

# Divorce, Abortion and the Sex Ratio at Birth

The Effect of the Amended Divorce Law in China

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# Question and Hypothesis:

- Question:  
How do the relative divorce options affect sex selective abortion decisions within marriages?
- Hypothesis (Story):  
The 2001 divorce law in China has improved women's divorce options, and that this change has led to fewer sex-selective abortions through the channel of improving women's welfare within marriage.
- Model:
  - Non transferrable utility function
  - Husband dictatorship decision making
- Empirical evidence

- Divorce and Bargaining (Theories)

marriage "exit" options are used as a "threat point" in intra-household decision making procedure (Manser and Brown, 1979, 1980; Horney and McElroy, 1981)

- Bargaining and Household outcomes (Empirical Evidence):

Household nutrition intake (Thomas 1990); the welfare of female children (Duflo and Udry 2005); gender differential children survival rate (Qian 2008)

- Household outcomes of Divorce law (Empirical evidence)

Labor supply (Gray 1998, Stevenson 2007); the welfare of children (Gruber 2004); the divorce rate (Friedberg 1998, Wolfers 2007); household specialization (Stevenson 2007) and domestic violence (Stevenson and Wolfers 2007).

- Gap

No specific model explains why public good provision (children's welfare) can be affected by bargaining when relative divorce options change.

# Two Open Questions

- Is divorce a relevant "threat"?  
non cooperative equilibrium "threats" within marriages: Wooley (1988); Tauchen, Witte, and Long (1991)  
Lundberg and Pollack (1993, 1996);
- Can sex selection behavior be curbed by policies?
  - Yes: Rosenzweig and Schultz 1982; Duflo (2009); Qian (2008)
  - Probably not: Drèze and Sen (1998); Foster and Rosenzweig (2001); Almond, Edlund and Milligan (2009)

# The New Marriage Law ("Divorce Law") in 2001:

- Four new articles to protect property rights.
  - Women's land and property loss upon divorce (Liu and Chan, 1999; Hare, Li and Englander, 1997)
- Unilateral divorce is available under the case of domestic violence and extra-marital relationships.
  - All-China Women's Federation 2002 Survey
- Further clauses stipulating enforcement.
  - Social assistance and Legal Liability Provisions.

# Sex Selection in China

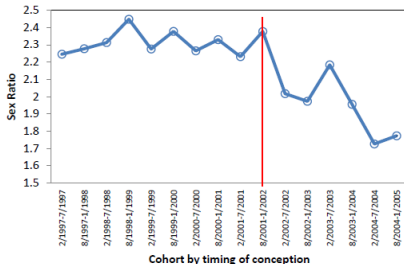
- Son Preference
- Family Planning Policy for Han ethnicity (majority) in rural China
  - (1) One Child Policy (6 provinces); (2) Second child allowed after having a firstborn daughter (24 provinces)
- Sex Selection Performed:
  - Ultra-sound B sex screening and induced abortions (Greenhalgh and Li, 1995; 1996; Chu 2001; Li, 2005; Li and Zheng, 2009)
- Asymmetric health-related costs of sex selective abortions (Chu 2001, 1997 In-depth fertility survey).

# The "Turning Point" of the Second Birth Sex Ratio

**Definition** sex ratio at birth is the ratio of males to females among newborns

- The margin where sex selective abortions are heavily used:
  - Second pregnancy after having a firstborn daughter (Poston et al. 1997).

**Figure:** Sex ratio of the second-born children after having firstborn daughters



# Why do we need a Model

## Rule out alternative explanations

- Rule out a secular trend or other simultaneous policies
  - Difficulty: No ideal control group
- Rule out the effect of channels other than improvement of women's welfare within households

## A formal theoretical framework

- Provide a better understanding of the sex selection decision making procedure
- Prediction on spatial variation in the magnitude of the effect helps to drop out other time trend

# Two Key Assumptions and the Main Prediction

- Two key features (Assumptions):
  - NTU within marriage: The health-related costs of sex selective abortion depreciates the wife's marginal utility of private consumption
  - Decision making: Husband dictatorship but the wife has the right to initiate divorce
- Main prediction:  
Sex selective abortions decrease ( sex ratio converge to the natural level).

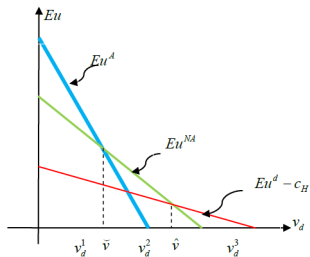
# The intuitions (1): NTU and husband dictatorship

$$\max_{\{x_H, x_W, e\}} u - u_r \quad (\text{p1})$$

subject to the budget constraint and  $v \geq v_r$ ;

$$\frac{\partial}{\partial e} \left( \frac{\partial v}{\partial x_W} \right) < 0; \quad \frac{\partial}{\partial e} \left( \frac{\partial u}{\partial x_H} \right) \geq 0$$

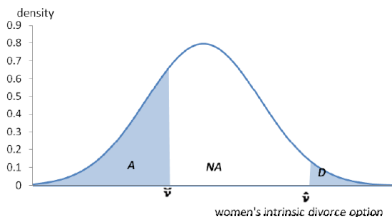
Figure: The wife's type and husband's optimization



## Predictions and Intuitions

# The Intuition (2): project the individual household decision making onto SRB

Figure: Sex ratio in the population

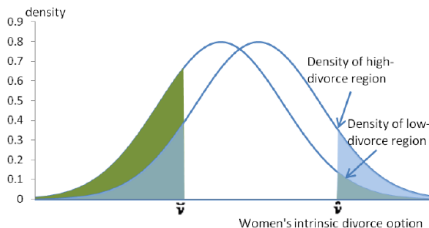


- The rank:
  - Holding all other factors constant, women with better divorce options can afford to divorce (Liu and Chan 1999; Platte 1988)
  - Under the two assumptions, amongst those staying married, women in abortion households should have worse divorce options.

## The Intuition (3): Spatial Variation

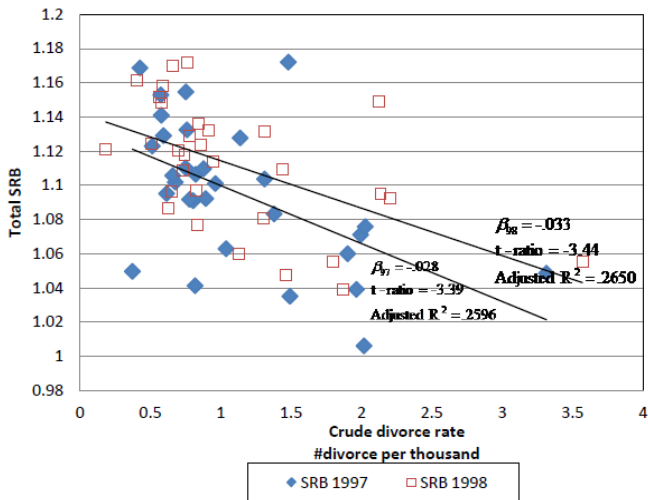
- The effect of fewer abortions drives the sex ratio (#boys/#girls) downward
- The effect of more divorces drives the sex ratio (#boys/#girls) upward
- Under the assumption of single-peaked symmetry distribution, sex ratio should decline the most in historically low divorce regions.

Figure: Regional variations in the policy effect on SRB2



## Predictions and Intuitions

# Assumption about distribution and negative relationship between SRB and divorce



# Data sources

- 0.1 % sample of 2000 Population Census
- 0.25 % sample of 2005 Population Census
- 91, 93, 97, 00, 04, 06, 09 waves of CHNS data

# Empirical Strategy

## Empirical Tests on Divorce

$$\begin{aligned}
 \text{Divorce}_{ipt} = & \alpha + \underset{(+)}{\text{post}_t \cdot \delta} + \text{div2000}_p \times \underset{(+)}{\text{post}_t \cdot \beta} \\
 & + X_{ipt}\eta + Z_{pt}\rho + \lambda_p + \pi_c + \varepsilon_{ipt}
 \end{aligned}$$

## Sex Ratio declined most in Historically Low Divorce Region

$$\text{male}_{ipc} = \alpha + \sum_{l=1}^{15} 1\{c = l\} \cdot \underset{(-)}{\beta_l} + X_{ipc}\gamma + \lambda_p + \varepsilon_{ipc}$$

$$\begin{aligned}
 \text{male}_{ipc} = & \alpha + \sum_{l=1}^{15} 1\{c = l\} \times \underset{(+)}{\text{Divorce}_p \cdot \omega_l} \\
 & + \sum_{l=1}^{15} 1\{c = l\} \cdot \underset{(-)}{\beta_l} + X_{ipc}\gamma + \lambda_p + \varepsilon_{ipc}
 \end{aligned}$$

Trend of sex ratio of survival children

# The Increase in Divorce Propensity

TABLE 4-THE CHANGE IN DIVORCE PROPENSITY AFTER THE IMPLEMENTATION OF THE AMENDED DIVORCE LAW

	<i>Dependent variable: the indicator for whether the woman was "currently divorced"</i>							
	<i>"Girl Exception" or "two Children"</i>				<i>"One-Child Policy"</i>			
	One Daughter		One Son		One Daughter		One son	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post implementation	-.005 (.004)	.000 (.005)	.004 (.003)	.006 (.004)	.015 (.023)	-.025 (.033)	-.001 (.006)	.017 (.027)
Historical Crude Divorce $\times$ post	.008 (.004)*	.008 (.004)**	.002 (.003)	-.002 (.003)	.018 (.008)**	.017 (.058)	.002 (.006)	.041 (.049)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Provincial F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Woman Cohort F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	.0164	.0169	.0124	.0138	.0019	.0050	.0032	.0034
Observations	24,119	24,119	23,983	23,983	7,859	7,859	10,480	10,480

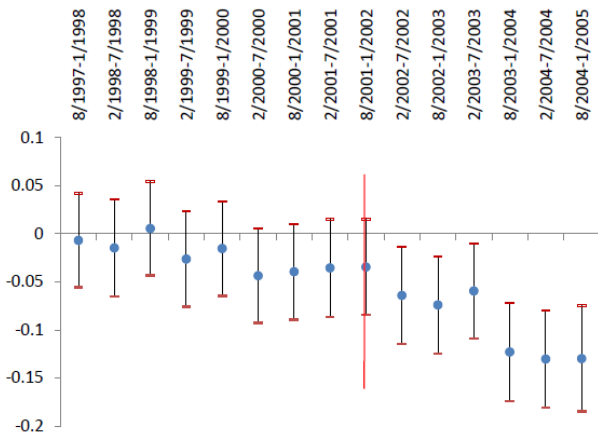
*Note:* The divorce rate in the interaction terms is the crude divorce rate in 2000. Control variables include women's education years, age at the time of survey, quadratic term of age, and age at first marriage; and provincial GDP per capita, population, women's labor participation rate, the sex ratio of adults (aging from 20-40 at the survey point). We use 1990 Population Census data to calculate the provincial sex ratio of those aged 10 to 30 as a proxy for the adult sex ratio for adults between 20 and 40 in year 2000, and we calculate the sex ratio of those aged 5 to 25 to proxy the sex ratio of adults between 20 and 40 in 2005 data.

In columns (1)-(8), the numbers in parentheses are the clustered standard errors by province using Moulton

Trend of sex ratio of survival children

# Sex Ratio at Birth Converges to Natural Level

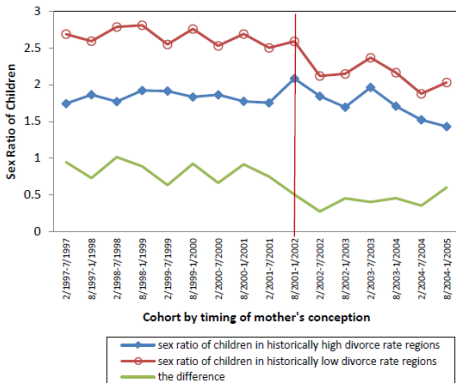
Coefficients of Sex Ratio Trend by Cohort: Each Cohort is Defined as All Babies Conceived in a Certain Six-month Period as Listed in the Table (cohort conceived within 2/1997-7/1997 is the reference group)



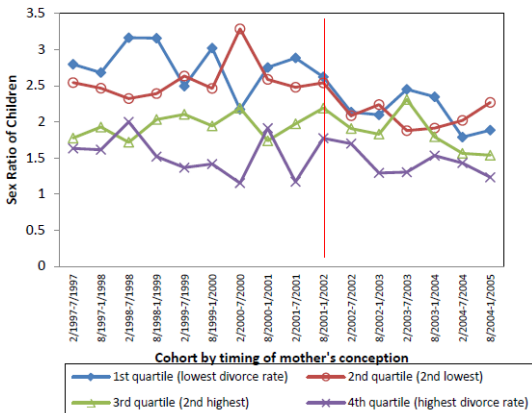
Trend of sex ratio of survival children

# Spatial variation in the magnitude of the effect(1)

**Figure:** Trend of SRB2 (approximated by the sex ratio of surviving children who are registered in the residency system (Hukou)) by historical median divorce rate



**Figure:** Trend of SRB2 (approximated by the sex ratio of surviving children who are registered in the residency system (Hukou)) by quantiles of historical divorce rate



## Spatial variations

TABLE 6-THE DIFFERENCE OF SEX RATIO BETWEEN HISTORICALLY HIGH- AND LOW-DIVORCE-RATE REGIONS ACROSS COHORTS (cohort conceived within 2/1997-7/1997 as the reference group)

<i>Dependent Variable: the indicator for whether the second child is male</i>								
	<i>High vs Low</i>		<i>1st quartile v.s. 3rd and 4th</i>		<i>2nd quartile v.s. 3rd and 4th</i>		<i>Crude divorce rate In 2000</i>	
	(low div=1)		quartiles(1stqt=1)		quartiles(2ndqt=1)			
	(1)		(2)		(3)		(4)	
Interact8/1997	-0.068	(.054)	-0.077	(0.058)	-0.059	(0.066)	0.154	(.083)*
Interact2/1998	-0.048	(.056)	-0.027	(0.06)	-0.085	(0.069)	0.089	(0.079)
Interact8/1998	-0.064	(.053)	-0.041	(0.058)	-0.098	(0.066)	0.075	(0.08)
Interact2/1999	-0.07	(.055)	-0.073	(0.059)	-0.066	(0.067)	0.125	(0.077)
Interact8/1999	-0.065	(.055)	-0.058	(0.059)	-0.073	(0.066)	0.039	(0.089)
Interact2/2000	-0.061	(0.054)	-0.055	(0.059)	-0.019	(0.066)	0.09	(0.076)
Interact8/2000	-0.062	(0.055)	-0.058	(0.059)	-0.067	(0.068)	0.095	(0.087)
Interact2/2001	-0.056	(0.056)	-0.047	(0.06)	-0.068	(0.068)	0.081	(0.081)
Interact8/2001	-0.112	(.054)**	-0.113	(.058)*	-0.11	(.066)*	0.159	(.079)**
Interact2/2002	-0.114	(.054)**	-0.102	(.058)*	-0.132	(.068)*	0.194	(.069)***
Interact8/2002	-0.144	(.054)***	-0.143	(.058)**	-0.141	(.068)**	0.171	(.081)**
Interact2/2003	-0.152	(.053)***	-0.136	(.057)**	-0.175	(.066)***	0.127	(.075)*
Interact8/2003	-0.078	(.054)	-0.077	(.059)	-0.079	(.067)	0.117	(.073)
Interact2/2004	-0.121	(.053)**	-0.12	(.057)**	-0.12	(.066)*	0.133	(.071)*
Interact8/2004	-0.054	(.058)	-0.064	(.063)	-0.036	(.071)	0.111	(.076)
Controls	Yes		Yes		Yes		Yes	
Provincial F.E.	Yes		Yes		Yes		Yes	
Adjusted $R^2$	0.0459		0.0533		0.0277		0.0434	
Observations	10,721		7,951		6,208		10,721	

*Note:* In column (1), we compare the gap in the SRB between historically high- and low-divorce-rate regions, categorized by the median of the 2000 divorce rate. We then categorize provinces into four groups by quantiles of divorce rate in 2000. In column (2), we compare the SRB of the first quartile with that of the third and fourth

# Robustness checks:

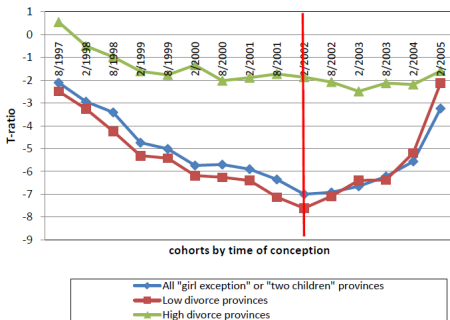
- Other policies?
  - Law of population and family planning
- Other channels of divorce law?
- The approximation on SRB using the sex ratio of survival children.
  - Gender differential on mortality rate?
  - Underreporting female births?

## Spatial variations

## The Discontinuity in Time Dimension

$$male_{ipc} = \alpha + d\{c > time\_conception\} \cdot \beta_1 + X_{ipc}\gamma + \lambda_p + \varepsilon_{ipc}$$

**Figure:** Coefficient T-ratio of the potential indicators for being first exposed to the implementation



# Sex ratio using fertility data

TABLE 7-THE CHANGE IN SEX RATIO FOR CHILDREN UNDER AGE ONE BETWEEN 2000 AND 2005 (Using only the fertility data reported by women between 15 and 49 years old regarding having given birth in the 12 months prior to the survey)

<i>Dependent Variable: indicator whether the second child is male</i>				
	<i>Comparison between</i>		<i>Comparison between</i>	
	<i>2000 and 2005</i>		<i>1990 and 2000</i>	
	(1)	(2)	(3)	(4)
Lowest divorce	-.147		.001	
Quartile×post	(.051)***		(.008)	
2nd Lowest divorce	-.002		.006	
Quartile×post	(.046)		(.009)	
2nd highest divorce	-.013		.009	
Quartile×post	(.045)		(.01)	
Divorce rate×post		.026		-.026
		(.016)*		(.021)
Post	.05	-.06	.087	.101
	(.074)	(.02)***	(.008)***	(.008)***
Province F.E.	Yes	Yes	Yes	Yes
R-square	.0368	.0268	.1412	.1414
Observations	3228	3228	177,204	177,204

*Note:* The control variables include mother's age when giving birth, mother's age squared, father's age when the baby was born, mother's education level, father's education level, whether the mother is an immigrant in column (1) and (2) and the baby's age at the survey point. The GDP per capita, population, women's labor participation rate, the sex ratio of adults (aging from 20-40 at the survey point) are also controlled. We use 2000 crude divorce rate to categorize quantiles in column (1), to generate the interaction term in column (2). We use 1990 crude divorce rate (The data is from Zeng(1993)) for the same purposes. The numbers in parentheses are the clustered standard errors by province using Moulton (1986) factors.

## Approximation on SRB

## Result on induced abortions

TABLE 8- THE PROPENSITY OF SELECTIVE ABORTIONS PRE AND POST THE ENACTMENT OF THE DIVORCE LAW

	<i>Dependent Variable: the indicator of having abortion(s) 10 months prior to the survey</i>							
	<i>Any abortion(s)</i>				<i>Induced abortion(s)</i>			
	<i>Whole Sample</i>		<i>Firstborn Daughter</i>		<i>Whole Sample</i>		<i>Firstborn Daughter</i>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wave1997	.009 (.021)		-.005 (.072)		-.041 (.036)		-.031 (.092)	
Wave 2000	.003 (.043)		.041 (.075)		-.030 (.041)		.066 (.093)	
Wave 2004	-.017 (.039)		-.049 (.068)		-.081 (.035)**		-.002 (.087)	
Wave 2006	-.064 (.050)		-.027 (.082)		-.096 (.045)**		-.081 (.145)	
Wave 2009	-.030 (.046)		-.053 (.074)		-.080 (.041)**		-.027 (.125)	
Post		-.058 (.049)		-.199 (.139)		-.062 (.038)*		-.118 (.133)
Linear trend		.001 (.005)		.015 (.013)		.000 (.003)		.008 (.013)
Controls	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Provincial F.E.	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	.3698		.1036	.2787	.226	.1101	.2409	.2384
Observations	891		244	244	900	872	245	245

Note: This table reports the results of the multinomial logit model estimated using the data from the Survey of Racial and Ethnic Disparities in the United States (SREDS) for the period 1997-2009. The dependent variable is the indicator of having an induced abortion 10 months prior to the survey. The independent variables are the wave of the survey, the indicator of being a firstborn daughter, and the indicator of being a firstborn daughter. The control variables are the indicator of being a firstborn daughter, the indicator of being a firstborn daughter, and the indicator of being a firstborn daughter. The adjusted R-squared is reported for each wave of the survey. The observations are reported for each wave of the survey.

## Approximation on SRB

## Result on induced abortions

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	<i>Whole Sample</i>		<i>Firstborn Daughter</i>		<i>Whole Sample</i>		<i>Firstborn Daughter</i>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wave1997	.009 (.021)		-.005 (.072)		-.041 (.036)		-.031 (.092)	
Wave 2000	.003 (.043)		.041 (.075)		-.030 (.041)		.066 (.093)	
Wave 2004	-.017 (.039)		-.049 (.068)		-.081 (.035)**		-.002 (.087)	
Wave 2006	-.064 (.050)		-.027 (.082)		-.096 (.045)**		-.081 (.145)	
Wave 2009	-.030 (.046)		-.053 (.074)		-.080 (.041)**		-.027 (.125)	
Post		-.058 (.049)		-.199 (.139)		-.062 (.038)*		-.118 (.133)
Linear trend		.001 (.005)		.015 (.013)		.000 (.003)		.008 (.013)
Controls	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Provincial F.E.	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	.3698		.1036	.2787	.226	.1101	.2409	.2384
Observations	891		244	244	900	872	245	245

Note: This table reports the results of the multinomial logit model estimated on the data from the Survey of Reproductive Behavior (SRB) in 1997, 2000, 2004, 2006, 2009, and 2012. The dependent variable is the indicator of having an induced abortion 10 months prior to the survey. The independent variables are the demographic characteristics of the women and the province. The results are reported in the table above. The standard errors are in parentheses. The asterisks indicate the significance levels: \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.

Other channels

## Result on consumptions

TABLE 10-CONSUMPTION IN HOUSEHOLDS FINISHING HAVING CHILDREN BEFORE 2001

Dependent Variable	Liquor and cigarettes consumption of the husband				Wife's nutrition intake 3-day average				Husband's nutrition intake 3-day average			
	#cigarettes per day		Frequency alcohol		Protein (g)		Calories		Protein(g)		Calories	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Wave1997	1.099 (1.385)		-1.145 (.262)		.849 (2.345)		19.060 (77.741)		-4.124 (2.257)		-40.414 (75.544)	
Wave 2000	.672 (2.123)		-.436 (.405)		5.867 (3.625)		200.726 (124.257)		-1.654 (3.429)		138.671 (117.254)	
Wave 2004	-.977 (3.148)		-.732 (.597)		9.673 (5.243)*		332.774 (181.481)*		-3.323 (4.985)		191.743 (180.538)	
Wave 2006	-1.034 (3.672)		-.862 (.695)		13.299 (6.158)**		379.244 ( 217.256)*		-1.467 (6.028)		259.323 (190.323)	
Wave 2009	-.183 (4.462)		-1.082 (.841)		17.284 (7.374)**		493.375 (256.512)*		-.624 (7.137)		315.804 (256.673)	
Post		-2.505 (.639)***		-.205 (.116)*		2.610 (1.377)*		88.694 (51.487)*		.671 1.362		57.448 (54.152)
Linear trend	.159 (.248)	.278 (.064)***	.058 (.049)	.005 (.009)	-4.250 (1.737)**	-.708 (.114)***	-48.771 (14.925)***	-30.864 (6.690)***	-.268 (.427)	-.346 (.106)***	-32.179 (15.234)**	-30.864 (6.690)***
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Community F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	.1653	.1645	.1011	.1010	.1867	.1794	.1909	.1577	.1071	.0864	.3146	.1247
Observations	3479	3479	5197	5197	4069	4069	4586	4586	3267	3267	3830	3830

Note: The control variables include age, education years, and spouse's age, and education years. The numbers in parentheses are the clustered standard errors by province using Moulton (1986) factors. The sample is confined to rural households who finish having children before 2001. Specifically, those who have one son, or 1 son and 1 daughter, or 2 daughters by 2001. The reference waves are wave 1991 and wave 1993. The 1989 wave does not compass the variables of liquor and cigarettes (in the PE data set). The sample size for diet data is only a half of the sample in other waves. So we use sample from 1991 for all regressions. In column (3) and (4) the frequency of having alcohol = 0 if never having any alcohol in last year; = 1 if less than once a month; = 2 if 1-3 times per month; = 3 if 1-2 times per week; = 4 if 3-4 times per week; = 5 if drink every day.

# Conclusions

- Better understanding of household decision making
- The empowerment of women through the new pro-women divorce law causes the sex ratio for the second birth after a first born girl to decrease from 2.3-2.4 boys for one girl to 1.19-1.24 boys for one girl, holding other factors constant.
- Policy implication: the empowerment of women through improving their relative divorce options can decrease sex selection behavior
- Decreasing sex ratio of children doesn't necessarily imply a high divorce rate.

Motivation  
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Background  
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A Model to Interpret the Observations  
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Data  
oo

Empirical Results  
oooooooooooo

Conclusion

**Thank you!**

## Lower Marginal Utility of Public Durable Goods?

$$public\_good_{ipt} = \alpha + firstborn\_girl_i \times post_t \beta + firstborn\_girl_i \gamma + X_{ipt} \sigma + \lambda_p + \tau_t + \varepsilon_{ipt}$$

Dependent Variable				
	# electric Fans owned (1)	#refrigerators owned (2)	#color tv owned (3)	#camera owned (3)
<b>Firstborn girl*Post</b>	-0.031 (0.062)	-0.009 (0.027)	-0.001 (0.023)	-0.031 (0.071)
<b>Firstborn girl</b>	0.030 (.034)	-0.012 (0.009)	-0.115 (0.014)	0.007 (0.011)
<b>Control var</b>	Y	Y	Y	Y
<b>Province F.E.</b>	Y	Y	Y	Y
<b>R squared</b>	.5589	.7781	.1585	.0788
<b>Observations</b>	2696	3210	4342	1906