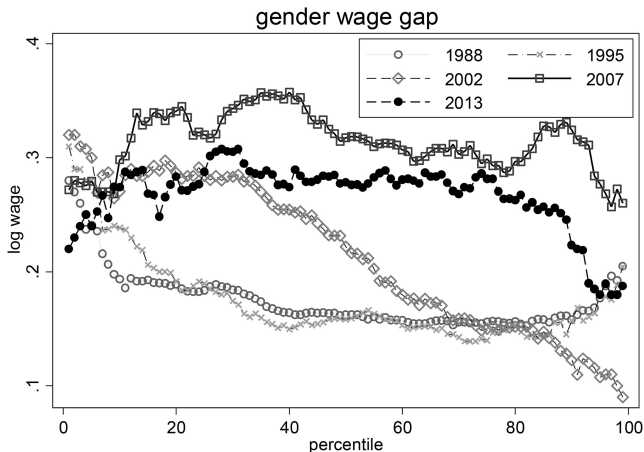
[1]National University of Singapore
[2]Tsinghua University

China Economics Summer Institute

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# Motivation
Gender Wage Gap
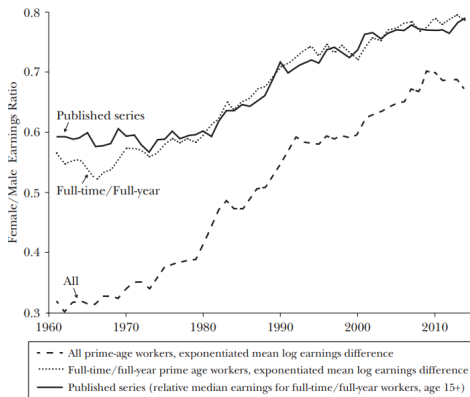
- Gender wage gap (China, Gustafsson and Wan, 2020)



gender wage gap

# Motivation

Gender Wage Gap

- Gender earnings gap (U.S., Juhn and McCue, 2017 JEP)

**Growth of the Female/Male Earnings Ratio**

# Motivation
Gender Wage Gap

- "Motherhood Penalty"
  - Having a young kid is associated with 16.1 log points lower wages for women (but 10.3 log points higher wages for men) (Juhn and McCue, 2017)

- Why?
  - Family division of labor
  - **Discrimination by employers**

- It is difficult to identify discriminatory actions as well as quantitatively measuring the effect on the gender wage gap

# Introduction

- We aim to identify gender discrimination using an employer-employee matched administrative data

- We use the relaxation of one-child policy as a shock (that target on female in fertility age)

- We focus on the salary of new hires, as well as
  - The number of new hires
  - The number of job leavers

- We use male's labor market outcomes as counterfactual
  - We also verify the results using exposure to policy shock within female employees

# Preview of the Findings

Gender Wage Gap Before and After the Policy
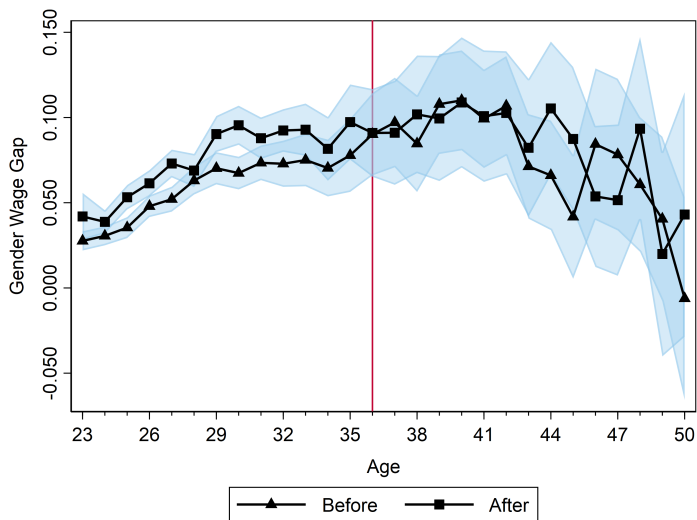
# Preview of the Findings

- After the relaxation of one-child policy,
  - The salary of female new hires is reduced by approximately 1.2%, accounting for 22% of gender wage gap in the sample
  - Employers hire 4.4% fewer female relative to male
  - Female job leavers are reduced by 4.3% relative to male

- The results are not driven by
  - Male new hire salary increase after the policy
  - Labor quality or labor effort decline of female employees

- We document the rich heterogeneity of the results
  - The effect concentrates on childbearing ages
  - The large employers and small employers respond to the policy change on different margins
  - The effect is the largest in the state-owned enterprises (SOEs)
  - The effect is primarily from industries that are more "brain" oriented

# Contributions

- Our paper provides the first causal analysis of the relationship between fertility policies and female labor market outcomes
  - While policies designed to boost birth rates may succeed in that goal, they may unintentionally encourage discrimination against female employees of childbearing age
    - Parental leave policies (Lalive & Zweimüller, 2009; Lequien, 2012; Schönberg & Ludsteck, 2014)

  - We show that the discrimination in labor market may actually precede the birth of the second child, and the females who plan for no change in fertility are also likely discriminated by the employers after the policy

# Contributions

- Our paper contributes to the literature on gender discrimination
  - ▶ Evidence from correspondence studies
    - ★ Gender discrimination (Correll, Benard, and Paik, 2007; Duguet and Petit, 2005; Petit, 2007)
    - ★ Experimental studies do not provide direct evidence on the effects of discrimination on wages (Neumark, 2018)
  - ▶ Evidence from job postings
    - ★ Gender discrimination in China (Kuhn and Shen, 2013; Helleseter, Kuhn and Shen, 2018)
  - ▶ Evidence from observational data
    - ★ Discrimination in the hiring process (Bagues and Esteve-Volart, 2010; Goldin and Rouse, 2000; Neumark, Bank and Nort, 1996)
  - ▶ Evidence from administrative data
    - ★ Gender wage gap (Chen, Zhang and Zhou, 2018) and gender inequality (Kleven, Landais, and Søgaard, 2019)

  - ▶ Our study is the first to causally examine the impact of fertility policy change on wage discrimination using administrative data
  - ▶ We not only investigate the effect of fertility relaxation on the salaries of new hires, but also examine such effect on the number of new hires and job leavers

# Contributions

- Our results are more consistent with *statistical* discrimination on female employees at fertility age after the relaxation of fertility restrictions
  - ▶ Discussions on different types of discriminations, in particular, taste discrimination versus statistical discrimination (Foster and Rosenzweig, 1996; Bertrand and Mullainathan, 2004; Carlsson and Rooth, 2012; Mobius and Rosenblat, 2006; Zschirnt and Ruedin, 2016)
  - ▶ The advantage of our setting is that the policy shock exogenously gives a (noisy) productivity signal to a specific group of employees
  - ▶ We also acknowledge that our results cannot rule out taste-based discrimination

# Policy Background

- One-child Policy in China
  - Implemented in 1979 (Gu, Wang, Guo, and Zhang, 2007; Hesketh, Lu, and Xing, 2005; Zhang, 2017)
  - A married couple could have at most one child in urban China
  - Exclusions: rural areas; minorities; both parents were only child (started before 2000)

- Relaxation of One-child Policy
  - China's total fertility rate dropped to 1.18 in 2010, far below replacement level
  - Announced in Nov 2013 (the Third Plenum of the 18th Central Committee of the Chinese Communist Party)
  - Families can have two children if one parent was an only child
  - On average, around 2,500 couples every month applied for the second child in the first year after the policy in our sample city
  - Starting from Jan 2016: universal two-child policy

# Data

- Housing Provident Fund Data
  - It is compulsory for all employees to monthly contribute part of their salaries to the HPF accounts
  - Administrative data that covers all the employees contributing HPF in a major city
    - 138,532,302 employee-month observations from 2012 to 2014, covering 5.4 million employees from more than 100,000 employers
  - We can infer the salary of the new hires from the deposit records
    - Deposit = base salary * 12% * 2
    - Base salary, existing employees: average monthly salary in the last calendar year (annually adjusted every July)
    - Base salary, new hires: current monthly salary
  - Individual attributes, including salary, age and gender
  - Employer information, including sector and industry

# Data
## Data Cleaning

- We exclude the observations with abnormal attributes

| Processing Procedure | Sample Size (million) | | |
| --- | --- | --- | --- |
| | All | New Hire | Job Leaver |
| Raw dataset | 138.53 | 3.49 | 2.81 |
| 1. Drop employees with salary beyond the reasonable range | 110.27 | 2.95 | 2.25 |
| 2. Drop employees more than 50 years old | 100.88 | 2.90 | 2.13 |
| 3. Drop employers with less than 5 employees | 94.99 | 2.60 | 1.90 |
| 4. Require that the ratio between the number of new hires by gender and the employer size (i.e., number of total employees) is no more than 1.0 every month; the number of new hires by gender is no more than 100 every month | 76.73 | 1.87 | 1.45 |
| 5. Require that the ratio between job leavers by gender and the number of total employees is no more than 0.5 every month | 73.51 | 1.74 | 1.22 |
| 6. Require that all employers have hiring records in consecutive years | 72.37 | 1.72 | 1.21 |
| 7. Require that all employers have consecutive employment records in consecutive years | 72.37 | 1.72 | 1.21 |
| Working dataset | 72.37 | 1.72 | 1.21 |

# Identification Strategy

Research Design

- Compare the outcomes on female (treated) and male (control), before and after the policy (DID)

$$Y_{ijt} = \beta FEMALE_i * POST_t + \alpha_j + \delta_t + \gamma_{jt} + \eta_{it} + \epsilon_{ijt}$$

  - $i$ refers to gender; $j$ represents employer; $t$ indexes the year-quarter
  - The standard errors are clustered at the employer-level

- Three outcomes at employer-quarter level
  - Major interest: Average salary of new hires (by gender)
  - Number of new hires (by gender) normalized by employer size
  - Number of job leavers (by gender) normalized by employer size

- Assumption: the three outcomes for female and male share parallel trend before the announcement of policy shock

# Identification Strategy
## Research Design
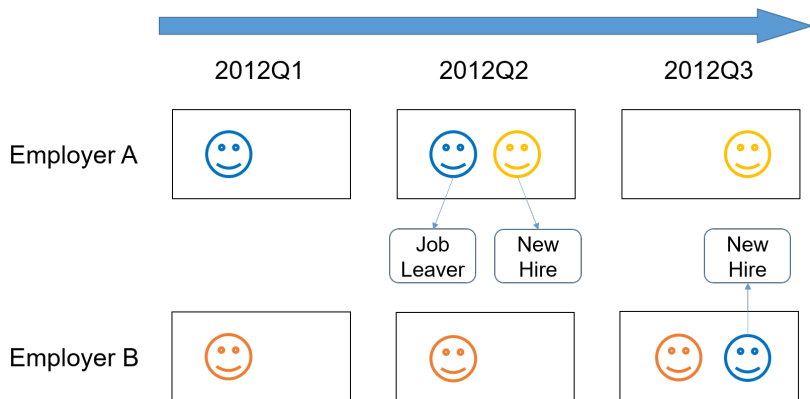
# Data
Summary Statistics

| Full | # of emp. | Before | | | # of emp. | After | | |
|---|---|---|---|---|---|---|---|---|
| | | Obs | Mean | SD | | Obs | Mean | SD |
| Salary | 31,134 | 201,205 | 3844.88 | 2486.069 | 33,609 | 156,596 | 4460.136 | 3128.74 |
| New Hire | 33,590 | 426,602 | 0.054 | 0.116 | 39,171 | 364,792 | 0.051 | 0.121 |
| Leave | 33,590 | 426,602 | 0.031 | 0.061 | 38,182 | 287,066 | 0.036 | 0.070 |
| Female | # of emp. | Obs | Mean | SD | # of emp. | Obs | Mean | SD |
| Salary | 29,241 | 99,929 | 3695.472 | 2359.391 | 30,202 | 77,211 | 4212.26 | 2875.57 |
| New Hire | 33,590 | 213,301 | 0.052 | 0.112 | 39,171 | 182,396 | 0.048 | 0.113 |
| Leave | 33,590 | 213,301 | 0.030 | 0.06 | 38,182 | 143,533 | 0.035 | 0.069 |
| Male | # of emp. | Obs | Mean | SD | # of emp. | Obs | Mean | SD |
| Salary | 28,991 | 101,276 | 3992.3 | 2596.63 | 30,108 | 79,385 | 4701.225 | 3339.11 |
| New Hire | 33,590 | 213,301 | 0.057 | 0.119 | 39,171 | 182,396 | 0.055 | 0.128 |
| Leave | 33,590 | 213,301 | 0.031 | 0.062 | 38,182 | 143,533 | 0.037 | 0.071 |

# Raw Trend: Logged Salary
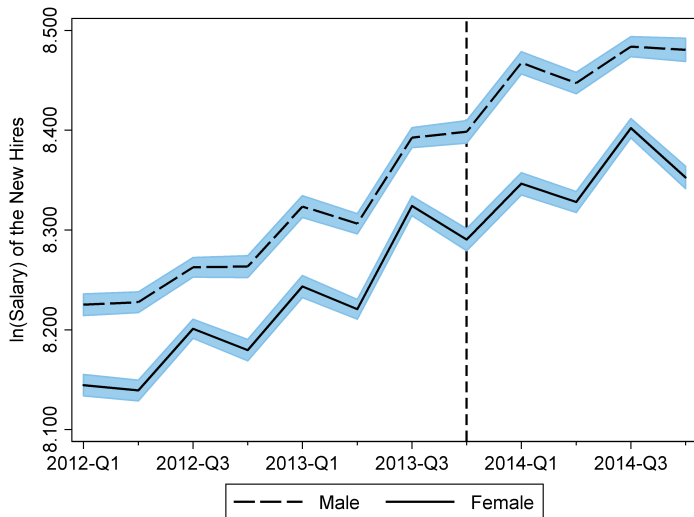
# Raw Trend: New Hire

Continued
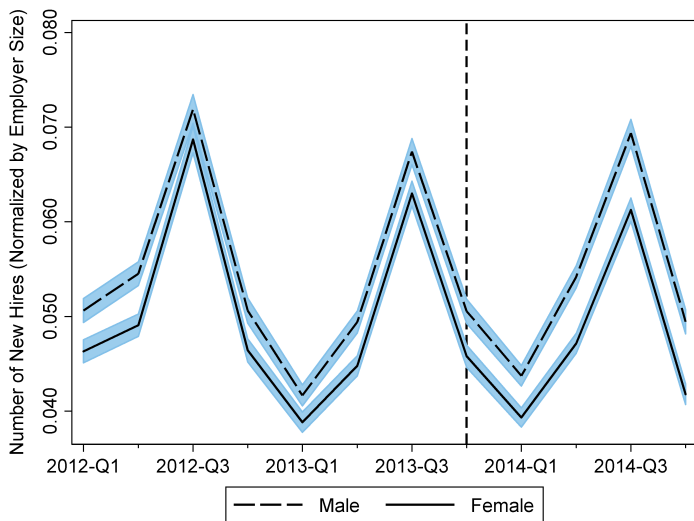
# Raw Trend: Jobs Leaver

Continued
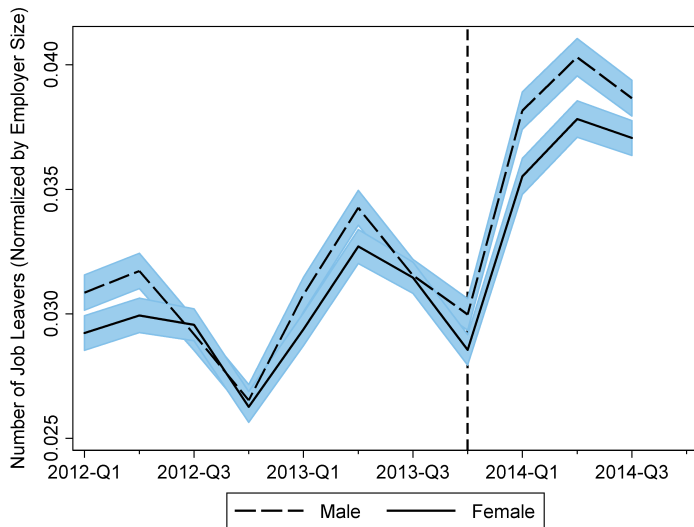
# Main Results
Employer-Quarter Level

- The salary of female new hire is reduced by 1.2%
  - Accounting for 22% (1.2%/5.5%) of gender wage gap in this sample
- Employers hire 4.4% fewer female relative to male
- Female job leavers are reduced by 4.3% relative to male

| | ln(Salary) | ln(Salary) | New Hire | New Hire | Leave | Leave |
|---|---|---|---|---|---|---|
| Female×Post | -0.0137*** | -0.0117*** | -0.0023*** | -0.0023*** | -0.0012*** | -0.0013*** |
| | (0.0021) | (0.0022) | (0.0004) | (0.0004) | (0.0003) | (0.0003) |
| N | 356,057 | 318,533 | 791,394 | 791,394 | 713,668 | 713,668 |
| R-sq | 0.7225 | 0.8554 | 0.2948 | 0.6221 | 0.2570 | 0.5240 |
| Benchmark | 3695.472 | 3695.472 | 0.0523 | 0.0523 | 0.0303 | 0.0303 |
| Relative Effect | -0.0136 | -0.0116 | -0.0440 | -0.0440 | -0.0396 | -0.0429 |
| Year*Qtr FE | Y | Y | Y | Y | Y | Y |
| Emp. FE | Y | N | Y | N | Y | N |
| Emp.*Year FE | N | Y | N | Y | N | Y |
| Emp.*Qtr FE | N | Y | N | Y | N | Y |
| Female*Qtr FE | N | Y | N | Y | N | Y |

# Event Study
## Salary of New Hire

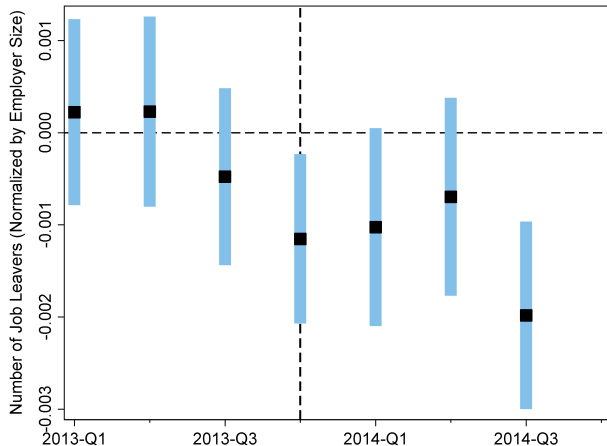We use year 2012 as the baseline year
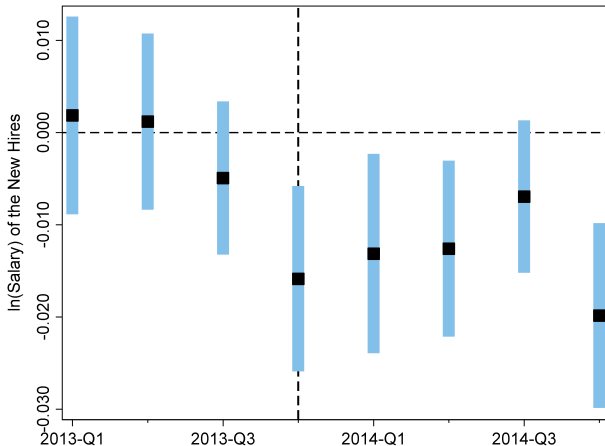
# Event Study

## New Hire

We use year 2012 as the baseline year
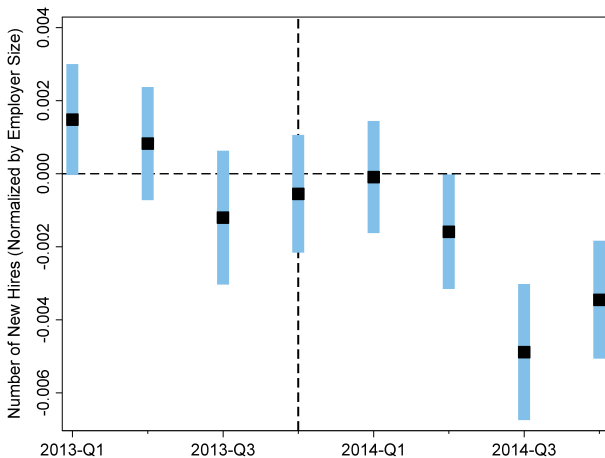
# Event Study

We use year 2012 as the baseline year

# Robustness Check
Alternative Interpretations

- Gender substitution: Salaries of male new hires increase after the policy change?
  - ▶ Use an event study by gender to rule out this alternative interpretation

- Labor quality change: The quality of female new hires declines after the policy?
  - ▶ Use the salary of the previous employer as a proxy for their quality
  - ▶ Use the employee fixed effects to control for their quality

- Labor effort change: Females reduce their labor effort after the policy?
  - ▶ Use a panel dataset from CFPS for 2010, 2012, and 2014 to rule out this alternative interpretation

# Robustness Checks: Gender Substitution
Specification

- We investigate whether the effects are driven by the males by an event study for the salary of each gender

$$Y_{jt} = \lambda POST_t + f(d_{jt}) + \alpha_j + \epsilon_{jt}$$

  ▶ Bandwidth: 3 or 4 quarters
  ▶ Polynomial degrees: According to AMSE from 500-fold cross-validation estimates by bandwidth and polynomial degree (Zimmerman, AER, 2019)
  ▶ The standard errors are clustered at the employer-level

## Robustness Checks: Gender Substitution
Results

- Almost all of the coefficients are significantly negative, while the coefficients for female are smaller than them for male
- The effects seem not likely to be driven by the males

| Degree Three | DV: ln(Salary) | | | |
|---|---|---|---|---|
| Post | -0.0189*** | -0.0250*** | -0.0108* | -0.0070 |
| | (0.0057) | (0.0049) | (0.0058) | (0.0051) |
| N | 100,168 | 128,314 | 102,642 | 131,439 |
| R-sq | 0.7797 | 0.7659 | 0.7824 | 0.7707 |
| Bandwidth | 3 | 4 | 3 | 4 |
| Gender | Female | Female | Male | Male |
| Emp. FE | Y | Y | Y | Y |

Other Outcomes

# Robustness Checks: Labor Quality Change

Individual-Level Analysis

- Columns 1-3: individual-employer-quarter level; Column 4-5: panel data at individual-employer-year level
- The effect is still significantly negative controlling for past salary
- The effect is still significant if controlling for employee fixed effects

| | ln(Salary) | ln(Salary) | ln(Past Salary) | ln(Salary) | ln(Salary) | ln(Salary) |
|---|---|---|---|---|---|---|
| Female×Post | -0.0043* | -0.0190*** | -0.0156*** | -0.0139*** | -0.0152*** | -0.0146*** |
| | (0.0026) | (0.0027) | (0.0030) | (0.0024) | (0.0020) | (0.0021) |
| N | 552,650 | 795,886 | 795,886 | 795,886 | 6,557,783 | 1,207,195 |
| R-sq | 0.7871 | 0.7209 | 0.4742 | 0.7752 | 0.9562 | 0.9247 |
| Control | Year*Qtr FE | Year*Qtr FE | Year*Qtr FE | Year*Qtr FE | Employee FE | Employee FE |
| | Emp.*Year FE | Emp.*Year FE | Emp.*Year FE | Emp.*Year FE | Emp.*Year FE | Emp.*Year FE |
| | Emp.*Qtr FE | Emp.*Qtr FE | Emp.*Qtr FE | Emp.*Qtr FE | | |
| | Female*Qtr FE | Female*Qtr FE | Female*Qtr FE | Female*Qtr FE | | |
| | Demographic | Demographic | Demographic | Demographic | | |
| | | | | Year FE (Past) | | |
| | | | | ln(Past Salary) | | |
| Sample | Fresh Grad | Job Switcher | Job Switcher | Job Switcher | Full Sample | Job Switcher |

# Robustness Checks: Labor Effort Change

Specification

- We analyze the impact of fertility relaxation on working hours using an individual-year level panel data from China Family Panel Studies for 2010, 2012, and 2014

$$Y_{it} = \beta_1 FEMALE_i * POST_t + \beta_2 X_{it} + \alpha_i + \delta_t + \epsilon_{it}$$

  - $i$ refers to individual; $t$ indexes the year
  - $X_{it}$ represents the demographic characteristics; $\alpha_i$ refers to individual fixed effects; $\delta_t$ refers to year fixed effects
  - The standard errors are clustered at the individual-level

  - Daily working hours are winsorized at 1 and 99 percentage level
  - The balanced panel dataset contains 902 individuals in three waves
    - ⋆ The individuals work in the urban areas and aged from 23 to 35 years old in 2013
    - ⋆ The self-employed individuals are excluded
    - ⋆ The individual has no more than one child in 2012

Sum Stat

# Robustness Checks: Labor Effort Change

Results

- The policy shock would not significantly reduce female labor effort

| Panel A | Working Hours | Working Hours | ln(Working Hours) | ln(Working Hours) |
|---|---|---|---|---|
| Female × Post | 0.0315 | -0.0017 | 0.0238 | 0.0170 |
| | (0.1843) | (0.1852) | (0.0399) | (0.0402) |
| N | 2,706 | 2,706 | 2,706 | 2,706 |
| R-sq | 0.4680 | 0.4698 | 0.4572 | 0.4591 |
| # of Kid in 2012 | 0/1 | 0/1 | 0/1 | 0/1 |
| Panel B | Working Hours | Working Hours | ln(Working Hours) | ln(Working Hours) |
| Female × Post | 0.1972 | 0.1849 | 0.0631 | 0.0610 |
| | (0.2632) | (0.2649) | (0.0543) | (0.0546) |
| N | 1,542 | 1,542 | 1,542 | 1,542 |
| R-sq | 0.4368 | 0.4379 | 0.4291 | 0.4303 |
| # of Kid in 2012 | 1 | 1 | 1 | 1 |
| Demographic | N | Y | N | Y |
| Individual FE | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y |

# Robustness Checks: Exposure to the Policy Shock
Specification

- We provide evidence that lower salary of female new hires after the policy change is related to concern about the increasing fertility of females

$$Y_{ijt} = \beta EXPOSURE_{it} * POST_t + \alpha_j + \delta_t + \eta_{it} + \gamma_{jt} + \theta X_{it} + \epsilon_{ijt}$$

  - $EXPOSURE_{it}$ is the probability of having a second child in 2010, conditional on having one child in 2009, by age and industry
    - Based on the micro-level dataset of the 2010 population census in the four municipalities and 22 provincial capitals
  - $X_{it}$ represents the demographic characteristics
  - $\eta_{it}$ refers to age-quarter fixed effects
  - The standard errors are clustered at the employer-level

  - Compare the outcome on female with different probability before and after the policy

# Robustness Checks: Exposure to the Policy Shock
Results

- The salary reduction is stronger for females who are more likely to have a second child

| VARIABLES | Mean | SD | p25 | p50 | p75 | p90 | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Exposure | 0.01 | 0.04 | 0 | 0 | 0 | 0.02 | 0 | 0.50 |

| VARIABLES | ln(Salary) | ln(Salary) |
|---|---|---|
| Exposure × Post | -0.0790** | -0.0661** |
| | (0.0333) | (0.0329) |
| N | 259,516 | 259,516 |
| R-sq | 0.7325 | 0.7391 |
| Demographic | Y | Y |
| Year*Qtr FE | Y | Y |
| Emp.*Year FE | Y | Y |
| Emp.*Qtr FE | Y | Y |
| Age*Qtr FE | N | Y |

# Other Robustness Checks

- We use the alternative sets of fixed effects
- We use weighted OLS regressions by gender-specific employer size
- We change the frequency of aggregation from quarterly to monthly and semi-yearly
- We exclude the employers with fewer than 3 employees instead of 5 employees
- We exclude the observations in the fourth quarter
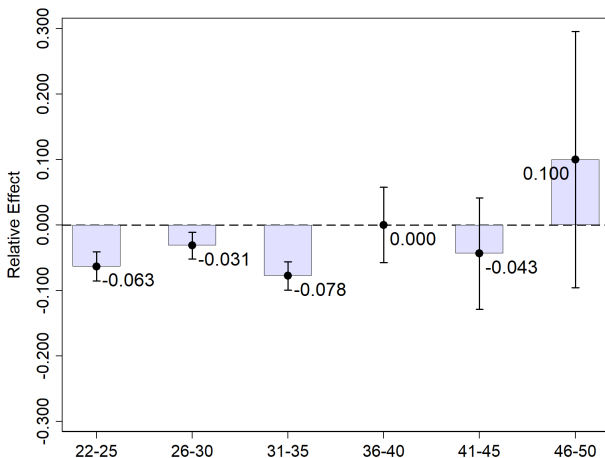
# Heterogeneous Effect: by Age

## Salary of New Hire
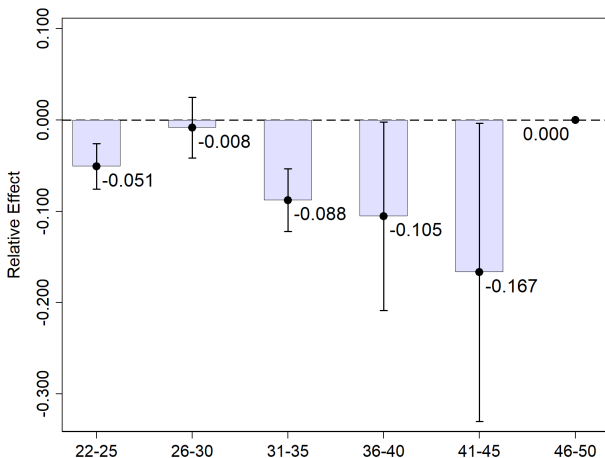
We divide employees into six age groups
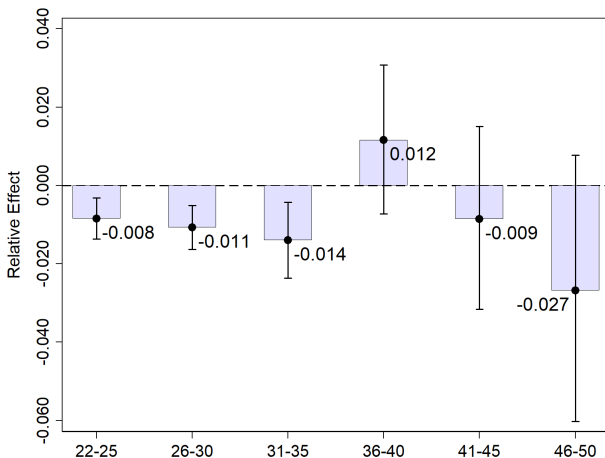
# Heterogeneous Effect: by Age

New Hire

We divide employees into six age groups

# Heterogeneous Effect: by Age

## Jobs Leaver

We divide employees into six age groups

# Heterogeneous Effect: by Age

Gender Wage Gap of New Hires by Age
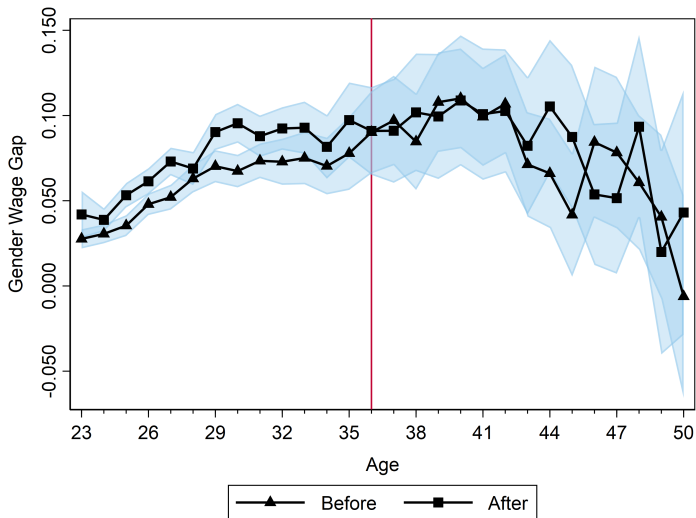
# Heterogeneous Effect: New vs. Existing Employers
Employers Entry and Exit

- The employers appearing only after the policy change are mainly POEs with lower female to male employee ratios

| Total Number | | Before & After 33,236 | Only Before 354 | Only After 5,935 |
|---|---|---|---|---|
| Employer's Sector | Public | 5,915 | 13 | 191 |
| | POE | 15,440 | 243 | 4,684 |
| | SOE | 2,493 | 11 | 175 |
| | Joint Venture | 3,821 | 45 | 242 |
| Female % | | 0.4958 | 0.5012 | 0.4583 |

# Heterogeneous Effect: New vs. Existing Employers
### Balanced Panel

- Large employers may respond to the policy change by cutting the salary of female new hires
- Small employers may respond to the policy change by reducing the headcount of female new hires

| | ln(Salary) | ln(Salary) | New Hire | New Hire | Leave | Leave |
|---|---|---|---|---|---|---|
| Female×Post | -0.0168*** | -0.0145*** | 0.0005* | 0.0004 | -0.0009*** | -0.0010*** |
| | (0.0024) | (0.0026) | (0.0003) | (0.0003) | (0.0002) | (0.0002) |
| N | 282,946 | 254,389 | 659,928 | 659,928 | 604,934 | 604,934 |
| R-sq | 0.7097 | 0.8440 | 0.2104 | 0.4612 | 0.2369 | 0.4625 |
| Benchmark | 3730.274 | 3730.274 | 0.0390 | 0.0390 | 0.0286 | 0.0286 |
| Relative Effect | -0.0167 | -0.0144 | 0.0128 | 0.0103 | -0.0315 | -0.0350 |
| Year*Qtr FE | Y | Y | Y | Y | Y | Y |
| Emp. FE | Y | N | Y | N | Y | N |
| Emp.*Year FE | N | Y | N | Y | N | Y |
| Emp.*Qtr FE | N | Y | N | Y | N | Y |
| Female*Qtr FE | N | Y | N | Y | N | Y |

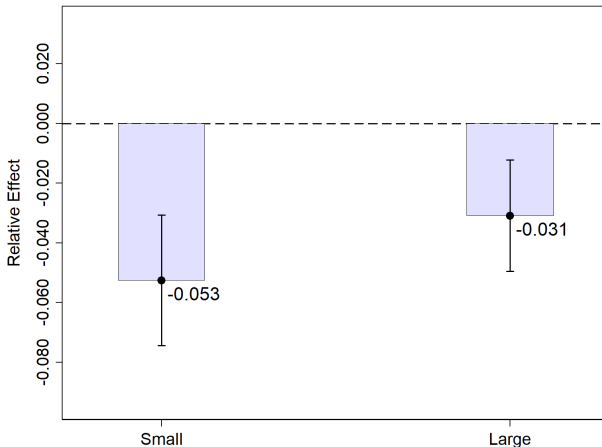# Heterogeneous Effect: Large vs. Small Employers

Salary of New Hire

Median employer size: 29.5 in 2012; 26 in 2013; 22 in 2014
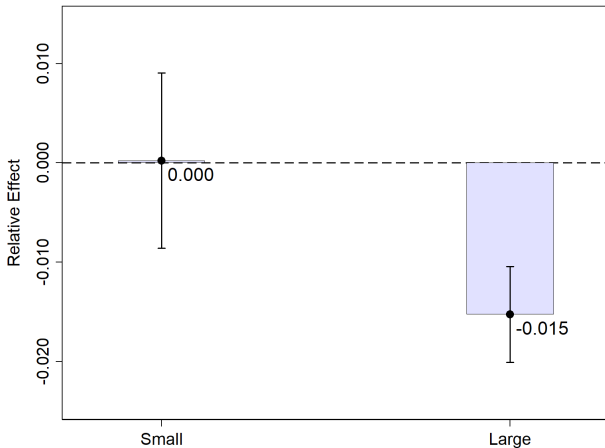
# Heterogeneous Effect: Large vs. Small Employers
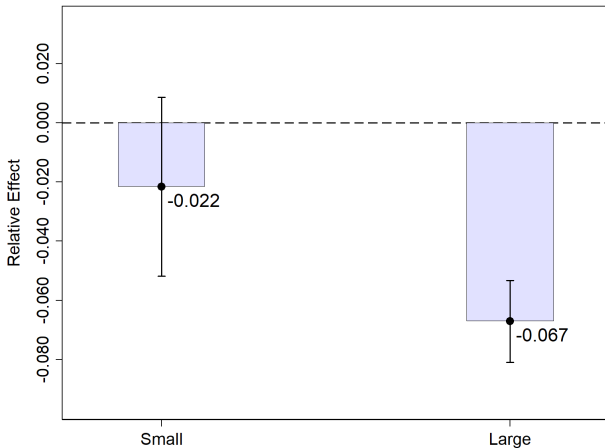
## New Hire

Median employer size: 29.5 in 2012; 26 in 2013; 22 in 2014

# Heterogeneous Effect: Large vs. Small Employers

Jobs Leavers

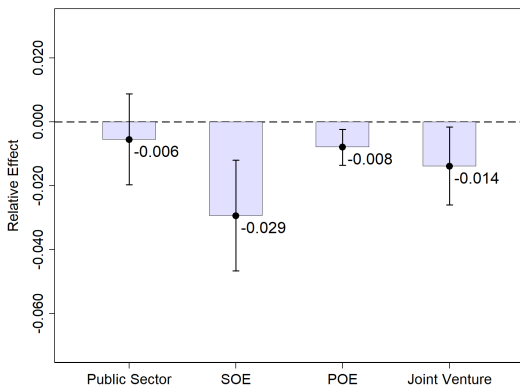Median employer size: 29.5 in 2012; 26 in 2013; 22 in 2014

# Heterogeneous Effect: by Sector

Salary of New Hire

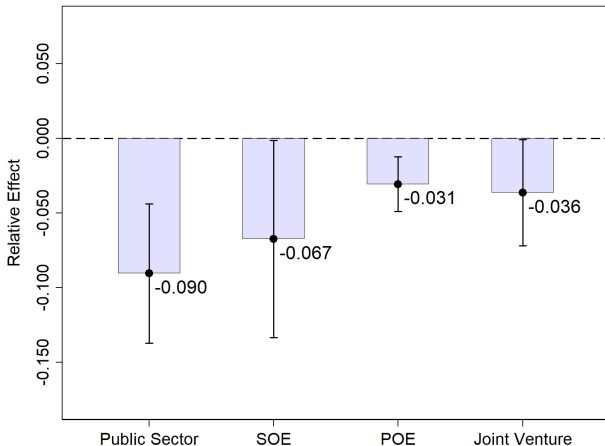Four sectors: public sector, SOE, POE, JV

- Possible explanation: higher probability of having a second child in SOEs due to better welfare packages
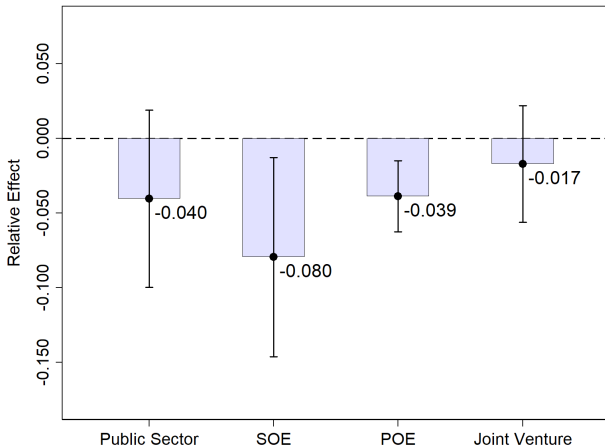
# Heterogeneous Effect: by Sector

New Hire

Four sectors: public sector, SOE, POE, JV

# Heterogeneous Effect: by Sector

Jobs Leaver

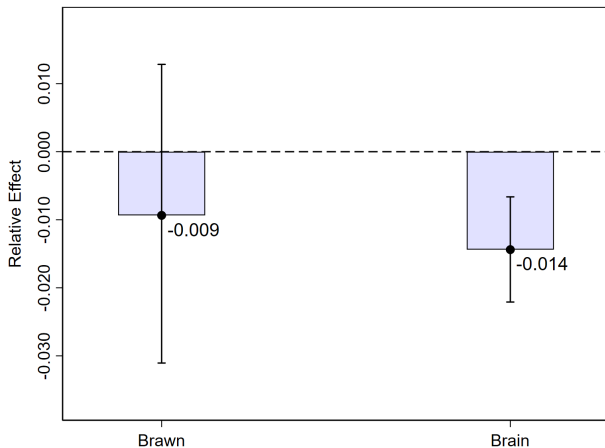Four sectors: public sector, SOE, POE, JV

# Heterogeneous Effect: by Industry

Salary of New Hire

"Brawn" (containing the primary and secondary industries)

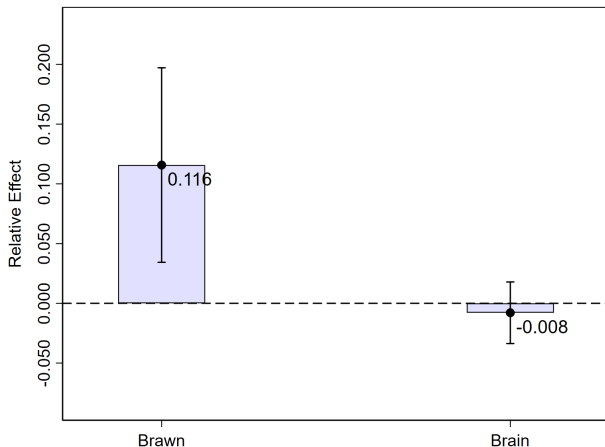"Brain" (including all service industries and the public sectors)

# Heterogeneous Effect: by Industry

New Hire

"Brawn" (containing the primary and secondary industries)

"Brain" (including all service industries and the public sectors)

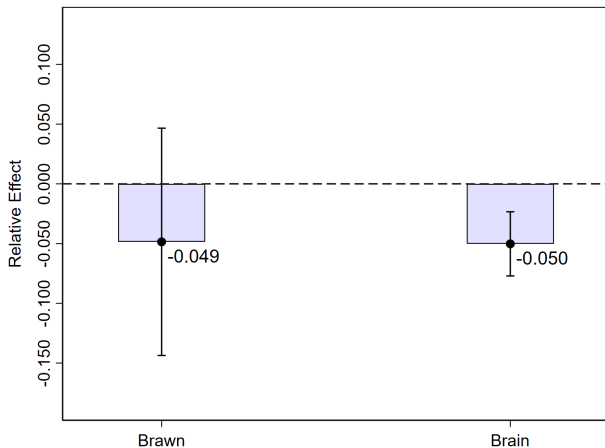The "brawn" industries hire more females in age cohorts 22-25 and 46-50

# Heterogeneous Effect: by Industry

Jobs Leaver

"Brawn" (containing the primary and secondary industries)
"Brain" (including all service industries and the public sectors)

# Conclusion

- Discrimination on females after fertility relaxation accounts for 22% (1.2%/5.5%) of gender wage gap in our sample
- 1950 (=0.0023*64.351*39,525/3) female employees are less likely to be hired per month post-policy
- 1059 (=0.0013*64.351*37,986/3) female employees are less likely to quit their jobs per month post-policy

- They are the unintended consequence of fertility relaxation policy on females (who may not even plan for a second child)
- Policy makers may devote more effort towards a non-discriminative labor market

Thank you!

Questions and Comments:

ikeyangli@gmail.com

# Robustness Checks: Gender Substitution

| Degree One | DV: New Hire | | | |
|---|---|---|---|---|
| Post | -0.0180*** | -0.0070*** | -0.0178*** | -0.0055*** |
| | (0.0008) | (0.0007) | (0.0009) | (0.0008) |
| N | 238,513 | 308,072 | 238,513 | 308,072 |
| R-sq | 0.3735 | 0.3504 | 0.3793 | 0.3596 |
| Degree Three | DV: Leave | | | |
| Post | -0.0083*** | -0.0066*** | -0.0075*** | -0.0051*** |
| | (0.0006) | (0.0006) | (0.0006) | (0.0006) |
| N | 238,513 | 268,597 | 238,513 | 268,597 |
| R-sq | 0.3646 | 0.3485 | 0.3683 | 0.3517 |
| Bandwidth | 3 | 4 | 3 | 4 |
| Gender | Female | Female | Male | Male |
| Emp. FE | Y | Y | Y | Y |

Back

# Robustness Checks: Labor Quality Change

Summary Statistics

| Zero/one kid in 2012 | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Working Hours | 2,706 | 5.6761 | 2.7085 | 1.1429 | 12.2301 |
| Female | 2,706 | 0.4834 | 0.4998 | 0 | 1 |
| Married | 2,706 | 0.6707 | 0.47 | 0 | 1 |
| Children | 2,706 | 0.5628 | 0.4961 | 0 | 1 |
| Age | 2,706 | 28.2764 | 4.039 | 20 | 36 |
| One kid in 2012 | Obs | Mean | Std. Dev. | Min | Max |
| Working Hours | 1,542 | 5.9241 | 2.7725 | 1.1429 | 13.8082 |
| Female | 1,542 | 0.537 | 0.4988 | 0 | 1 |
| Married | 1,542 | 0.9514 | 0.2152 | 0 | 1 |
| Children | 1,542 | 0.9222 | 0.268 | 0 | 1 |
| Age | 1,542 | 30.1005 | 3.3988 | 20 | 36 |

Back