A House for My Family: the Impacts of Down Payment Rate on Marriage and Fertility

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May 2024

Intro

Motivation

- "... many young people opt out of marriage because they cannot afford to buy a house" – Barrons (2023)
- "You have to lie flat in your career, and then you also have to lie flat for marriage and childbirth, because you don't have the money to have children and get married" – Voice of America News (2024)
    - "Lying flat": rejecting intense competition or social expectations
- "Financial concerns also led people to have fewer children than what they considered to be ideal" – NY Times (2018)
- "Cost-of-living crisis means more Canadians are putting parenthood on pause" – CBC (Canadian Broadcasting Corporation) (2023)

Effect of housing price on fertility: mixed evidence

- Housing price $\rightarrow$ fertility rates ($-$) for **non-owners**
  - ▶ Dettling and Kearney, 2014 JPubE (US); Atalay et al., 2021 JHousingE (Australia); Liu et al., 2020 CER (China)
- Housing price $\rightarrow$ fertility rates ($+$) for **owners** in developed countries
  - ▶ Lovenheim and Mumford, 2013 ReStat (US); Dettling and Kearney, 2014 JPubE (US); Daysal et al., 2021 JPubE (Denmark); Atalay et al., 2021 JHousingE (Australia)
- Housing price $\rightarrow$ fertility rates ($-$) for **owners** in China: Liu et al., 2023 JPopE

Two forces behind the effect of housing price on fertility

- Negative price effect
    - Negative substitution effect on the demand for children
    - Housing is a major cost associated with (additional) children
    - **potential first-time homeowners**
    - **current homeowners who need extra space**
- Home equity effect
    - **Homeowners** use new housing equity to fund childbearing needs
    - Wealth effect AND equity extraction effect
- Housing price effects difficult to interpret
    - price effect ($-$) and home equity effect ($+$)
    - Homeowners self-selected
        - ⋆ future parents buy homes $\rightarrow$ housing price effects biased towards zero

Down Payment Rate v.s. Housing Price

- Down payment requirement is a liquidity constraint
  - ▶ Housing price: changes the housing wealth and child costs
  - ▶ Down payment rate: short-run cash constraint, uncorrelated with housing wealth
- Type of effect is different
  - ▶ Housing price: affects total fertility through price/housing wealth effect
  - ▶ Down payment rate: affects fertility timing (liquidity constraint)
- It's important to study DPR effects in the context of fertility
  - ▶ No causal studies so far, we are the first
- Example: Size of cash requirement is large
  - ▶ In 2014 Shanghai, city-average housing price was CNY 30,779 per sqm
  - ▶ Consider a typical 90 square meters apartment with 30% DPR
  - ▶ Minimum down payment is CNY 831, 003 = 30% × 90 × 30779
  - ▶ 12.7 times the average annual wage (CNY 65,417) in Shanghai

This study

- Research question: what are the causal effects of down payment rate (DPR) policy on marriage and fertility?
  - First-marriage, first-birth, and higher-order-birth decisions
- Our study:
  - CFPS data 2010-2020, city-year DPR 2008-2020, city-year housing price index 2010-2020
  - Urban women aged 22-45 in 20 cities (first- and second-tier cities)
  - Flow outcome analysis using fixed effects model
- Methodological novelties
  - 1. Constructed annualized panel of marriage and birth flows (2008-2020)
  - 2. Unique policy data: hand-collected city-year level DPR 2008-2020
    - ⋆ DPR and housing price jointly considered
  - 3. First decomposition of the housing market effect on three margins of fertility
    - ⋆ Marriage, extensive margin, and intensive margin

Methodological novelty: Panel of marriage and births flow

- We argue that analyses need to be on a panel of flows, rather than stocks
  - ▶ In each year, policies affect the transitional flows of marriage and births during that year
  - ▶ Over years, the flows in different directions are accumulated into stocks

- Flow of marriage and fertility during each 12-month window are based on the information on the timing of first marriage and each birth
  - ▶ To our understanding, this is the first time *[we need to confirm]* that annualized flows of first marriage are identified for all ever-married women in the CFPS data
  - ▶ We carefully remove step-children by restricting the sample to gene-member women

Methodological novelty: Identification

- Plausibly exogenous variations
  - ▸ city-level DPR
    - ⋆ DPR policy-making is a top-down process to control housing price
    - ⋆ policy timing is exogenous
    - ⋆ DPR is unlikely a direct response to local marriage and fertility rates
  - ▸ city-level Housing Price Index (reasonably exogenous)
    - ⋆ an individual household should not influence the local housing market
- Model specification
  - ▸ Linear probability model with fixed effects and city-specific linear time trends
  - ▸ DPR and housing price jointly considered
- Source of identification
  - ▸ Exogenous DPR and HPI variations within city and year

Methodological novelty: Three margins of fertility

- Fertility can be affected through three mechanisms
- Three margins of fertility
  - ▶ Marriage: an extra margin prior to carrying out fertility plans
  - ▶ Extensive fertility margin: whether to have a child (first birth)
  - ▶ Intensive fertility margin: how many children to have (higher-order births)
- Differential effects of an overheated housing market
  - ▶ Marriage: $\rightarrow$ marriage market success $(+/-)$
  - ▶ Extensive fertility margin: $\rightarrow$ timing of first birth $(-)$
  - ▶ Intensive fertility margin: $\rightarrow$ number of higher-order births $(-)$
- East Asian social norms
  - ▶ A family home is a prerequisite for marriage
  - ▶ Marriage is a prerequisite for childbearing (single mothers are scarce)

Effect of credit condition on various outcomes

- LTV policy loosening $\rightarrow$ mortgage expansion: Chen et al., 2020 NBERWP
- credit expansion $\rightarrow$ price-rent ratio (+): Greenwald and Guren, 2021 NBERWP
- required down payment $\rightarrow$ ownership intention (−): Fuster and Zafar, 2016 AER
- credit tightening $\rightarrow$ ownership rates (−): Acolin et al., 2016 AER
- mortgage subsidy $\rightarrow$ home ownership (+) and marriage (+): Ricks, 2021 RSUE
- relaxation of down payment constraints $\rightarrow$ WTP for a home (+): Fuster and Zafar, 2021 AEJ-Policy
- household debt to GDP ratio$\rightarrow$ economic growth (−): Mian et al., 2017 QJE
- relaxation of financing constraints $\rightarrow$ housing boom: Favilukis et el., 2017 JPE

- None has looked at fertility

Fertility and housing market: Evidence from China

- Liu et al., 2020 CER
  - ▶ house price → fertility response (−) among renter families
  - ▶ response is insignificant for home owning families
  - ▶ Data: 2010 census
- Liu et al., 2023 JPopE
  - ▶ house price → fertility response (−) among home-owning women
  - ▶ Data: CFPS (2010, 2012, 2014, 2016, and 2018)
- Ge and Zhang, 2019 Population Research (in Chinese)
  - ▶ housing price → probability of having children (−)
  - ▶ housing price → age of first birth (−)
  - ▶ Data: 2014 CFPS
- Zhang et al., 2023 Population Research (in Chinese)
  - ▶ housing price → probability of having children (−)
  - ▶ housing price → marriage rate (−)
  - ▶ Data: 2010-2018 CFPS

Preview of Findings

- Main takeaway: credit constraint on housing lowers fertility on the extensive margin
  - ▶ DPR (+) 1% → first birth (−) 1.1 percentage points
  - ▶ No effect from housing price
  - ▶ Women with education, 25 or older, rural hukou
- Main takeaway: housing price increase lowers fertility on the intensive margin
  - ▶ Housing price (+) 1% → higher-order birth (+) 0.16 percentage points
  - ▶ No effect from first purchase DPR
  - ▶ Educated women, aged under 35, urban hukou
- Policy implications
  - ▶ down payment subsidy for families with no children
  - ▶ home equity loans for families with one or more child

Content

- Institutional Background
- Data and Empirical Method
- Results
- Conclusion

Institution

Institutional Background

- China's housing policies by 3 goals:
  - ▶ (1) To promote home ownership: housing market privatization
  - ▶ (2) To improve housing affordability: affordability housing policy and housing provident fund (HPF)
  - ▶ (3) Housing market regulation: mortgage interest rate policy, credit policy (down payment rate policy), tax policy etc.
- 3 types of mortgage:
  - ▶ (1) An HPF loan with interest rate, down payment rate and maximum loan value ruled by the Housing Fund Management Center
  - ▶ (2) A commercial loan with interest rate and down payment rate set by the central bank, The People's Bank of China
  - ▶ (3) A combination loan of HPF and commercial, which takes up a very small share of mortgages due to difficulty of processing

Share of different types of mortgage
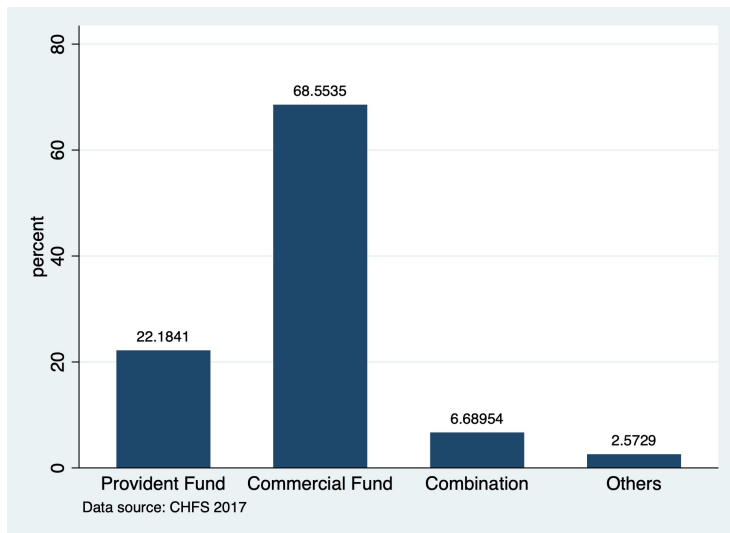
DPR policy for first purchase 2000-2020

- Earliest record: November 2001, DPR set at 20% nationally
- Tightening: March 2005, DPR raised to 30% in the major cities
- Loosening: October 2008, DPR lowered to a national 20%
- Tightening: April 2010, 30% DPR for housing units over 90 sqms, and in September 2010, 30% for all first purchases
- Loosening: September 2015, DPR changed to 25% in cities without housing purchase restrictions
- DPR localized in the major cities since 2015
- Tightening: December 2016, "houses are for living in, not for speculation", city-specific DPR 20%-35% in major cities

Data

The CFPS Panel

- CFPS 2010, 2012, 2014, 2016, 2018, 2020 Waves

- Retrospective information on women's marriage and fertility histories
  - Timing of first marriage and each birth
  - Converted into flows of marriage and fertility during each calendar year

- Reference women's year of birth, ethnicity, their own and parents' education level

Construction of Annual Fertility Flows

- We assume each women started without children at the beginning of the calendar year during which she turned 16
  - ▶ Exclude individuals who reported giving birth before 16

- For each following calendar year, we determine from the retrospective data how many children she gave birth to during the year

- To confirm biological relationship between mothers and children, we follow the following procedure:
  - ▶ In the 2010 wave, there is a variable indicating whether each mother-child relationship is biological
  - ▶ In the following waves, we keep only mother who are gene members of the survey, and count only her gene-member children (which include biological and adopted children; unfortunately, we are unable to distinguish the two, causing measurement errors in biological children).

Construction of Annual Marriage Flows

- We assume each women started unmarried at the beginning of the calendar year during which she turned 16
    - Exclude individuals who report getting married before 16

- For each following calendar year, we determine from the retrospective data whether she started or ended her first marriage during the year. The specific variables for the starting year and ending year for each women depends on her realized branches of the decision tree in the survey, which in turn, depends on
    - Current marital status (never-married, married, cohabiting, divorced, widowed)
    - Whether she was a respondent in any previous wave, and her marital status in the last observed wave
    - Whether the current marriage or previous marriage is her first marriage
    - How she responded in the confirmation modules that check the correctness and consistency in her previous answers
    - Decision trees in questionnaires differ across waves

Sample Restrictions

- Common for both fertility and first-marriage sample
  - Women born during 1971-1995
  - Ages 22-45
  - Non-missing values on age, education, whether first marriage started or ended, year of the start and end if it did, year and gender of each birth if there is any
  - Living in places where she was born during all observed waves
  - Living in the 20 cities where the down payment policy information are available

- Only for fertility sample
  - Did not give birth last year

- Only for first-marriage sample
  - Never-married at the beginning of the calender year

Outcome Variables

- Fertility in the next year
    - ▸ A dummy indicating whether the women will give birth in the next calendar year, conditioning on parity
    - ▸ Starts at zero in the calendar year when the woman turns 15, or one year after the calendar year during which the women gave her last birth
    - ▸ Stays at zero if there is no birth during the next calendar year
    - ▸ Equals one if the woman gave birth(s) during the next calendar year, and missing afterwards

- First marriage in the current year
    - ▸ A dummy indicating whether the women will marry in the calendar year, conditioning on never married before
    - ▸ Stays at zero from the calendar year during which the women turns 16 to one year before the calendar year during which the women married for the first time in her life
    - ▸ Equals one for the calendar year during which the woman has her first marriage, and missing afterwards

When Did Outcomes Switch from 0 to 1 in the Sample?
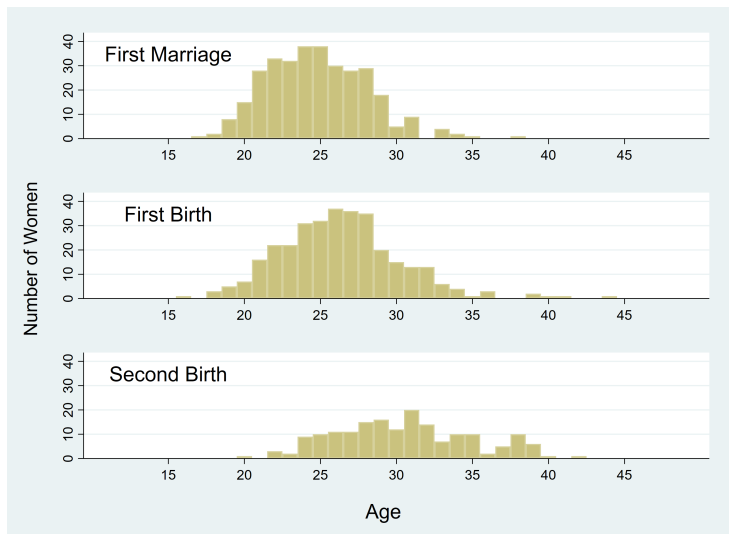
Down Payment Rate (DPR) and Housing Price Index (HP)

- DPR
  - ▶ Hand-collected city-year DPR 2008-2020 for major cities
  - ▶ Source of information ranked by importance: government documents, news from government agencies and big media, phone call records with local government branches, and news from other online sources (websites of housing agencies, local news, online Q&A etc.)
  - ▶ Policy cutoff date: if announced before July 1st, a policy change is treated as effective in the current year, otherwise the next year
  - ▶ Forward imputation: a DPR is assumed to carry on until another documented change by the central bank or the government

- HP
  - ▶ Source: 70 major city housing price index released by the National Bureau of Statistics
  - ▶ New commercial and second-handed housing price indices for units under 90 sqms, released on each July 2010-2020

Summary statistics, DPR and HP
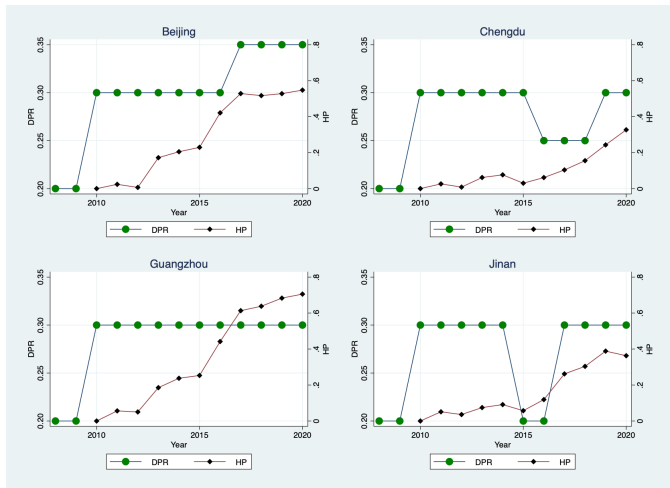
Control Variables

- Dummies indicating each year of age
- Dummies for number of prior births by sex composition
- Dummies for ethnicity and education level
- Reference woman's parents' education levels
- Year and city fixed effects
- City-specific linear year trends

Empirical Method

Baseline Regression Model

$$Y_{it} = \alpha + \beta_0 ln(DPR_{ct}) + \beta_1 \frac{ln(DPR_{c,t-1}) + ln(DPR_{c,t-2}) + ln(DPR_{c,t-3})}{3}$$
$$+ \gamma_0 ln(P_{ct}) + \gamma_1 \frac{ln(P_{c,t-1}) + ln(P_{c,t-2}) + ln(P_{c,t-3})}{3}$$
$$+ \theta X_{it} + \rho_t + \lambda_c(\delta + \eta t) + \epsilon_{it}$$

- Y_{it} is a dummy indicating whether woman i 's outcome switched from 0 to 1 during each calendar year

- DPR_{ct} is the down payment rate in city c during year t

- P_{ct} is the housing price index in city c during year t

- X_{it} includes control variables listed on the last page

- ρ_t are year fixed effects and $\lambda_c(\delta + \eta t)$ are city fixed effects and city-specific linear time trends.

- Error term ϵ_{it} is clustered at the city level

Results

Baseline Results

Dependent = 100 Times -->	First Birth Next Year			Higher-Order Birth Next Year			First Marriage		
Which Past Years to Take Average -->	t-1	t-1,t-2	t-1,t-2,t-3	t-1	t-1,t-2	t-1,t-2,t-3	t-1	t-1,t-2	t-1,t-2,t-3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
100 * ln(DPR), Current Year	0.060	0.017	-0.055	0.006	0.004	0.011	0.177	0.187	0.191
	(0.093)	(0.104)	(0.122)	(0.022)	(0.021)	(0.024)	(0.106)	(0.110)	(0.123)
100 * ln(DPR), Past Years Average	-0.267**	-0.482	-1.055**	0.016	-0.008	0.033	-0.167	-0.057	-0.058
	(0.070)	(0.303)	(0.351)	(0.024)	(0.067)	(0.072)	(0.144)	(0.169)	(0.380)
100 * ln(Price), Current Year	0.023	-0.055	-0.064	0.173*	0.153*	0.157*	0.005	-0.099	-0.140
	(0.164)	(0.178)	(0.173)	(0.081)	(0.072)	(0.071)	(0.179)	(0.194)	(0.205)
100 * ln(Price), Past Years Average	-0.061	0.007	0.230	-0.102	-0.102	-0.152	-0.184	-0.181	-0.278
	(0.158)	(0.291)	(0.290)	(0.089)	(0.096)	(0.119)	(0.187)	(0.201)	(0.373)
Age Dummy, Parity and Sex Combination	yes	yes	yes	yes	yes	yes	yes	yes	yes
Education, Beauty, Intellegence	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ethnicity and Parents' Educaction	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE, City-Specific Linear Trend	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1534	1534	1534	4913	4913	4913	1321	1321	1321
Number of Women	396	396	396	862	862	862	341	341	341

Robustness to Alternative Number of Lags

Dependent = 100 Times -->	First Birth Next Year				Higher-Order Birth Next Year				First Marriage			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
100 * ln(DPR), Current Year	0.089 (0.103)	0.060 (0.093)	0.039 (0.106)	-0.021 (0.128)	0.001 (0.022)	0.006 (0.022)	-0.002 (0.023)	0.004 (0.027)	0.193'+ (0.103)	0.177 (0.106)	0.209'+ (0.108)	0.234'+ (0.131)
100 * ln(DPR), 1 Years Ago		-0.267** (0.070)	-0.293* (0.117)	-0.377** (0.122)		0.016 (0.024)	0.009 (0.032)	0.016 (0.028)		-0.167 (0.144)	-0.142 (0.131)	-0.124 (0.164)
100 * ln(DPR), 2 Years Ago			-0.116 (0.262)	-0.209 (0.234)			-0.033 (0.043)	-0.028 (0.038)			0.162 (0.099)	0.188 (0.125)
100 * ln(DPR), 3 Years Ago				-0.352* (0.139)				0.028 (0.056)				0.016 (0.295)
100 * ln(Price), Current Year	-0.047 (0.209)	0.023 (0.164)	-0.079 (0.185)	-0.045 (0.180)	0.152* (0.062)	0.173* (0.081)	0.146 (0.091)	0.143 (0.098)	-0.101 (0.211)	0.005 (0.179)	0.148 (0.319)	0.065 (0.329)
100 * ln(Price), 1 Years Ago		-0.061 (0.158)	0.152 (0.290)	0.149 (0.269)		-0.102 (0.089)	-0.053 (0.120)	-0.052 (0.122)		-0.184 (0.187)	-0.357 (0.309)	-0.453 (0.315)
100 * ln(Price), 2 Years Ago			-0.194 (0.343)	0.054 (0.308)			-0.042 (0.071)	-0.066 (0.087)			0.119 (0.344)	0.465 (0.369)
100 * ln(Price), 3 Years Ago				-0.214 (0.633)				0.034 (0.118)				-0.576 (0.462)
High School	-0.416 (3.632)	-0.313 (3.630)	-0.279 (3.641)	-0.173 (3.632)	-0.361 (0.896)	-0.361 (0.894)	-0.362 (0.895)	-0.362 (0.896)	1.279 (5.014)	1.063 (5.083)	1.118 (5.058)	1.045 (5.066)
Associate Degree	-3.121 (2.069)	-2.985 (2.052)	-2.973 (2.040)	-2.896 (2.024)	0.178 (0.852)	0.172 (0.852)	0.168 (0.854)	0.163 (0.852)	-3.156 (3.000)	-3.178 (3.011)	-3.235 (3.011)	-3.235 (3.030)
Bachelor's Degree	-8.619* (3.014)	-8.495* (2.994)	-8.498* (3.000)	-8.365* (2.984)	-1.197 (1.042)	-1.188 (1.040)	-1.186 (1.039)	-1.188 (1.040)	-7.396* (3.159)	-7.507* (3.202)	-7.555* (3.193)	-7.570* (3.229)
Age Dummy, Parity and Sex Combination	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Education, Beauty, Intelligence	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ethnicity and Parents' Education	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE, City-Specific Linear Trend	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1534	1534	1534	1534	4913	4913	4913	4913	1321	1321	1321	1321
Number of Women	396	396	396	396	862	862	862	862	341	341	341	341

'+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001. Standard errors are clustered at the city level. Samples are restricted to local-province women, ages 22-45 and cohorts 1971-1995.

Robustness to Alternative City Weights

Dependent = 100 Times -->	First Birth Next Year				Higher-Order Birth Next Year				First Marriage			
How to Re-weight Cities -->	Do Nothing (Baseline)	Re-Weighted	Exclude 1st-Tier	Re-Wt and No 1st-Tier	Do Nothing (Baseline)	Re-Weighted	Exclude 1st-Tier	Re-Wt and No 1st-Tier	Do Nothing (Baseline)	Re-Weighted	Exclude 1st-Tier	Re-Wt and No 1st-Tier
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Weighted Mean of Y-Variable	11.147	11.804	11.078	11.801	2.727	3.200	3.063	3.315	11.204	12.947	11.647	12.788
100 * ln(DPR), Current Year	-0.055	-0.198'+	-0.100	-0.197'+	0.011	0.029	0.010	0.028	0.191	0.170	0.142	0.145
	(0.122)	(0.105)	(0.103)	(0.100)	(0.024)	(0.024)	(0.026)	(0.026)	(0.123)	(0.176)	(0.145)	(0.195)
100 * ln(DPR), 1-3 Years Ago Average	-1.055**	-1.367***	-1.197**	-1.368***	0.033	0.045	-0.007	0.023	-0.058	-0.038	-0.083	-0.069
	(0.351)	(0.249)	(0.354)	(0.242)	(0.072)	(0.070)	(0.065)	(0.067)	(0.380)	(0.300)	(0.351)	(0.306)
100 * ln(Price), Current Year	-0.064	-0.132	-0.210	-0.192	0.157*	0.258**	0.318***	0.317***	-0.140	-0.243	-0.385	-0.270
	(0.173)	(0.196)	(0.301)	(0.234)	(0.071)	(0.076)	(0.054)	(0.064)	(0.205)	(0.233)	(0.248)	(0.269)
100 * ln(Price), 1-3 Years Ago Average	0.230	0.587	0.190	0.624	-0.152	-0.352*	-0.427*	-0.506**	-0.278	-0.796'+	-0.821'+	-1.073*
	(0.290)	(0.367)	(0.514)	(0.525)	(0.119)	(0.159)	(0.167)	(0.170)	(0.373)	(0.424)	(0.444)	(0.446)
Age Dummy, Parity and Sex Combination	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Education, Beauty, Intellegence	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ethnicity and Parents' Educaction	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE, City-Specific Linear Trend	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1534	1534	1002	1002	4913	4913	3657	3657	1321	1321	850	850
Number of Women	396	396	253	253	862	862	631	631	341	341	212	212

Robustness to Controlling Parents' Education

Dependent = 100 Times -->	First Birth Next Year			
Which Parent's Education to Control -->	None	Father's	Mother's	Both
	(1)	(2)	(3)	(4)
100 * ln(DPR), Current Year	-0.054	-0.054	-0.051	-0.051
	(0.085)	(0.086)	(0.088)	(0.090)
100 * ln(DPR), 1-3 Years Ago Average	-0.919*	-0.933*	-0.917*	-0.932*
	(0.364)	(0.359)	(0.366)	(0.363)
100 * ln(Price), Current Year	-0.077	-0.070	-0.081	-0.073
	(0.171)	(0.172)	(0.176)	(0.177)
100 * ln(Price), 1-3 Years Ago Average	0.114	0.115	0.113	0.114
	(0.351)	(0.351)	(0.342)	(0.342)
High School	0.917	1.942	0.921	1.915
	(3.689)	(3.578)	(3.744)	(3.635)
College	-6.028	-5.560	-5.608	-5.397
	(3.529)	(3.605)	(3.570)	(3.679)
Age Dummies, Ethnicity	yes	yes	yes	yes
Sibling Number and Sex Combination	yes	yes	yes	yes
Year FE, City-Specific Linear Trend	yes	yes	yes	yes
Observations	1490	1490	1490	1490
Number of Women	380	380	380	380

Robustness to Controlling Beauty and Intelligence Index

Dependent = 100 Times -->	First Birth Next Year				Higher-Order Birth Next Year				First Marriage			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
100 * ln(DPR), Current Year	-0.058	-0.053	-0.061	-0.055	0.011	0.011	0.011	0.011	0.177	0.182	0.177	0.191
	(0.123)	(0.121)	(0.122)	(0.122)	(0.024)	(0.024)	(0.024)	(0.024)	(0.124)	(0.125)	(0.124)	(0.123)
100 * ln(DPR), 1-3 Years Ago Average	-1.072**	-1.049**	-1.083**	-1.055**	0.034	0.035	0.032	0.033	-0.079	-0.069	-0.081	-0.058
	(0.360)	(0.351)	(0.353)	(0.351)	(0.072)	(0.072)	(0.072)	(0.072)	(0.387)	(0.387)	(0.390)	(0.380)
100 * ln(Price), Current Year	-0.060	-0.066	-0.056	-0.064	0.157*	0.157*	0.157*	0.157*	-0.123	-0.127	-0.124	-0.140
	(0.178)	(0.174)	(0.174)	(0.173)	(0.071)	(0.071)	(0.071)	(0.071)	(0.210)	(0.207)	(0.212)	(0.205)
100 * ln(Price), 1-3 Years Ago Average	0.248	0.227	0.251	0.230	-0.153	-0.153	-0.153	-0.152	-0.236	-0.251	-0.236	-0.278
	(0.294)	(0.290)	(0.287)	(0.290)	(0.119)	(0.119)	(0.119)	(0.119)	(0.386)	(0.379)	(0.386)	(0.373)
Beauty Score		2.748		2.452		-0.595		-0.876		1.763		5.194'+
		(1.882)		(2.155)		(0.789)		(0.854)		(1.971)		(2.759)
Intelligence Score			1.548	0.412			-0.243	0.423			-0.692	-4.898*
			(1.892)	(1.565)			(0.819)	(0.698)			(2.004)	(1.933)
Age Dummy, Parity and Sex Combination	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Education	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ethnicity and Parents' Education	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE, City-Specific Linear Trend	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1534	1534	1534	1534	4913	4913	4913	4913	1321	1321	1321	1321
Number of Women	396	396	396	396	862	862	862	862	341	341	341	341

Subgroup Heterogeneity Results: First Birth

Y = First Birth Next Year *100	All	Education		Beauty > Median		Intellegence > Median		Age		Hukou at Age 12	
		<=15	16+	Yes	No	Yes	No	22-25	26-45	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Sample Mean of Y-Variable	11.147	13.350	8.784	12.202	10.940	12.179	10.465	7.124	15.077	13.067	8.453
100 * ln(DPR), Current Year	-0.055	-0.148	0.038	0.029	-0.180	-0.036	-0.046	-0.007	-0.125	-0.168	0.006
	(0.122)	(0.202)	(0.105)	(0.155)	(0.196)	(0.172)	(0.125)	(0.122)	(0.181)	(0.154)	(0.130)
100 * ln(DPR), 1-3 Years Ago Average	-1.055**	-2.055*	-0.404	-0.748'+	-1.333*	-1.102	-1.201**	-0.467	-1.730*	-1.695***	-0.205
	(0.351)	(0.821)	(0.375)	(0.372)	(0.608)	(0.648)	(0.340)	(0.339)	(0.698)	(0.408)	(0.308)
100 * ln(Price), Current Year	-0.064	-0.381	0.275	-0.097	-0.013	0.326	-0.471'+	-0.203	0.112	-0.196	0.297'+
	(0.173)	(0.282)	(0.181)	(0.355)	(0.210)	(0.217)	(0.248)	(0.211)	(0.165)	(0.222)	(0.148)
100 * ln(Price), 1-3 Years Ago Average	0.230	1.341'+	-0.701	0.072	0.553	0.229	0.480	-0.025	0.690	0.390	-0.141
	(0.290)	(0.674)	(0.422)	(0.260)	(0.635)	(0.557)	(0.514)	(0.249)	(0.684)	(0.385)	(0.362)
Baseline Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1534	794	740	754	713	739	774	758	776	926	556
Number of Women	396	229	167	190	193	182	210	287	247	255	127

Subgroup Heterogeneity Results: Higher-Order Births

Y = Higher-Order Births Next Year *100	All	Education		Beauty > Median		Intellegence > Median		Age		Hukou at Age 12	
		<=11	12+	Yes	No	Yes	No	22-34	35-45	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Sample Mean of Y-Variable	2.727	2.542	2.964	2.143	3.347	2.157	3.340	5.578	0.845	2.878	2.152
100 * ln(DPR), Current Year	0.011	0.031	-0.025	0.073	-0.052	0.020	0.007	-0.068	0.063**	0.010	-0.049
	(0.024)	(0.024)	(0.038)	(0.051)	(0.042)	(0.038)	(0.031)	(0.073)	(0.020)	(0.030)	(0.082)
100 * ln(DPR), 1-3 Years Ago Average	0.033	0.044	0.003	0.182	-0.127'+	0.012	0.033	-0.112	0.132*	0.014	0.089
	(0.072)	(0.137)	(0.155)	(0.165)	(0.073)	(0.146)	(0.092)	(0.147)	(0.058)	(0.086)	(0.302)
100 * ln(Price), Current Year	0.157*	0.090	0.274**	0.164	0.137	0.133	0.195**	0.277'+	0.094	0.140	0.376*
	(0.071)	(0.120)	(0.092)	(0.180)	(0.080)	(0.175)	(0.059)	(0.141)	(0.062)	(0.085)	(0.133)
100 * ln(Price), 1-3 Years Ago Average	-0.152	-0.319	0.063	-0.321	0.097	-0.143	-0.142	-0.180	-0.122	-0.214	0.042
	(0.119)	(0.213)	(0.120)	(0.188)	(0.174)	(0.145)	(0.158)	(0.241)	(0.074)	(0.157)	(0.319)
Baseline Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4913	2754	2159	2427	2420	2457	2425	1954	2959	4066	790
Number of Women	862	457	405	419	430	438	417	502	587	701	148

Subgroup Heterogeneity Results: First Marriage

Y = First Marriage *100	All	Education		Beauty > Median		Intellegence > Median		Age		Hukou at Age 12	
		<=15	16+	Yes	No	Yes	No	22-24	25-45	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Sample Mean of Y-Variable	11.204	13.226	9.415	11.720	10.652	10.940	11.458	7.143	14.752	12.405	9.467
100 * ln(DPR), Current Year	0.191	0.482**	-0.034	-0.020	0.129	0.066	0.260'+	0.101	0.171	0.370'+	-0.253
	(0.123)	(0.156)	(0.000)	(0.161)	(0.184)	(0.220)	(0.149)	(0.202)	(0.188)	(0.180)	(0.283)
100 * ln(DPR), 1-3 Years Ago Average	-0.058	-0.008	-0.009	-0.055	-0.513	0.267	-0.292	-0.173	-0.308	0.477	-1.018'+
	(0.380)	(0.621)	(0.000)	(0.624)	(0.669)	(0.810)	(0.457)	(0.711)	(0.521)	(0.486)	(0.505)
100 * ln(Price), Current Year	-0.140	-0.621*	0.294	0.080	-0.298	0.224	-0.473	-0.071	-0.221	-0.395'+	0.334
	(0.205)	(0.240)	(0.000)	(0.314)	(0.304)	(0.286)	(0.300)	(0.232)	(0.322)	(0.200)	(0.415)
100 * ln(Price), 1-3 Years Ago Average	-0.278	0.271	-0.651	-0.545	0.193	-0.741	0.053	0.320	-0.320	-0.342	0.427
	(0.373)	(0.404)	(0.000)	(0.726)	(0.576)	(0.729)	(0.441)	(0.608)	(0.573)	(0.492)	(0.400)
Baseline Controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1321	620	701	657	629	649	672	616	705	790	507
Number of Women	341	185	156	160	173	152	189	268	222	211	122

Conclusion

Summary of Contributions

- First to study DPR $\rightarrow$ fertility
- Unique policy data: hand-collected city-year level DPR 2008-2020
- DPR and housing price jointly considered
  - ▶ earlier studies considered only one at a time
- Decomposition of fertility effect on three margins
- First piece of evidence from China
  - ▶ housing price rising
  - ▶ fertility falling