Son Preference, Maternal Health, and Women's Survival: A Cross-Cultural Analysis

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Maternal mortality in the developing world

- 10.7 million women died between 1990 and 2015 due to maternal causes
- The lifetime risk of maternal death in the developing world is about 32 times higher than the developed region
- Most maternal deaths in South Asia and sub-Saharan Africa
- Direct causes: severe bleeding, infections, high blood pressure, complications from delivery, and unsafe abortions
- Indirect causes: anemia, HIV, cardiovascular diseases, cancer, diabetes, chronic respiratory diseases
- For every maternal death, 20 other women suffer pregnancy-related illness, infection, injury, other physical and psychological long-term consequences

The role of son preference

Milazzo (2018) for India:

Son preference → Fertility behavior → Maternal morbidity and mortality

- These fertility behaviors are common among women who only have daughters and want to conceive a son ("son- preferring fertility behavior")

- Medical research:
  - High fertility → Increased lifetime risk of death due to pregnancy
  - Short spacing → increased risk of maternal mortality and morbidity

This paper

- Role of cultural norms in determining maternal morbidity and mortality for 74 countries

  1. If the harmful fertility behaviors that follow the birth of a daughter are indeed partly responsible for the high mortality of Indian women, the decline in survival of women with first-born girls (FBG) into older ages should not be present in countries with:

  - No (or limited) son preference or
  - Limited risk of maternal mortality

  2. What are the economic, historical and cultural correlates of higher mortality of women with FBG

Data

Demographic and Health Surveys (DHS)

- 219 DHS for 74 countries between 1990-2015
- Working sample: Over 2.5 million 15-49-year-old women who ever gave birth, excluding twins at first-birth

Cross-country data sources:

- World Development Indicators (WDI): maternal mortality and other markers of health, gender-related attitudes, labor force participation, school enrollment
- Alesina et al (2013): Historical variables related to patterns of inheritance and agriculture collected from Murdock's Ethnographic Atlas
- World Value Survey (WVS): Attitudes regarding female employment and leadership (5 rounds between 1989 to 2014

Measure of high son preference

- Consider the coefficients on "first-born girl" in separate regressions for each country-year where the dependent variables (Y_i^s) are:
  - Number of children even born (for sample likely to have completed fertility)
  - Desire to have more children
  - Currently using contraception
  - Ever had a terminated pregnancy
  - Birth spacing (i.e., number of months between 1st and 2nd child)

$$Y_i^s = \alpha^s + \beta^s FirstBornGirl_i^s + \varepsilon_i^s \quad \forall \text{ survey s}$$

- A survey (s) is classified as "high son preference" if at least three of the five coefficients indicate son preference and are statistically significant

Measure of high maternal mortality

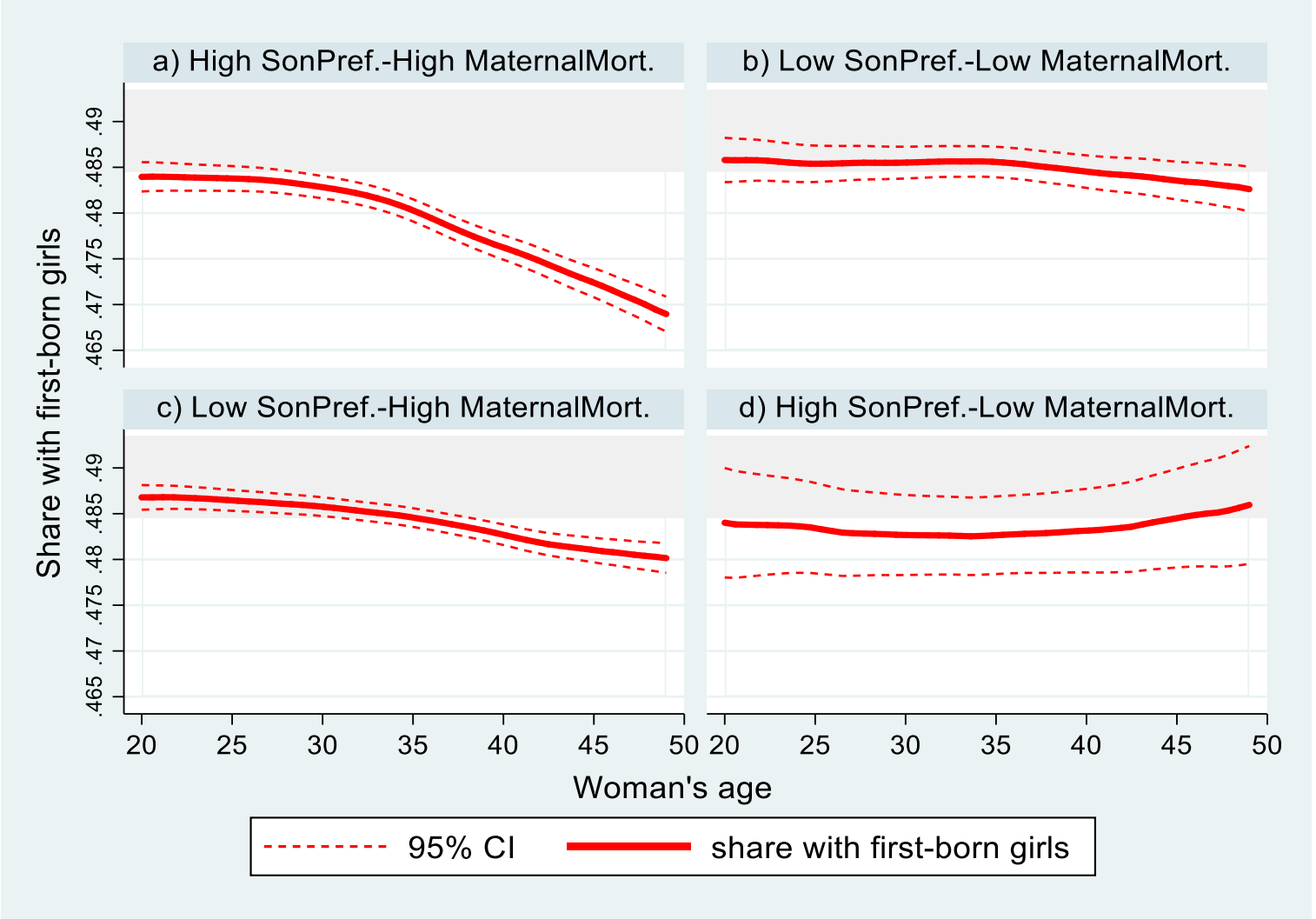
- =1 if lifetime risk of maternal death is greater than or equal to the *median* of lifetime risk of maternal death for all developing countries covered in the WDI database

Four groups by the degree of son preference and maternal mortality risk

1) High SonPref & High Mortality Risk	2) Low SonPref & Low Mortality Risk
33% of the sample (predominantly S. Asia)	17% of the sample (mostly Latin America, Philippines, South Africa, others)
3) Low SonPref & High Mortality Risk	**4) High SonPref & Low Mortality Risk**
47.5% of the sample (predominately SSA)	2.6% of the sample (Egypt, Jordan, Kyrgyz Republic, Turkey)

Summary stats by group, By time since delivery, List of surveys for four groups

Share of women with a first-born girl, by degree of son preference and risk of maternal death



Robustness Checks: By education, Without India, Alternate cut offs for SP, Age at 1st birth, Time since birth, Using neo-natal mortality, Using overall female mortality, Country-level analysis, By time, Regression Evidence

Anemia as a channel for maternal mortality risk

- Anemia- a well-documented risk factor for maternal mortality

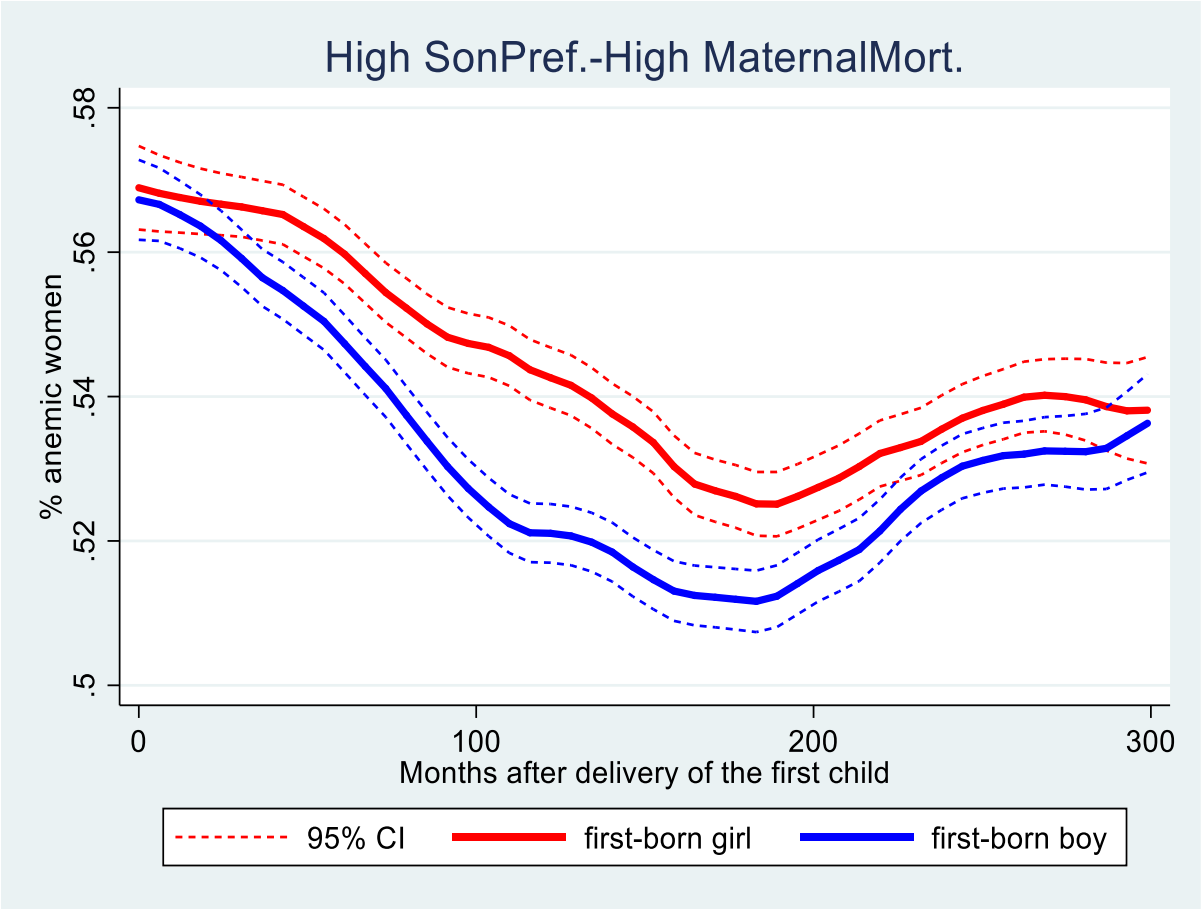
- Particularly high prevalence among pregnant and breastfeeding mothers and children

- Childbearing → increases demand for iron:

  40%-50% of women of reproductive ages and over 40% of pregnancies in the developing world are diagnosed with anemia (Sharman 2000, Kozuki et al. 2012, Balarajan et al. 2011, Stevens et al. 2013)

  13%-40% of maternal deaths can be attributed to anemia (WHO 2008, Daru et al. 2018, Khan et al. 2006, Kalaivani 2009, Gragnolati et al. 2005, Ross & Thomas 1996).

Anemia patterns by time since delivery



→ NO differential incidence of anemia in the other 3 country-year groups

Without India, Other three groups, Regression evidence, Regression for first-two girls

Quantify the imbalance in sex ratio

- Summarize the decreasing share of women with first-born girls at the country-year-level (which we call imbalance)

- We define an indicator for "*imbalance",* which is =*1* if the coefficient on age in:

$$First\ born\ Girl_{ia}^{s} = \alpha_a^s + \beta_a^s age_i + \mu_i^s \qquad \forall\ survey\ s$$

is negative and significant (for any of the age group 15-49, 20-49, 25-49, or 30-49), and the share of women with first-girls in the 30-49 age group is below the biological range i.e. 0.485, else 0

List of surveys with imbalance =1, imbalance over time

Cultural and Historical Correlates of Imbalance

Dependent var.= Imbalance=1 if negative slope									
Panel C: Cultural and Historical variables									
% want more boys than girls	0.976**								
	(0.387)								
Mean age at first marriage		-0.036**							
		(0.015)							
Mean age at first birth			-0.013						
			(0.018)						
Beating is justified				0.003**					
				(0.002)					
Men have more right to job when jobs scarce					0.141				
					(0.148)				
Men make better political leader						0.003			
						(0.084)			
Aboriginal plow use							0.256**		
							(0.120)		
Matrilocality								-0.253**	
								(0.105)	
Patrilocality									0.216**
									(0.097)
Observations	189	219	219	92	57	54	73	73	73
R-squared	0.052	0.026	0.003	0.045	0.015	0.005	0.082	0.009	0.036

Note: imbalance=1 if the share of women with first born girl is decreasing with age. All regressions control for average share of women with first born girl in age 15-19 years old. Clustered standard errors at country level in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

Without India

Economic Correlates of Imbalance

Dependent var.= Imbalance=1 if negative slope						
Panel A: Economic Variables						
% urban	-0.386***					
	(0.137)					
Women's mean edu in years		-0.021**				
		(0.009)				
Ratio of female and male primary enrolment			-0.592***			
			(0.211)			
Ratio of female and male secondary enrolment				-0.300**		
				(0.149)		
Ratio of female and male labor force participation					-0.186	
					(0.129)	
Share of female ownership of firms						-0.003
						(0.002)
Observations	219	218	179	127	219	203
R-squared	0.032	0.029	0.039	0.038	0.016	0.024

Note: imbalance=1 if the share of women with first born girl is decreasing with age. All regressions control for average share of women with first born girl in age 15-19 years old. Clustered standard errors at country level in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

Without India

Health Correlates of Imbalance

Dependent var.= Imbalance=1 if negative slope					
Panel B: Health Variables					
% high skilled birth	-0.132***				
	(0.043)				
Ratio of female and male mortality		0.227			
		(0.162)			
Ratio of female and male life expectancy			-1.678*		
			(0.894)		
% anemic				0.827**	
				(0.344)	
% severe or moderate anemic					1.718**
					(0.829)
Observations	164	219	219	93	93
R-squared	0.027	0.009	0.025	0.103	0.086

Note: imbalance=1 if the share of women with first born girl is decreasing with age. All regressions control for average share of women with first born girl in age 15-19 years old. Clustered standard errors at country level in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

Without India

Conclusions

- Results suggest that having a first-born girl worsens the incidence of anemia and increases mortality in places where:
  - Son preference and
  - Risk of Maternal Mortality
  - Are both high
- This corroborates suggestive evidence of higher mortality of women with a FBG in these contexts
- The interaction between cultural norms and general health conditions mortality matters
- Historical and cultural factors, such as traditional plough use, post-marital residence patterns, age at first marriage, attitude towards wife beating are strongly correlated with our measure of imbalance in sex ratio for women with first-born girls
- Shed light on:
  - The determinants of female mortality during the reproductive ages
  - The effects of son preference beyond early ages and before birth

Thank you!

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Appendix Slides

Joint role of son preference and risk of maternal mortality

$$Imbalance_s = \alpha + \delta(High\ SP\ * High\ MM)_s + \beta_1 High\ SP_s + \beta_2 High\ MM_s + \pi SR15/19_s + \varepsilon_s$$

- $High\ SP_s$: =1 if country-year shows high son preference
- $High\ MM_s$: =1 if country-year shows high risk of maternal mortality
- $SR15/19$: share of women with a first-born girl in the age group 15-19 years

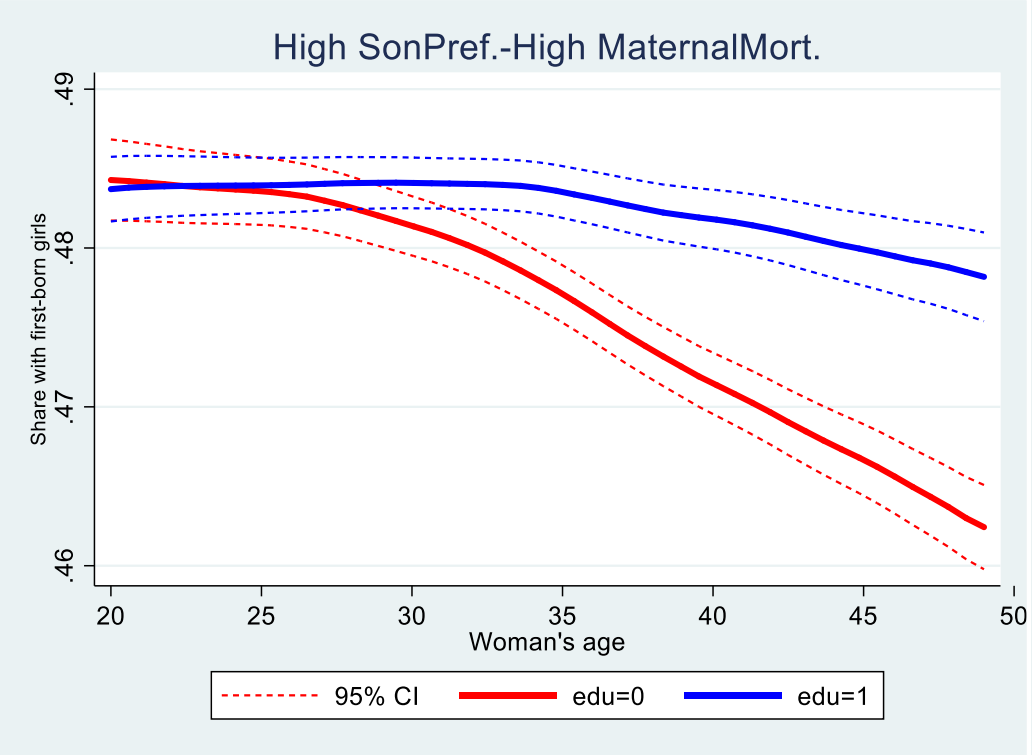
Joint role of son preference and risk of maternal mortality

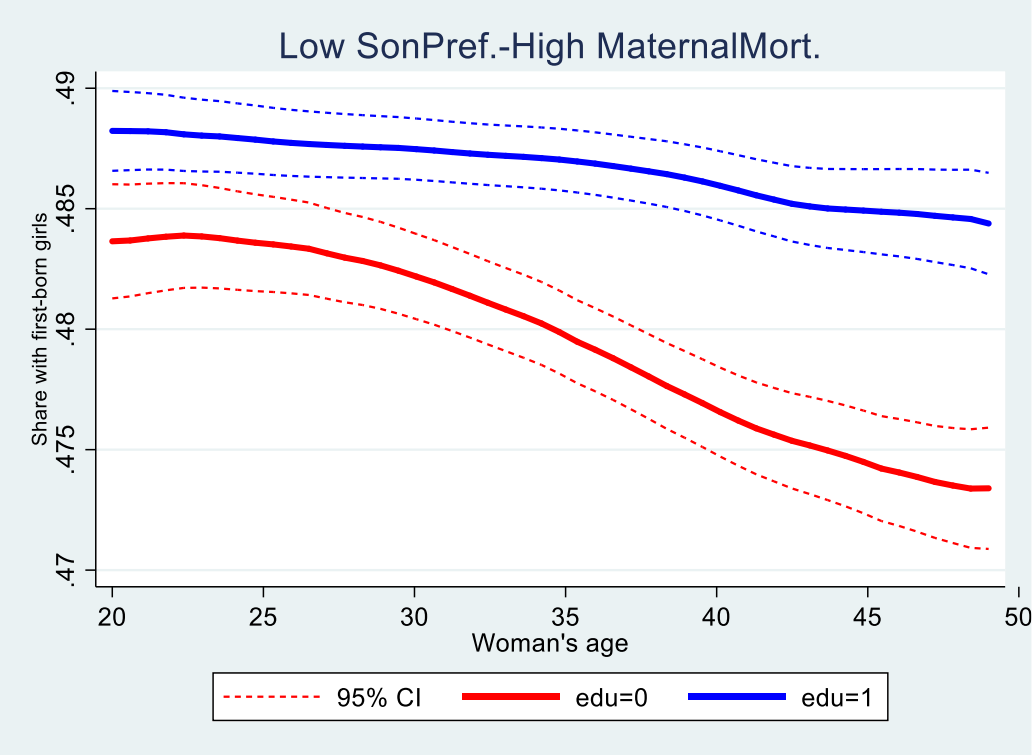
	(1)	(2)	(3)	(4)	(5)
Dep. var.= Imbalance=1 if negative slope					
High Son Preference	0.241*		-0.105**	-0.147**	-0.136
	(0.130)		(0.046)	(0.072)	(0.091)
High Risk of Maternal Mortality		0.074	0.017	-0.007	0.033
		(0.055)	(0.056)	(0.071)	(0.064)
High Son Pref*High M.Mortality			0.511***	0.494**	0.553**
			(0.162)	(0.195)	(0.210)
Region Fixed Effect	N	N	N	Y	N
Survey Year Fixed Effect	N	N	N	N	Y
Observations	219	219	219	219	219
R-squared	0.048	0.009	0.104	0.131	0.186

Note: All regressions control for average share of women aged 15-19 with a first-born girl. Robust standard errors clustered at the country level in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

Robustness on adding correlates Back

High Mortality Groups by Education





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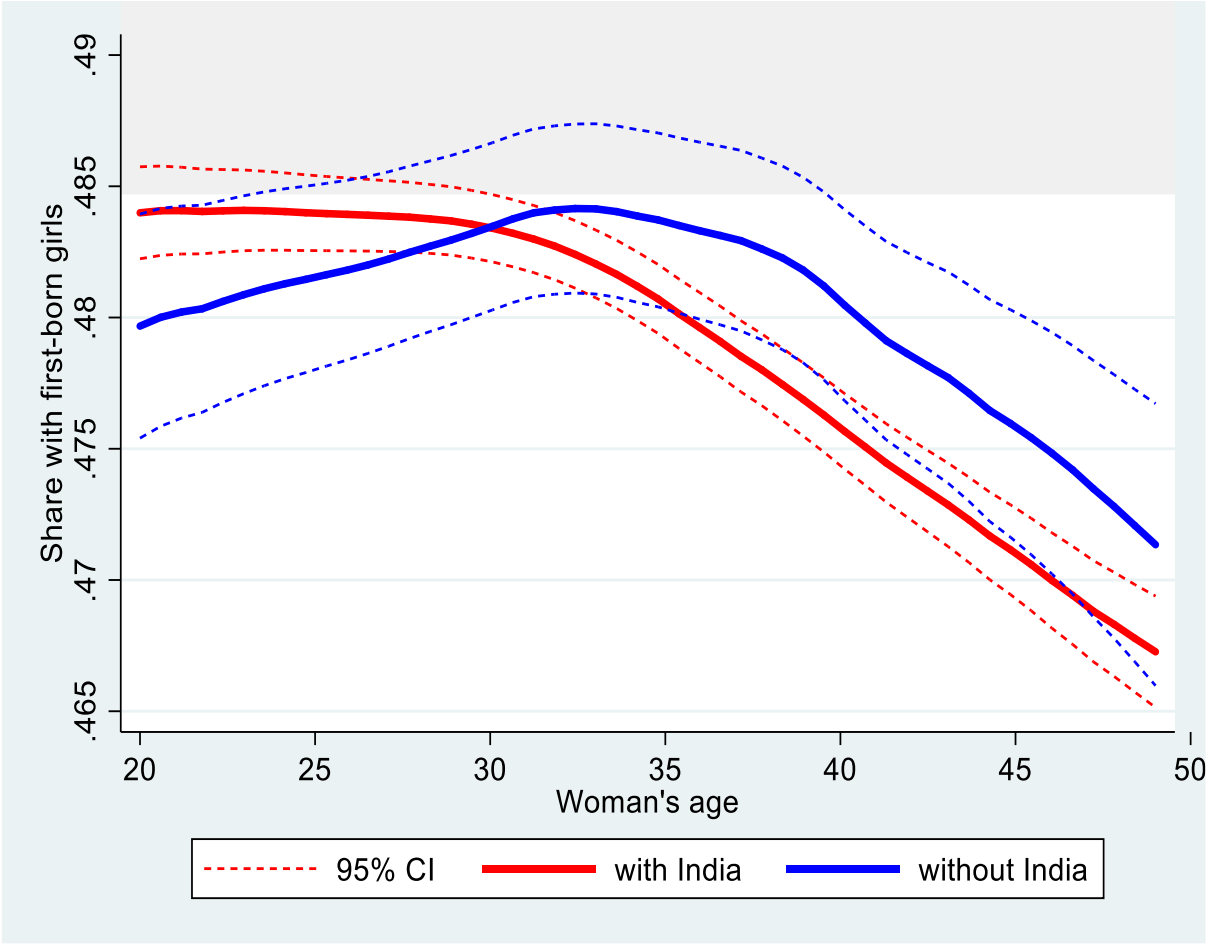
High SP and High MM without India



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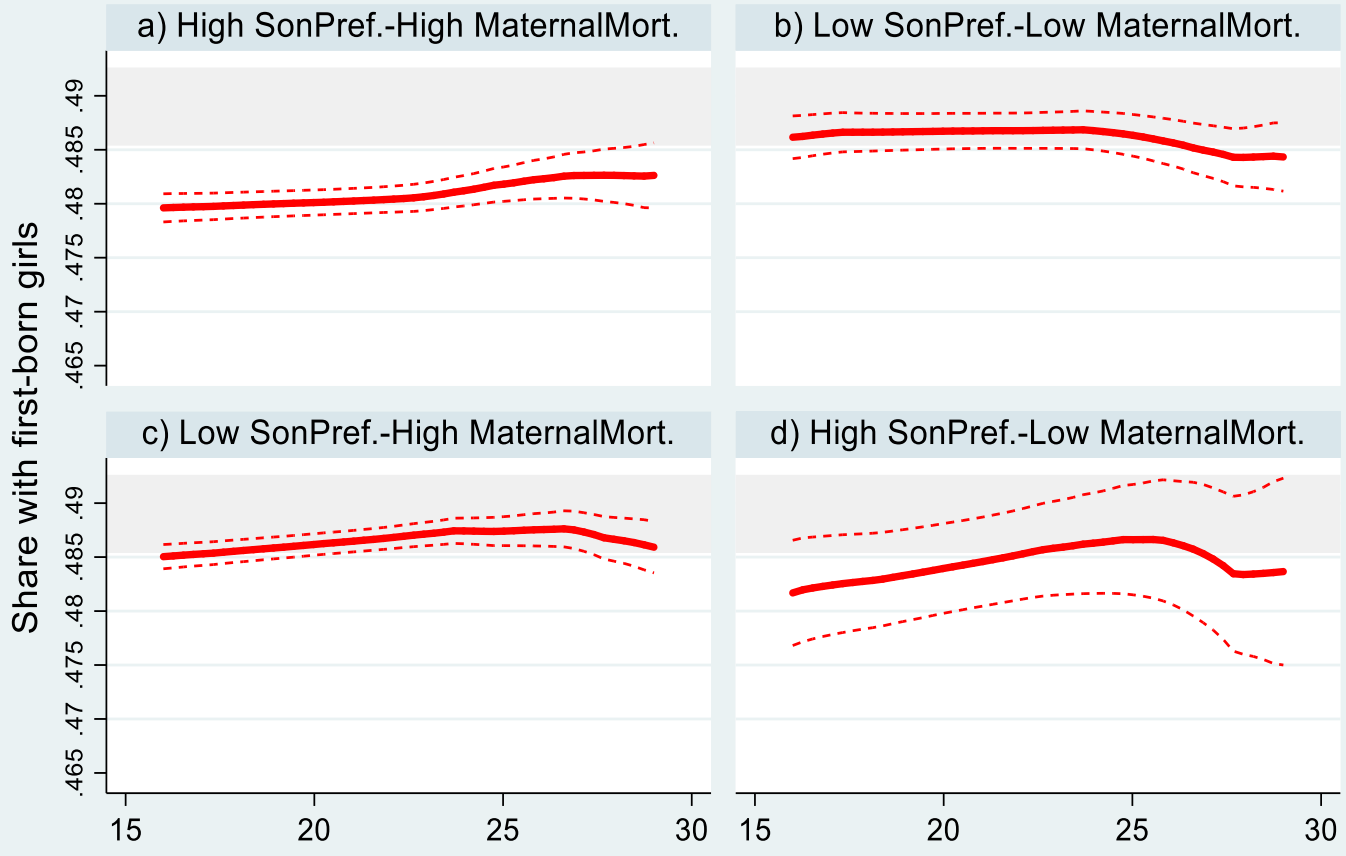
By age at first birth



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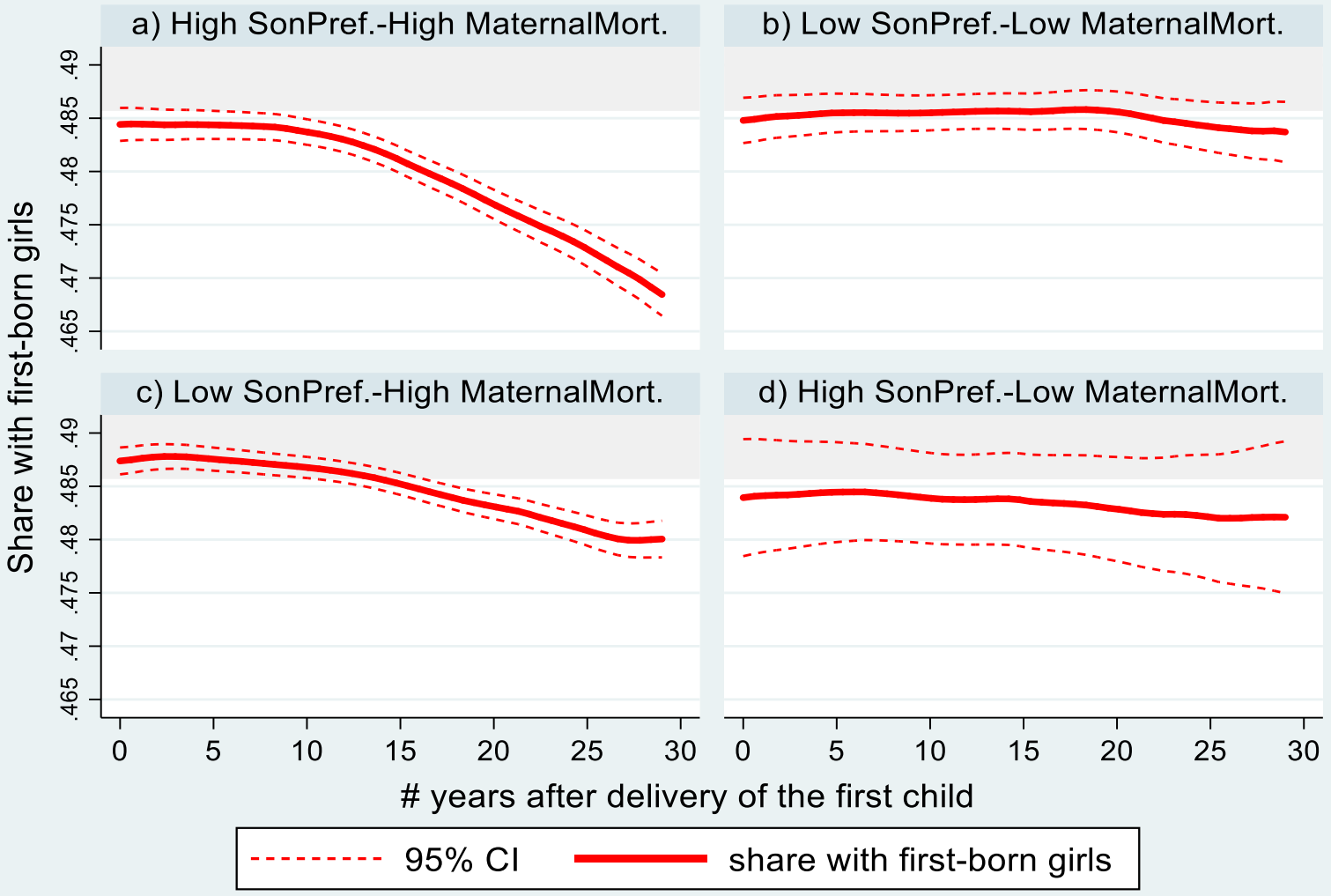
By years since first birth



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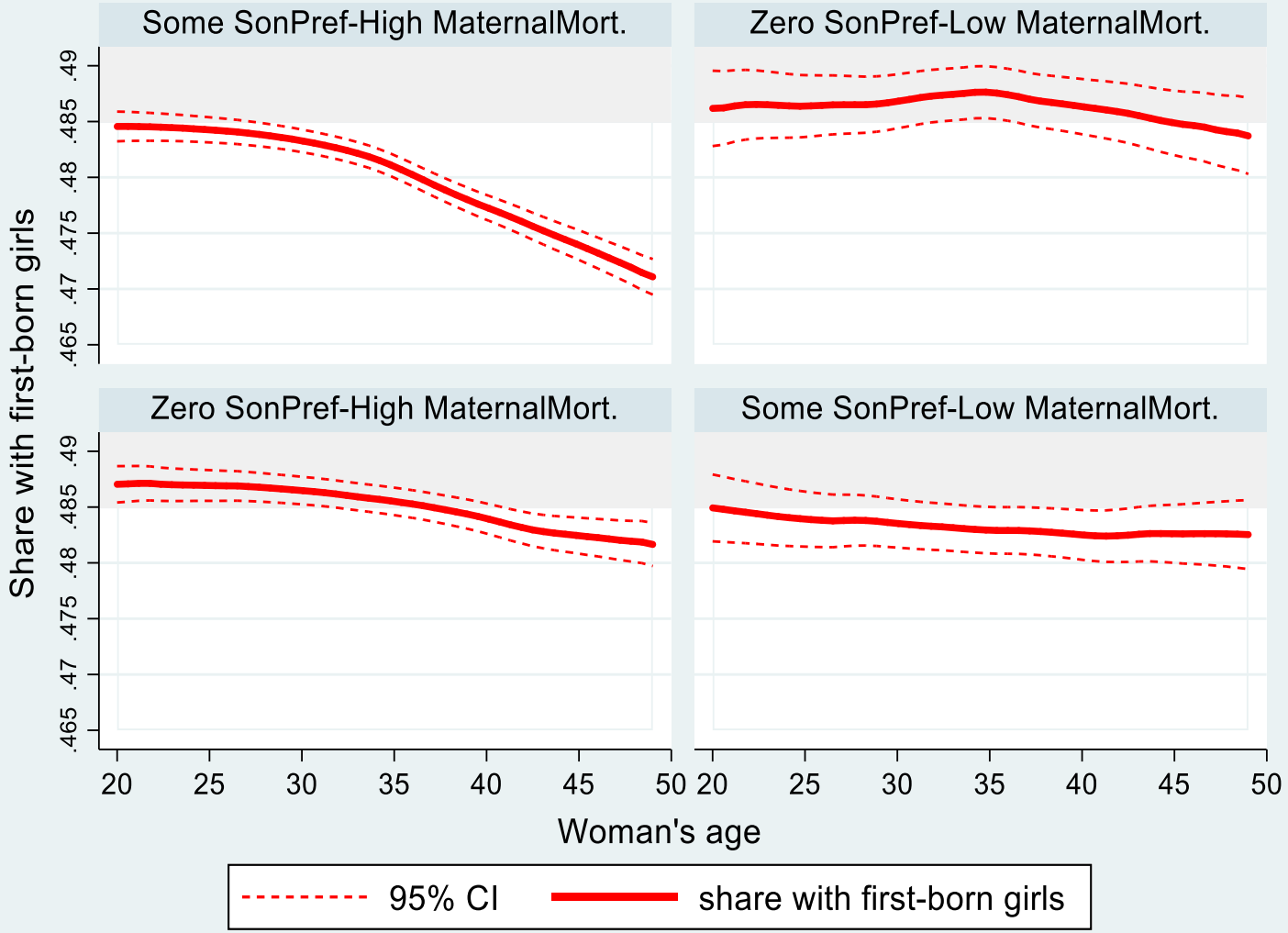
No/Some Son Preference and Maternal Mortality



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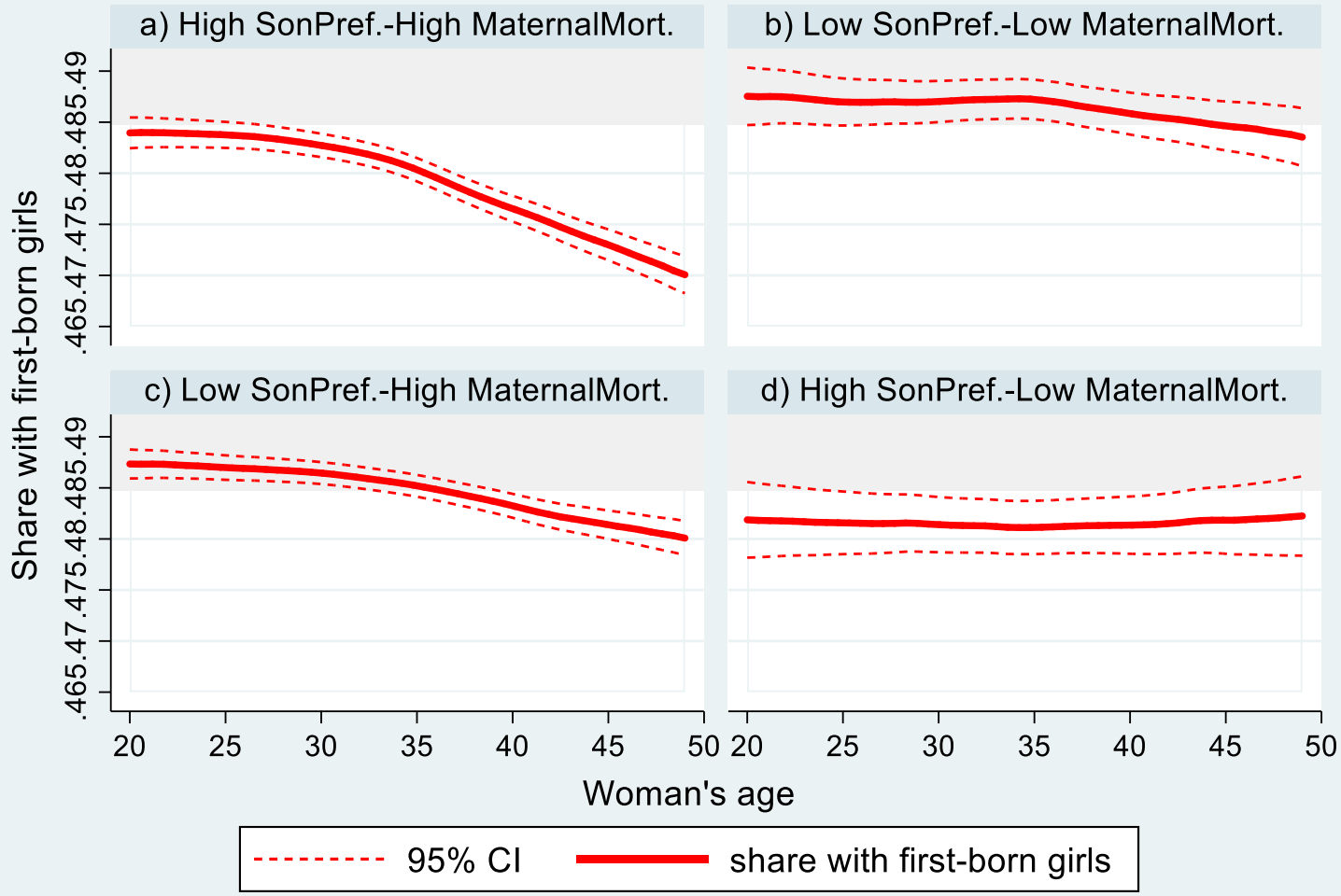
Son Preference =1 if 2 out of 5 indicators show son preference



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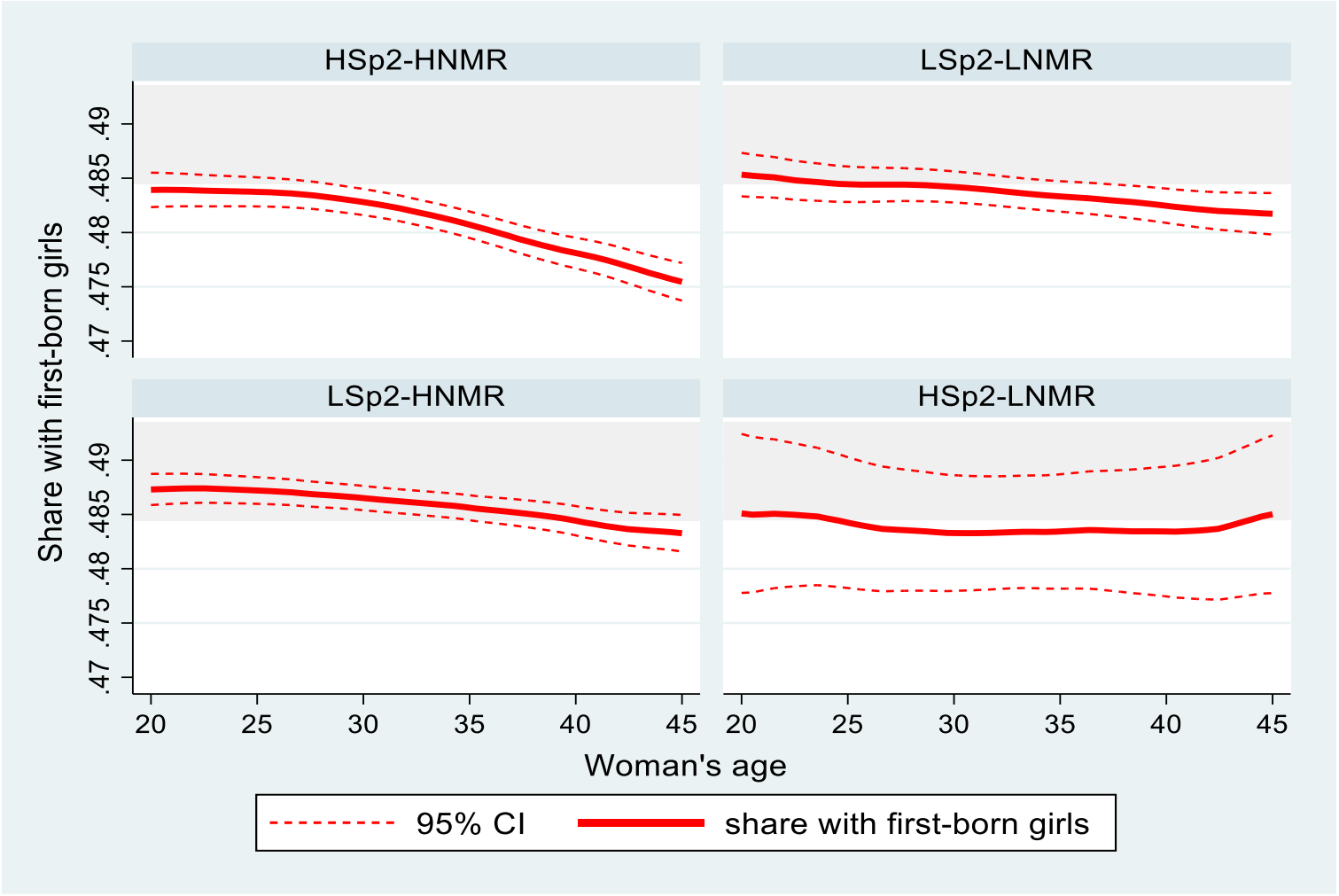
Using neo-natal mortality as an alternative measure of health



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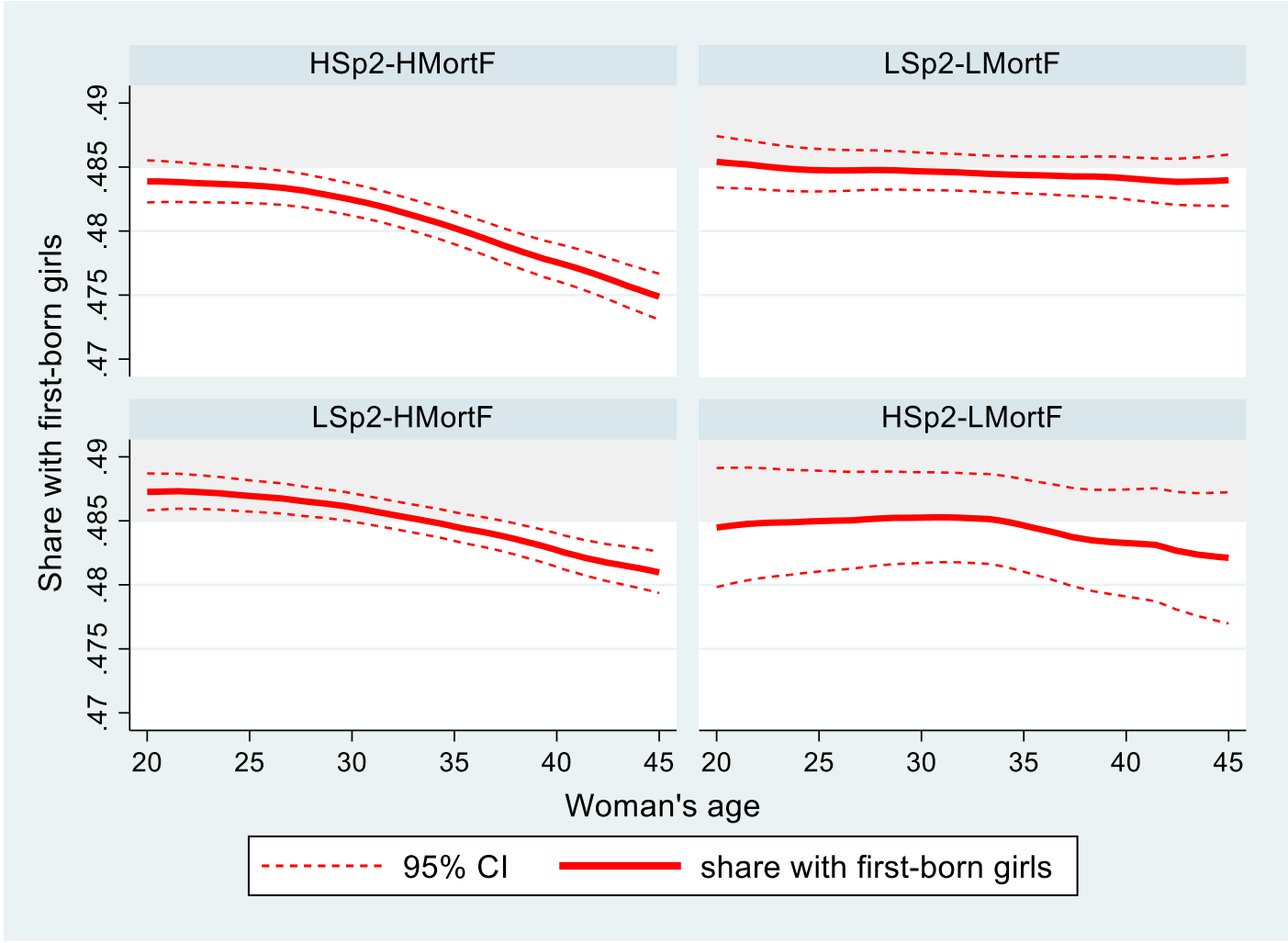
Using overall female mortality as an alternative measure of health



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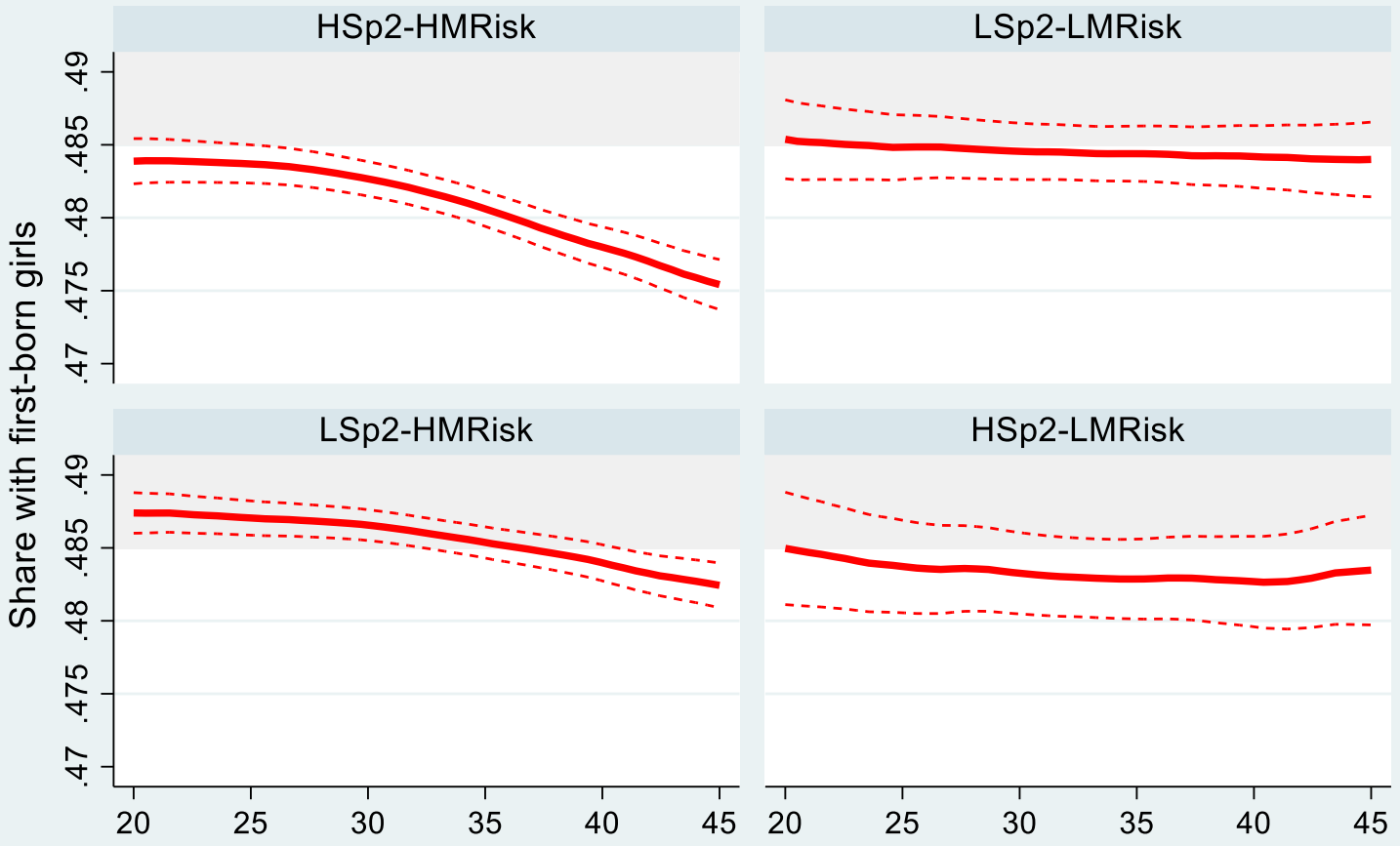
Country-level analysis



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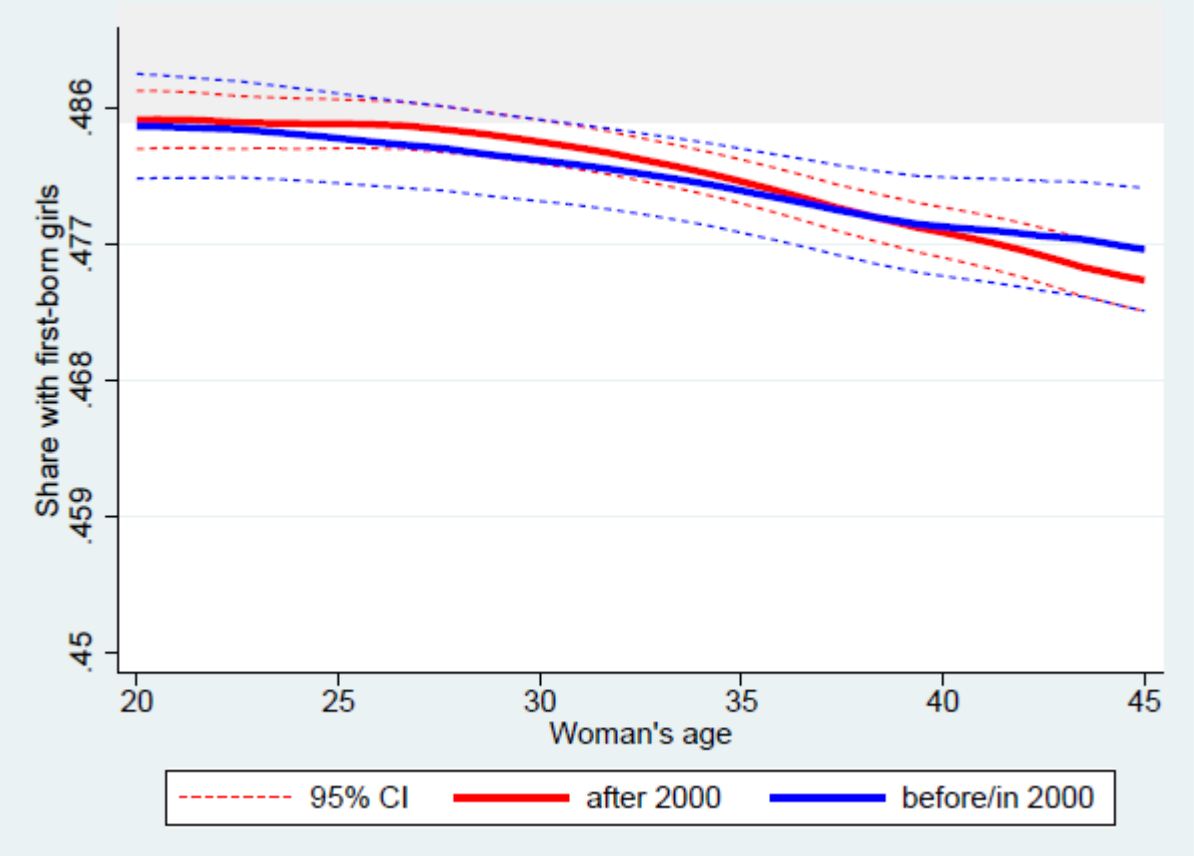
Before and after 2000 for HH group



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List of Surveys by Four Groups

High Son Preference					
High Mortality Risk			**Low Mortality Risk**		
Country	Survey Years	Observations	Country	Survey Years	Observations
Afghanistan	2015	26400	Egypt	1992 ,1995 ,2000	36049
Bangladesh	1996 ,2004 ,2007 ,2011	43867	Jordan	1997 ,2012	15113
Benin	2006	13613	Kyrgyz Republic	2012	5572
India	1992 ,1998 ,2005 ,2015	717545	Turkey	1993 ,1998	11412
Nepal	1996 ,2001 ,2006 ,2011	31690			
Pakistan	2006 ,2012	20622			

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Low Son Preference

High Mortality Risk

Country	Survey Years	Observations	Country	Survey Years	Observations
Angola	2015	11044	Lesotho	2004 ,2009 ,2014	14445
Bangladesh	1993 ,1999 ,2014	33784	Liberia	2006 ,2013	13125
Benin	1996 ,2001 ,2011	21121	Madagascar	1992 ,1997 ,2003 ,2008	28223
Bolivia	1993 ,1998 ,2003 ,2008	37435	Malawi	1992 ,2000 ,2004 ,2010 ,2015	59759
Burkina Faso	1992 ,1998 ,2003 ,2010	32232	Mali	1995 ,2001 ,2006 ,2012	38056
Burundi	2010	5877	Morocco	1992	4942
Cambodia	2000 ,2005 ,2010 ,2014	44051	Mozambique	1997 ,2003 ,2011	26900
Cameroon	1991 ,1998 ,2004 ,2011	24956	Myanmar	2015	7734
Central African Republic	1994	4348	Namibia	1992 ,2000 ,2006 ,2013	21414
Chad	1996 ,2004 ,2014	24480	Nicaragua	1997 ,2001	18883
Comoros	1996 ,2012	4542	Niger	1992 ,1998 ,2006 ,2012	27204
Congo	2005 ,2011	13800	Nigeria	1990 ,2003 ,2008 ,2013	62118
Congo Democratic Republic	2007 ,2013	21108	Pakistan	1990	5884
Cote d'Ivoire	1994 ,1998 ,2011	15515	Philippines	2013	10078
Ethiopia	2000 ,2005 ,2011	30176	Rwanda	1992 ,2000 ,2005 ,2010 ,2014	34736
Gabon	2000 ,2012	10773	Sao Tome and Principe	2008	1999
Gambia	2013	6798	Senegal	1992 ,1997 ,2005 ,2010	30651
Ghana	1993 ,1998 ,2003 ,2008 ,2014	20597	Sierra Leone	2008 ,2013	18058
Guatemala	1995	8754	Swaziland	2006	3455
Guinea	1999 ,2005 ,2012	18472	Tanzania	1991 ,1996 ,1999 ,2004 ,2009 ,2015	40186
Guyana	2009	3462	Timor-Leste	2009	7921
Haiti	1994 ,2000 ,2005 ,2012	24713	Togo	1998 ,2013	13077
Honduras	2005 ,2011	29673	Uganda	1995 ,2000 ,2006 ,2011	23556
Indonesia	1991 ,1994 ,1997 ,2002 ,2007 ,2012	162743	Yemen	1991 ,2013	19649
Kenya	1993 ,1998 ,2003 ,2008 ,2014	45941	Zambia	1992 ,2001 ,2007 ,2013	28580
			Zimbabwe	1994 ,1999 ,2005 ,2010 ,2015	28558

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Low Son Preference Low Mortality Risk		
Country	Survey Years	Observations
Albania	2008	4779
Armenia	2000 ,2005 ,2010 ,2015	16413
Azerbaijan	2006	5213
Brazil	1991 ,1996	12148
Colombia	1990 ,1995 ,2000 ,2004 ,2009 ,2015	107090
Dominican Republic	1991 ,1996 ,1999 ,2002 ,2007 ,2013	54515
Egypt	2005 ,2008 ,2014	51243
Guatemala	2014	17083
Jordan	1990 ,2002 ,2007	21038
Kazakhstan	1995 ,1999	5970
Kyrgyz Republic	1997	2757
Maldives	2009	6063
Moldova	2005	4910
Morocco	2003	8572
Paraguay	1990	3945
Peru	1991 ,1996 ,2000	48767
Philippines	1993 ,1998 ,2003 ,2008	35057
South Africa	1998	8165
Tajikistan	2012	6126
Turkey	2003	7290
Ukraine	2007	4758
Uzbekistan	1996	2997
Vietnam	1997 ,2002	10684

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Country-Years with Imbalance=1

SP-MM	CountryName	Year
HH	Pakistan	2006
HH	Nepal	1996
HH	Bangladesh	1996
HH	India	1992 ,1998 ,2005 ,2015
HH	Afghanistan	2015
LL	Maldives	2009
LL	Tajikistan	2012
LL	Philippines	2003
LL	Jordan	1990
LL	Vietnam	1997
LH	Mali	2001 ,2012
LH	Benin	2001 ,2006 ,2011
LH	Burkina Faso	2003
LH	Guinea	2012
LH	Nigeria	1990 ,2013
LH	Zimbabwe	1994
LH	Honduras	2005
LH	Uganda	1995
LH	Indonesia	2007 ,2012
LH	Chad	2014
LH	Cambodia	2000
LH	Yemen	1991
LH	Cameroon	1991 ,2004

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Descriptive Statistics for High SP and High MM

	High SonPref & High Mortality Risk			
	fg-fb	se	fb mean	Obs.
Edu in years	0.033**	(0.016)	3.973	859301
=1 if urban	-0.002	(0.002)	0.290	859681
Age	-0.205***	(0.029)	32.734	859681
Age at first birth	0.032***	(0.012)	19.21	858429
No. of children born	0.210***	(0.007)	3.108	859681
=1 if ever terminated pregnancy	0.010***	(0.001)	0.193	853663
=1 if using contraception	-0.041***	(0.002)	0.547	859681
=1 if wants more children	0.040***	(0.001)	0.201	844612
Spacing between 1st & 2nd birth	-0.884***	(0.076)	33.969	700237
=1 if anemic	0.011***	(0.002)	0.533	631091
=1 if severe of moderate anemic	0.006***	(0.002)	0.150	631091
Respondent's height	-0.022	(0.023)	151.59	707348

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Descriptive Statistics for Low SP and Low MM

	Low SonPref & Low Mortality Risk			
	fg-fb	se	fb mean	Obs.
Edu in years	-0.020	(0.023)	8.064	433,232
=1 if urban	0.001	(0.003)	0.569	445583
Age	-0.058	(0.050)	34.140	445583
Age at first birth	-0.017	(0.025)	21.216	445534
No. of children born	0.059***	(0.015)	3.083	445583
=1 if ever terminated pregnancy	-0.001	(0.003)	0.274	431583
=1 if using contraception	-0.007**	(0.003)	0.636	444956
=1 if wants more children	-0.002	(0.002)	0.230	431122
Spacing between 1st & 2nd birth	-0.325*	(0.170)	34.757	346328
=1 if anemic	0.006	(0.006)	0.289	68536
=1 if severe of moderate anemic	0.004	(0.003)	0.047	68536
Respondent's height	-0.045	(0.043)	157.088	254388

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Descriptive Statistics for Remaining Groups

	Low SonPref & High Mortality Risk				High SonPref & Low Mortality Risk			
	fg-fb	se	fb mean	Obs.	fg-fb	se	fb mean	Obs.
Edu in years	0.038**	(0.015)	4.843	1230345	0.057	(0.049)	5.004	68144
=1 if urban	0.002	(0.002)	0.318	1245586	-0.008	(0.005)	0.548	68146
Age	-0.095***	(0.029)	32.572	1245586	0.064	(0.085)	33.683	68146
Age at first birth	0.053***	(0.014)	19.391	1244834	0.106***	(0.041)	20.400	68140
No. of children born	-0.007	(0.008)	3.619	1245586	0.130***	(0.024)	3.638	68146
=1 if ever terminated pregnancy	0.001	(0.001)	0.166	1101868	0.004	(0.005)	0.359	68144
=1 if using contraception	0.001	(0.002)	0.386	1245574	-0.023***	(0.005)	0.581	68146
=1 if wants more children	0.001	(0.002)	0.465	1206800	0.014***	(0.004)	0.211	64616
Spacing between 1st & 2nd birth	-0.022	(0.108)	37.983	996431	-1.571***	(0.229)	30.203	58210
=1 if anemic	0.003	(0.003)	0.399	323429	-0.002	(0.009)	0.302	18513
=1 if severe of moderate anemic	-0.000	(0.002)	0.109	323429	-0.005	(0.005)	0.062	18513
Respondent's height	0.018	(0.031)	156.740	731084	-0.063	(0.072)	157.069	47698

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Descriptive Statistics by Time since Delivery

	High SonPref.-High Mortality Risk									
	td<=6		tdgr<5		tdgr<10		tdgr<15		tdgr>=15	
	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb
Edu in years	0.076	5.861	0.001	5.787	-0.024	5.233	-0.020	4.805	0.057***	2.823
=1 if urban	-0.015	0.269	-0.000	0.284	-0.002	0.285	-0.002	0.286	-0.003	0.294
Age at first birth	0.078	20.603	0.006	20.33	-0.005	19.987	0.003	19.759	0.038**	18.45
No. of children born	0.000	1.000	0.036***	1.405	0.102***	1.937	0.163***	2.342	0.329***	4.169
=1 if ever terminated pregnancy	0.004	0.093	0.008***	0.136	0.008***	0.166	0.008***	0.183	0.013***	0.206
=1 if using contraception	-0.003	0.134	-0.037***	0.326	-0.051***	0.428	-0.050***	0.497	-0.024***	0.617
=1 if wants more children	0.034***	0.865	0.062***	0.624	0.066***	0.436	0.056***	0.327	0.008***	0.02
=1 if anemic	0.001	0.586	0.008*	0.56	0.012***	0.546	0.014***	0.536	0.005*	0.528
Spacing between 1st & 2nd birth			-0.130	25.986	-0.156	30.955	-0.403***	32.571	-1.319***	35.413

Back

Descriptive Statistics by Time since Delivery

	Low SonPref.-Low Mortality Risk									
	td<=6		tdgr<5		tdgr<10		tdgr<15		tdgr>=15	
	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb
Edu in years	0.054	9.175	-0.056	9.188	-0.030	8.977	-0.035	8.758	-0.009	7.013
=1 if urban	-0.005	0.56	-0.002	0.568	0.000	0.57	0.003	0.567	-0.003	0.571
Age at first birth	-0.234	22.106	-0.077	22.045	-0.075*	21.938	-0.054	21.836	0.026	20.274
No. of children born	0.000	1.000	0.024***	1.363	0.048***	1.835	0.062***	2.224	0.074**	4.389
=1 if ever terminated pregnancy	-0.006	0.100	0.001	0.148	-0.000	0.19	-0.002	0.224	0.001	0.35
=1 if using contraception	0.005	0.386	-0.014**	0.559	-0.014***	0.611	-0.009**	0.642	-0.003	0.627
=1 if wants more children	-0.005	0.758	0.002	0.586	-0.002	0.441	-0.004	0.348	-0.001	0.048
=1 if anemic	0.038	0.371	0.014	0.297	0.007	0.294	0.003	0.293	0.011	0.285
Spacing between 1st & 2nd birth			-0.484**	24.963	-0.489**	31.756	-0.491**	34.270	-0.127	35.274

Back

Descriptive Statistics by Time since Delivery

	Low SonPref.-High Mortality Risk									
	td<=6		tdgr<5		tdgr<10		tdgr<15		tdgr>=15	
	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb
Edu in years	0.077	6.244	-0.011	6.184	0.013	5.791	0.006	5.495	0.046**	3.864
=1 if urban	0.011	0.319	0.001	0.336	0.004	0.329	0.004*	0.325	-0.001	0.308
Age at first birth	-0.113	20.711	-0.016	20.518	0.022	20.242	0.010	20.055	0.077***	18.392
No. of children born	0.000	1.000	-0.004	1.352	0.005	1.936	0.019***	2.470	0.027*	5.344
=1 if ever terminated pregnancy	-0.003	0.076	0.001	0.096	0.001	0.117	0.001	0.135	0.004	0.211
=1 if using contraception	0.010	0.239	-0.004	0.384	-0.004*	0.39	-0.002	0.401	0.004	0.363
=1 if wants more children	-0.003	0.883	0.002	0.824	0.001	0.729	-0.000	0.642	-0.009***	0.194
=1 if anemic	0.003	0.468	-0.001	0.410	0.006	0.398	0.003	0.395	0.004	0.406
Spacing between 1st & 2nd birth			0.248**	27.133	-0.066	34.169	0.186	36.745	-0.193	39.288

Back

Descriptive Statistics by Time since Delivery

	High SonPref.-Low Mortality Risk									
	td<=6		tdgr<5		tdgr<10		tdgr<15		tdgr>=15	
	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb	fg-fb diff	fb
Edu in years	0.379	6.997	0.064	6.961	0.074	6.536	0.059	6.054	0.035	3.511
=1 if urban	-0.003	0.544	0.005	0.543	-0.012	0.557	-0.009	0.556	-0.008	0.536
Age at first birth	-0.017	21.868	0.051	21.746	0.045	21.514	0.077	21.211	0.133**	19.247
No. of children born	0.000	1.000	0.023*	1.448	0.087***	2.024	0.105***	2.520	0.186***	5.228
=1 if ever terminated pregnancy	0.021	0.108	-0.009	0.195	-0.003	0.248	0.000	0.290	0.011	0.456
=1 if using contraception	0.036	0.360	-0.022*	0.521	-0.025***	0.579	-0.025***	0.609	-0.019**	0.540
=1 if wants more children	0.036	0.868	0.034***	0.606	0.020**	0.432	0.018***	0.330	0.005**	0.027
=1 if anemic	-0.057	0.415	-0.018	0.337	-0.000	0.324	-0.001	0.319	-0.006	0.28
Spacing between 1st & 2nd birth			-1.187***	25.234	-1.677***	29.507	-1.799***	30.349	-1.324***	30.046

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Joint Role of Son Preference and Risk of Maternal Mortality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Dependent var.= Imbalance=1 if negative slope									
High Son Preference	0.241*		-0.105**	-0.147**	-0.136	-0.182***	-0.123**	-0.124**	-0.182**	-0.228***
	(0.130)		(0.046)	(0.072)	(0.091)	(0.054)	(0.050)	(0.047)	(0.075)	(0.072)
High Risk of Maternal Mortality		0.074	0.017	-0.007	0.033	-0.070	-0.028	0.047	-0.004	-0.014
		(0.055)	(0.056)	(0.071)	(0.064)	(0.093)	(0.097)	(0.069)	(0.077)	(0.122)
High Son Pref*High M.Mortality			0.511***	0.494**	0.553**	0.504***	0.485***	0.472***	0.506***	0.528***
			(0.162)	(0.195)	(0.210)	(0.158)	(0.148)	(0.167)	(0.167)	(0.149)
Region Fixed Effect				Y						
Survey Year Fixed Effect					Y					
Economic Correlates						Y				Y
Health Correlates							Y			Y
Cultural Correlates								Y		Y
Historical Correlates									Y	Y
Observations	219	219	219	219	219	218	219	219	216	215
R-squared	0.048	0.009	0.104	0.131	0.186	0.143	0.114	0.121	0.139	0.169

Note: All regressions control for average share of women with first born girl in age 15-19 years old. Economic Controls include ratio of female to male labor force participation, average years of education, and share of respondents living in urban areas. Health controls include ratio of female and male mortality, and ratio of female to male life expectancy. Cultural controls include average age at first marriage and average age at first birth. Historical controls include ancestral use of plough, historical prevalence of matrilocality, patrilocality, extended family and nuclear family. Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

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Effect of a first-born girl on anemia

$$Anemic_{is} = \alpha + \beta First\ born\ girl_{is} + X_{is} + \tau + \varepsilon_{is}$$

– X_{is}: age in years, urban, height, indicator for completing at least 1 year of education

– τ: Survey-year dummies

- Randomness of the sex of the first-born child (Das Gupta 1987; Bhat and Zavier 2007; Dahl and Moretti 2008; Bhalotra and Cochrane, 2010; Jha et al. 2011; Rosenblum 2013; Heath and Tan 2016; Anukriti et al. 2016; Milazzo 2018)

Effect of a first-born girl on anemia

Country-year group: High SonPref & High Mortality Risk				
Dep. Var.:	*=1 if anemic*			
	(1)	(2)	(3)	(4)
Years since delivery:	all	<5	<10	<15
First-born daughter	0.010***	0.007	0.012***	0.014***
	(0.002)	(0.005)	(0.003)	(0.003)
Respondent's height in cm	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	629215	126216	246986	363417
R-sq	0.013	0.022	0.018	0.017
Y-Mean	0.533	0.560	0.546	0.536

Note: Other controls include dummy for urban, age at first birth, age, indicator variable if women has positive years of education, and survey year dummy. Robust standard error in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

→ An effect on anemia is ONLY found in places with both high son preference AND high mortality risk

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Anemia Regression for HH Group

	High SonPref.-High Mortality Risk							
	=1 if anemic				*=1 if severly/moderately anemic*			
	alltd	tdgr<5	tdgr<10	tdgr<15	alltd	tdgr<5	tdgr<10	tdgr<15
First-born daughter	0.010***	0.007	0.012***	0.014***	0.006***	-0.000	0.003	0.006***
	(0.002)	(0.005)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)
Respondent's height in cm	-0.003***	-0.003***	-0.003***	-0.003***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	629215	126216	246986	363417	629215	126216	246986	363417
R-sq	0.013	0.022	0.018	0.017	0.008	0.017	0.013	0.012
Y-Mean	0.533	0.560	0.546	0.536	0.150	0.170	0.162	0.154

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Anemia Regression for LL Group

Panel B: Low SonPref.-Low Mortality Risk								
	=1 if anemic				=1 if severly/moderately anemic			
	All td	td<5 yrs	td<10 yrs	td<15 yrs	All td	td<5 yrs	td<10 yrs	td<15 yrs
First-born daughter	0.007	0.009	0.006	0.003	0.003	-0.007	-0.003	-0.000
	(0.006)	(0.012)	(0.009)	(0.007)	(0.003)	(0.006)	(0.004)	(0.003)
Respondent's height in cm	0.000	0.001*	0.000	0.000	-0.001***	-0.000	-0.001**	-0.001***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	67440	13483	25910	38554	67440	13483	25910	38554
R-sq	0.034	0.051	0.038	0.037	0.019	0.026	0.020	0.020
Y-Mean	0.290	0.298	0.295	0.293	0.047	0.049	0.044	0.043

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Anemia Regression for LH Group

	Panel C: Low SonPref.-High Mortality Risk							
	=1 if anemic				=1 if severly/moderately anemic			
	All td	td<5 yrs	td<10 yrs	td<15 yrs	All td	td<5 yrs	td<10 yrs	td<15 yrs
First-born daughter	0.003	-0.000	0.005	0.002	-0.000	-0.000	-0.002	-0.001
	(0.003)	(0.006)	(0.004)	(0.004)	(0.002)	(0.004)	(0.003)	(0.002)
Respondent's height in cm	0.001**	0.001*	0.001*	0.001**	0.000***	0.000	0.000**	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	316345	73542	139593	199189	316345	73542	139593	199189
R-sq	0.025	0.028	0.026	0.026	0.011	0.017	0.014	0.013
Y-Mean	0.396	0.406	0.394	0.391	0.106	0.108	0.109	0.107

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Anemia Regression for HL Group

	Panel D: High SonPref.-Low Mortality Risk							
	=1 if anemic				=1 if severly/moderately anemic			
	All td	td<5 yrs	td<10 yrs	td<15 yrs	All td	td<5 yrs	td<10 yrs	td<15 yrs
First-born daughter	0.000	-0.016	0.004	0.004	-0.003	-0.010	0.001	0.001
	(0.009)	(0.021)	(0.015)	(0.013)	(0.005)	(0.010)	(0.007)	(0.006)
Respondent's height in cm	-0.003***	-0.002	-0.002	-0.002**	-0.002***	0.000	-0.002**	-0.002***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Observations	18482	4148	7726	10905	18482	4148	7726	10905
R-sq	0.012	0.008	0.006	0.010	0.010	0.012	0.008	0.009
Y-Mean	0.302	0.338	0.324	0.319	0.062	0.065	0.062	0.060

Note: td denotes time since first delivery.

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Anemia Regression for second-girl (HH Group)

	High SonPref.-High Mortality Risk							
	=1 if anemic				*=1 if severly/moderately anemic*			
	All td	td<5 yrs	td<10 yrs	td<15 yrs	All td	td<5 yrs	td<10 yrs	td<15 yrs
Second-born daughter	0.010***	0.013*	0.019***	0.017***	0.008***	0.015***	0.017***	0.013***
	(0.003)	(0.007)	(0.005)	(0.004)	(0.002)	(0.006)	(0.004)	(0.003)
Respondent's height in cm	-0.003***	-0.002***	-0.003***	-0.003***	-0.001***	-0.000	-0.001**	-0.001***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	245865	53201	105030	154871	245865	53201	105030	154871
R-sq	0.011	0.016	0.014	0.013	0.007	0.013	0.011	0.010
Y-Mean	0.540	0.565	0.551	0.542	0.153	0.164	0.158	0.154

Note: td denotes time since second delivery. Sample restricted to women who had a first-born girl and at least two births.

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Economic Correlates of Imbalance (without India)

Panel A: Economic Variables						
% urban	-0.351***					
	(0.131)					
Mean edu in years		-0.020**				
		(0.009)				
Ratio of female and male primary enrolment			-0.599***			
			(0.214)			
Ratio of female and male secondary enrolment				-0.312**		
				(0.147)		
Ratio of female and male labor force participation					-0.100	
					(0.098)	
Share of female ownership of firms						-0.001
						(0.002)
Observations	215	214	176	125	215	199
R-squared	0.029	0.028	0.043	0.044	0.006	0.013

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Health Correlates of Imbalance (without India)

Panel B: Health Variables					
% high skilled birth	-0.132***				
	(0.043)				
Ratio of female and male mortality		0.239			
		(0.162)			
Ratio of female and male life expectancy			-1.149		
			(0.746)		
% anemic				0.635**	
				(0.312)	
% severe or moderate anemic					1.371*
					(0.755)
Observations	164	215	215	90	90
R-squared	0.027	0.012	0.013	0.076	0.070

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Cultural and Historical Correlates of Imbalance (without India)

Dependent var.= Imbalance=1 if negative slope (Exclude India)									
Panel C: Cultural and Historical variables									
% want more boys than girls	0.743**								
	(0.333)								
Mean age at first marriage		-0.031**							
		(0.014)							
Mean age at first birth			-0.013						
			(0.018)						
Beating is justified				0.003**					
				(0.002)					
Men have more right to job when jobs scarce					0.119				
					(0.105)				
Men make better political leader						0.033			
						(0.061)			
Aboriginal plow use							0.227*		
							(0.120)		
Matrilocality								-0.230**	
								(0.102)	
Patrilocality									0.202**
									(0.097)
Observations	185	215	215	92	53	51	72	72	72
R-squared	0.033	0.022	0.004	0.045	0.014	0.006	0.067	0.008	0.033

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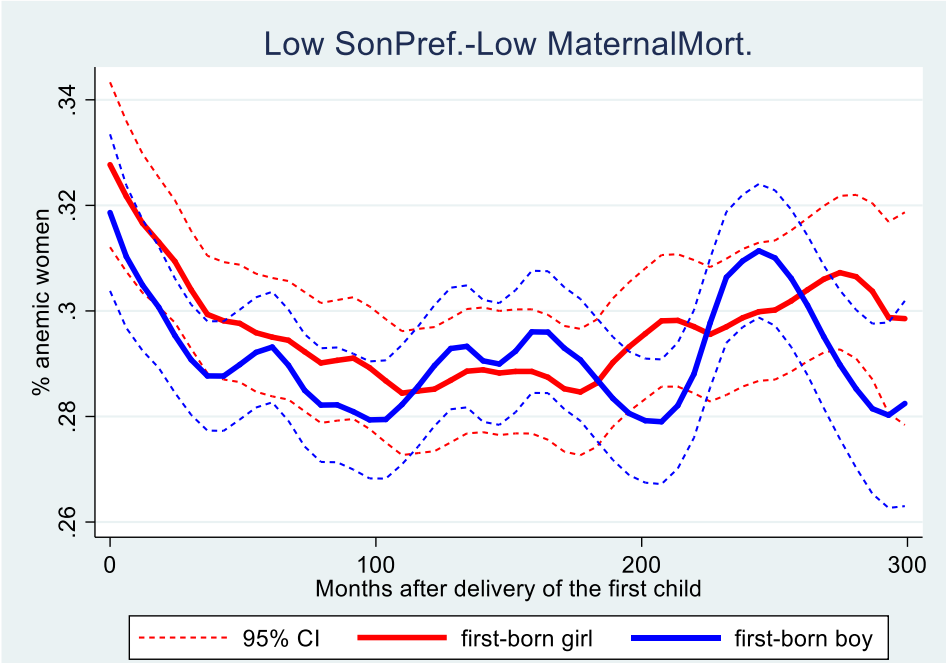
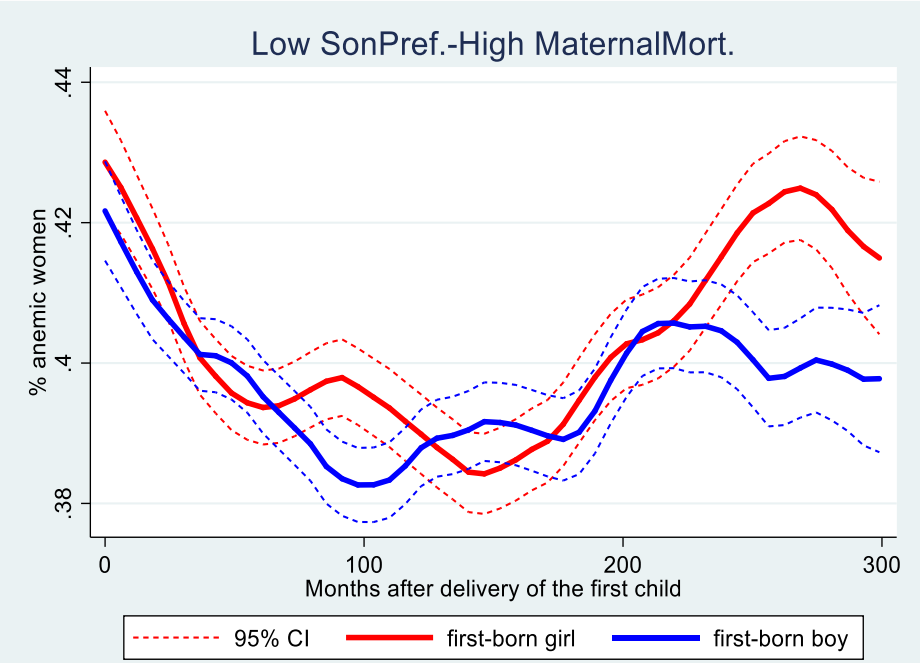
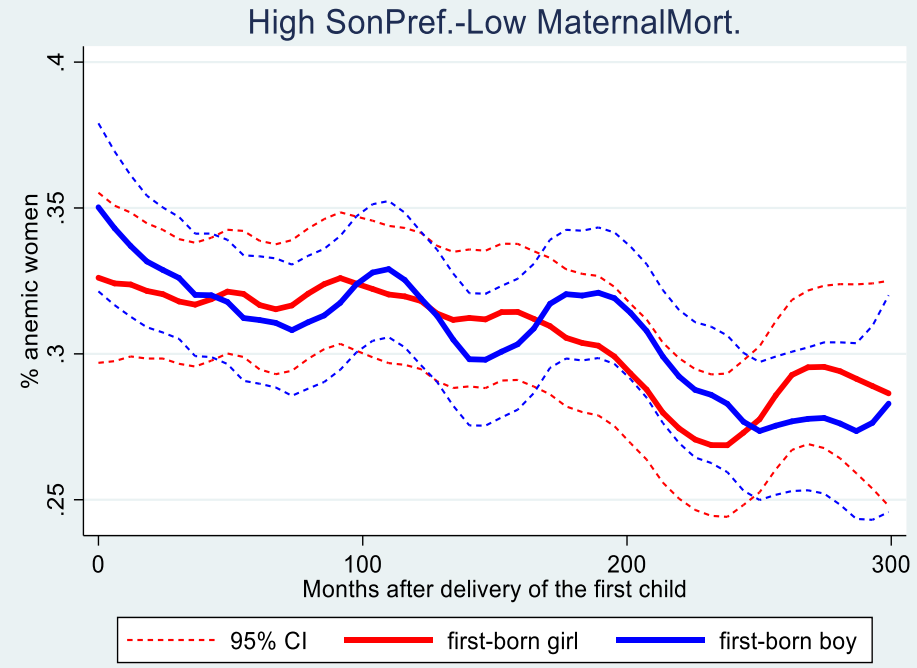

Low SonPref.-Low MaternalMort.
% anemic women
.26
.28
.3
.32
.34
0
100
200
300
Months after delivery of the first child
95% CI
first-born girl
first-born boy


Low SonPref.-High MaternalMort.
% anemic women
.38
.4
.42
.44
0
100
200
300
Months after delivery of the first child
95% CI
first-born girl
first-born boy


High SonPref.-Low MaternalMort.
% anemic women
.25
.3
.35
.4
0
100
200
300
Months after delivery of the first child
95% CI
first-born girl
first-born boy

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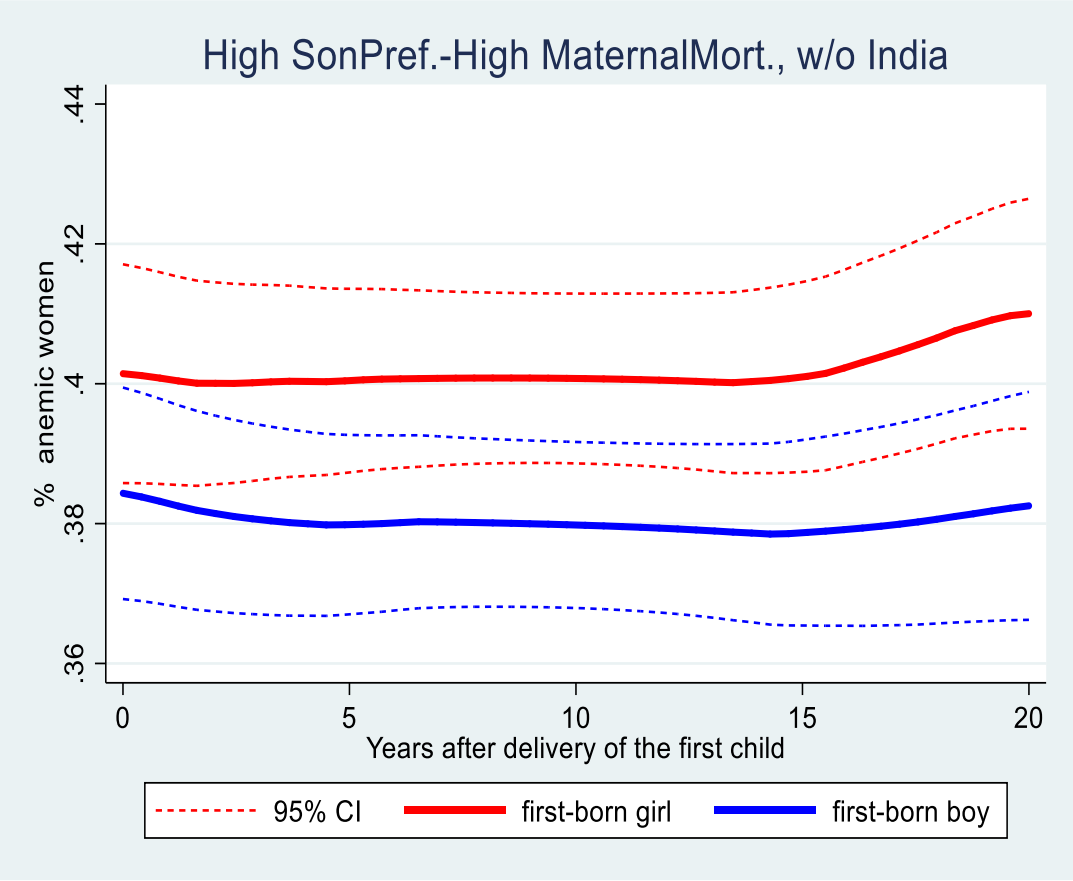
Anemia for High SP and High MM without India



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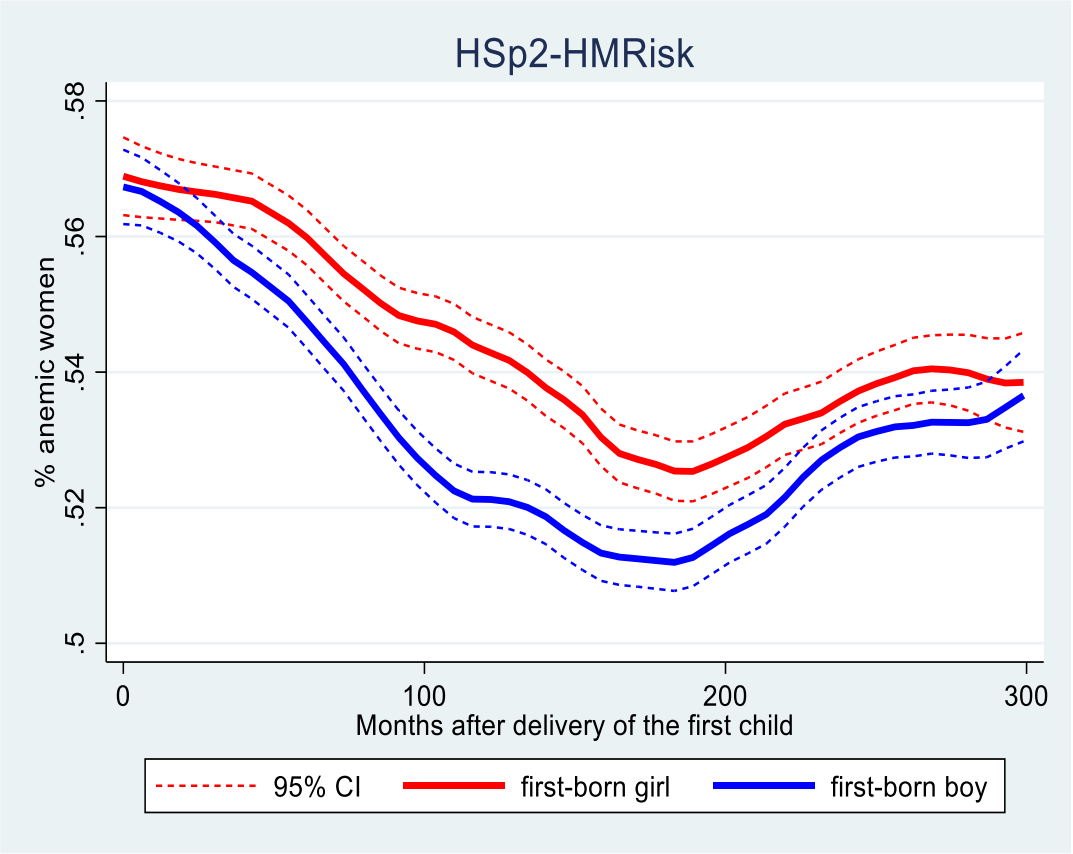
Anemia for High SP and High MM defined at country-level



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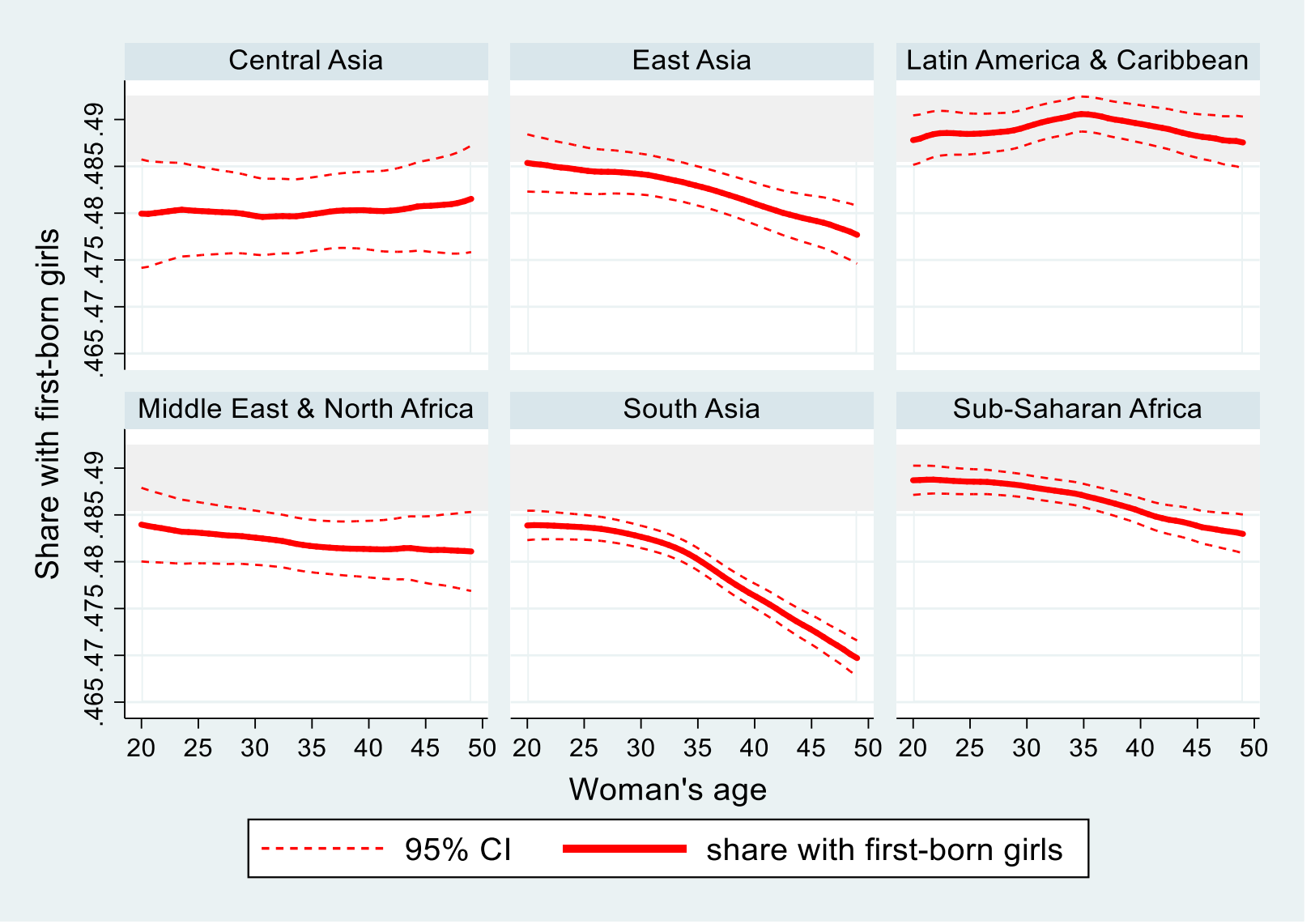
Share of Women with First-girl: By Region



Imbalance over time

Dep. Var.: =1 if Imbalance=1									
		with region FE	with country FE	Central Asia	East Asia	LAC	MENA	S Asia	SSA
year	-0.000	-0.001	-0.003	0.011	0.001	0.001	-0.021	-0.011	-0.001
	(0.003)	(0.003)	(0.005)	(0.011)	(0.023)	(0.001)	(0.013)	(0.010)	(0.004)
Obs	219	219	219	17	19	33	15	20	115
R-sq	0.001	0.103	0.462	0.239	0.094	0.041	0.347	0.266	0.007

	HSonPref-HMMortality	LSonPref-LMMortality	LSonPref-HMMortality	HSonPref-LMMortality
year	-0.022	0.002	-0.001	0.000
	(0.014)	(0.007)	(0.004)	(0.000)
Obs	17	48	146	8
R-sq	0.293	0.037	0.001	

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Contribution

- A potential channel to understand the phenomenon of missing adult women in the developing world for some parts of the developing world (Anderson and Ray 2010, 2012)

- Negative impact of son preference on mother's (and consequently) children's well-being (Jayachandran and Kuziemko 2011; Jayachandran and Pande 2013; Jensen 2003; Barcellos et al. 2014; Bhardwaj and Lakhdawala 2013)

- Present a comprehensive account of the prevalence and variation in son preference using behaviour measures for 74 countries (Bongaarts, 2013; Filmer, Friedman and Schady, 2009).

- Associations between ancestral and cultural norms and our indicator of maternal health (Alesina et al, 2013; Alesina, Brioschi and La Ferrara, 2020; Fernandez and Fogli, 2009; Giuliano, 2007; Guiso et al., 2008; Becker 2020)