Maternal Mortality and Female Life Expectancy: The Importance of Gender Inequality

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Motivating Fact: MMR decline slower than other infectious diseases

- Infant mortality decline started much earlier and progressed more rapidly than maternal mortality decline.
- Infant mortality decline has benefited from massive improvements in control of infectious disease.
- Historically, the same improvements led to maternal mortality declines, consistent with 40-50% of maternal deaths being the result of post-partum puerperal sepsis (an infection).
- Our hypothesis: the sluggishness of MMR decline is a function of gender prejudice, (in Med/Public Health: The Yentl Syndrome).

This Paper

Gender predjudice in societies has strong (lethal) implications on women-specific health outcomes. We test this in a number of ways:

1. Historical reforms (suffrage, sulfonamides) and state-varying MMR reductions
2. Time series and cross-sectional variation in gender inequality and female health world-wide
3. Historical intra-country and cross-country gender predjudice determinants
4. Examining placebo (gender-neutral) diseases using the same specifications

(1) Historical Reforms: Sulfa and Suffrage

We estimate the following DiD model:

$$\begin{aligned} log(MMR)_{st} \quad = \quad & \alpha + \beta \mathbb{I}[Post1937]_t + \gamma(EarlySuf_s \times t) + \delta_1(EarlySuf \times Post1937_t) \\ & + \delta_2(EarlySuf \times Post1937_t \times t) + \phi_t + \mu_s + \upsilon_{st}. \end{aligned}$$

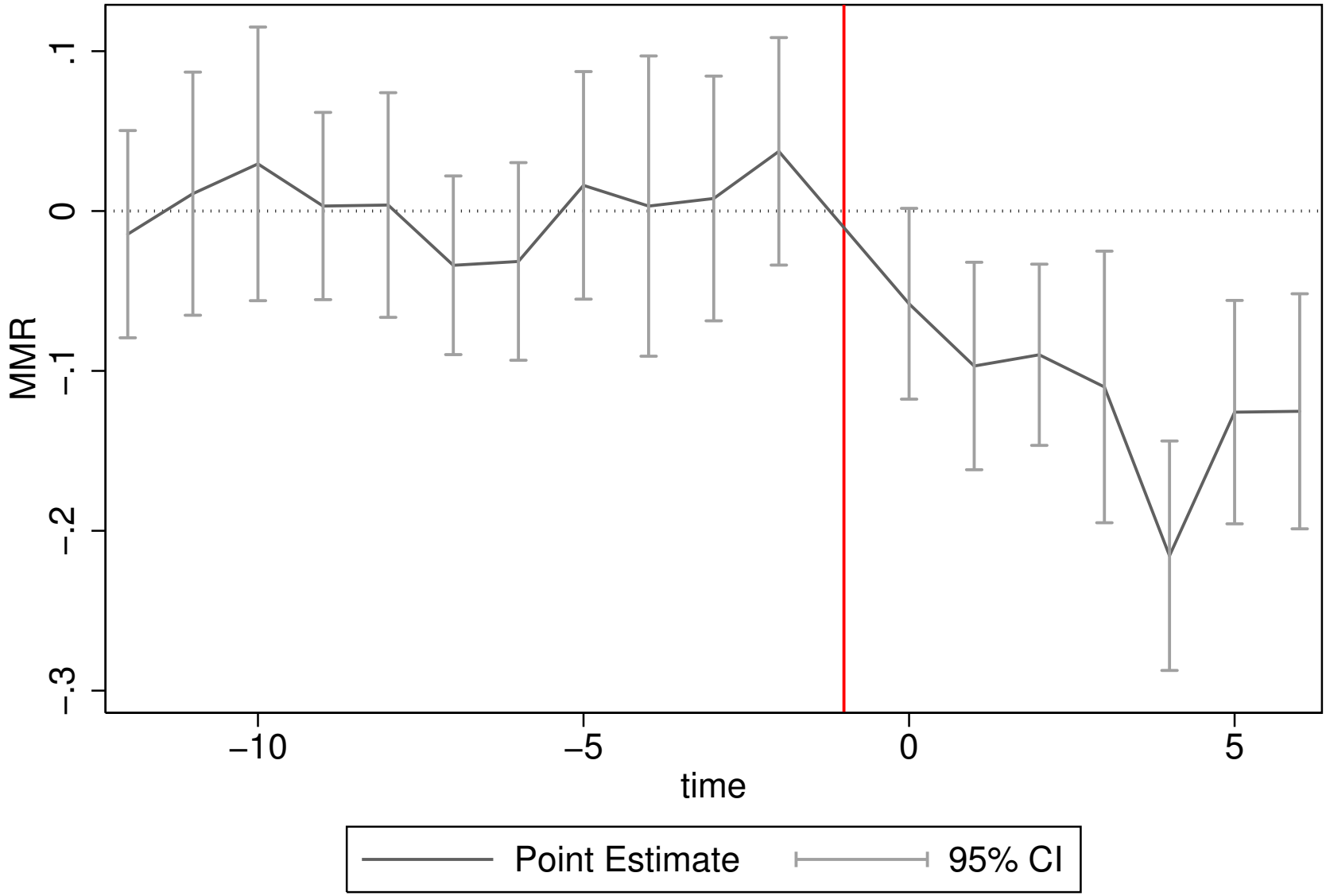
- δ_1 and δ_2 test whether there are larger level and trend breaks in MMR in early suffrage states.
- We estimate the same equation for pneumonia which was most prevalent among infants and especially boys, and was treatable with sulfa. So good falsification test.
- Data for 1925-1943; sulfa drugs introduced in 1937. Dummy for early vs late suffrage adoption.

Sulfa and Suffrage: Estimation and Results

We estimate the above specification, as well as full event studies for both (next slides)

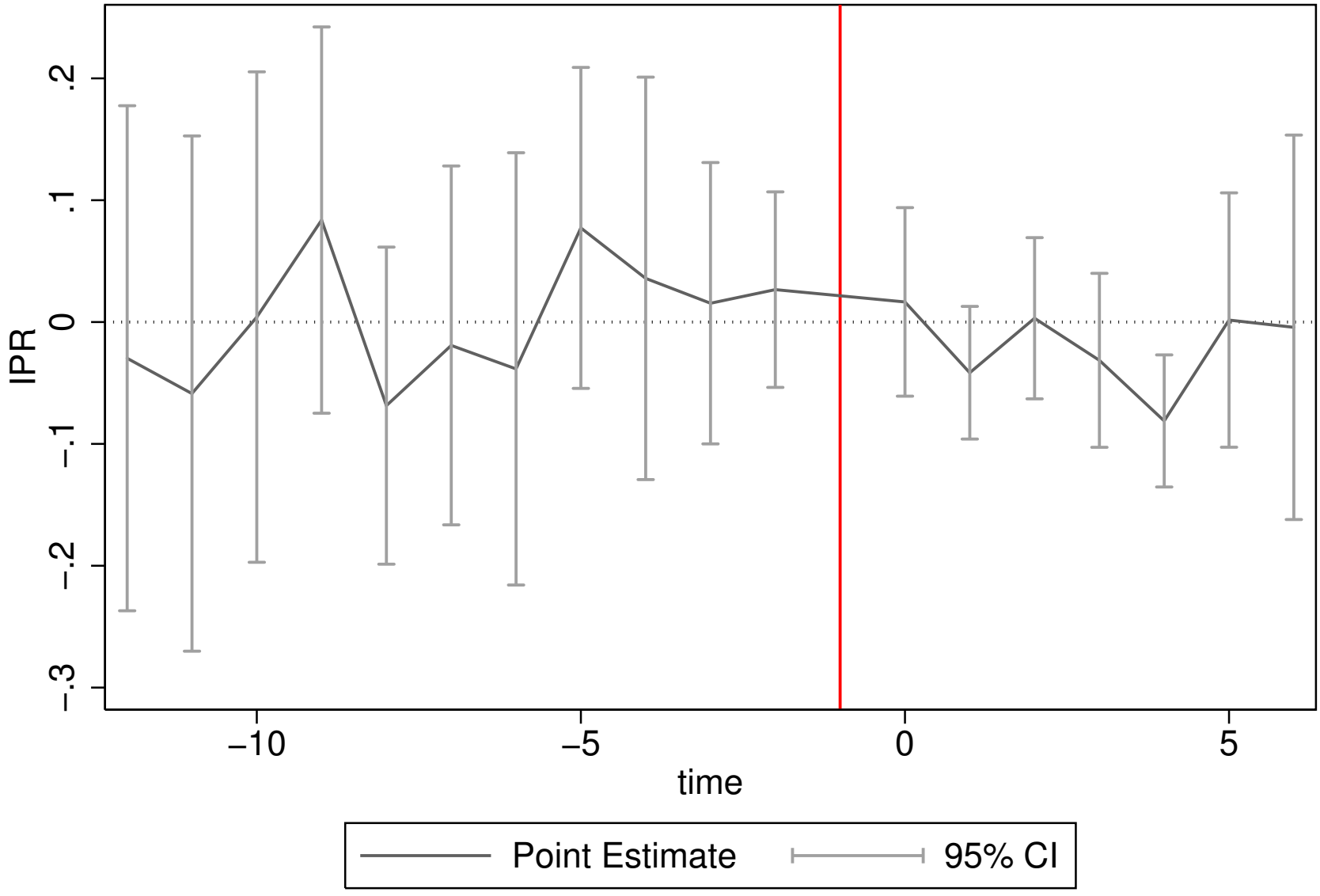
- We find that the MMR gap between early and late suffrage adopters widened after the arrival for sulfa drugs, but this was not the case for pneumonia mortality
- Suggests that preferences correlated with female suffrage may have influenced the adoption of medical technology for woman-specific MMR.
- Parallel trends, and regression-based estimates

Figure 1 : Maternal Mortality Event Study Plot



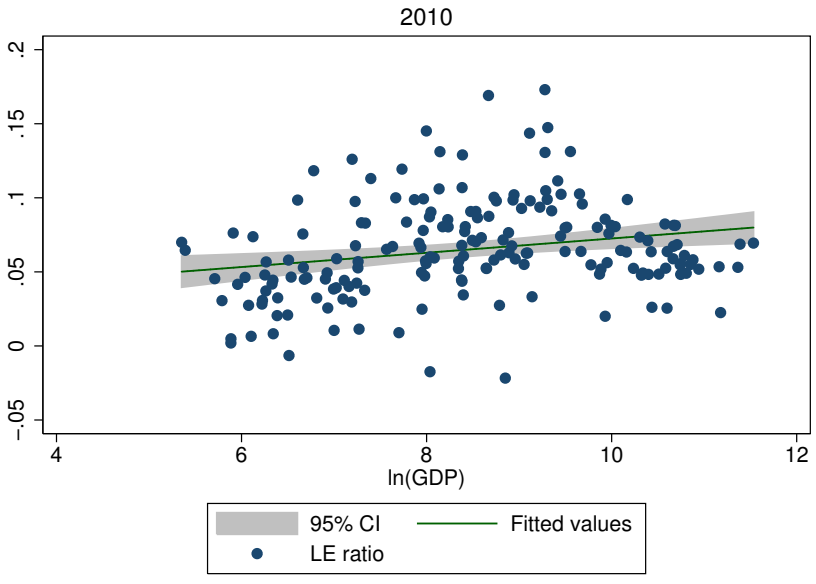
Year −1 is omitted as the base case.

Figure 2 : Pneumonia (Placebo) Event Study Plot

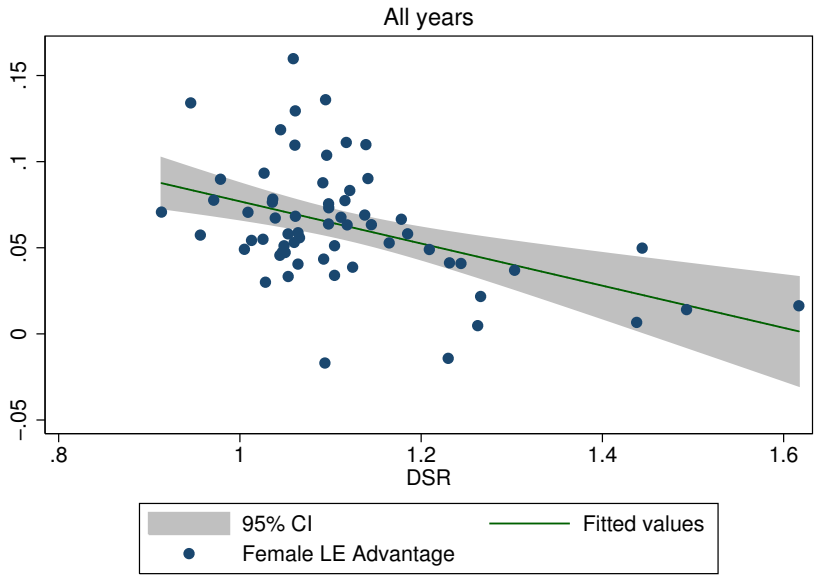


Year −1 is omitted as the base case.

(2) Cross-Country Evidence



(a) F/M Life Expectancy and GDP



(b) F/M Life Exp and gender bias

- Simple trends suggest strong relationship between LE and GDP
- However, this is not the case for life expectancy *ratio*
- LE ratio (and MMR) much more strongly related to gender bias

Conditional Analysis

We estimate the following regression using panel data:

$$MMR_{it} = \alpha + \beta GenderBias_{it} + \gamma_i + \delta_t + (\phi_i \times t) + \theta X_{it} + \varepsilon_{it}. \quad (1)$$

- MMR is later replaced with the log ratio of female-male life expectancy.
- $GenderBias_{it}$ is measured as desired sex ratio of births, women's rights and women's share of parliamentary seats.
- γ, δ, $(\phi_i \times t)$ - country and year specific FE, country specific trends.
- X_{it} includes ln(GDP), interactions
- Standard errors are always clustered at the country level.
- We construct/collect data from various sources: WB, WHO, DHS

Gender Bias Proxied by Desired Sex Ratio

Table 1 : MMR and Desired Sex Ratio (boys/girls)

	(1) MMR	(2) MMR	(3) MMR	(4) MMR	(5) MMR
Desired Sex Ratio	824.7**	655.0**	667.0**	923.9***	2627.7***
	[329.4]	[299.3]	[286.5]	[252.9]	[617.9]
ln(GDP)			40.9	12.4	318.5***
			[48.5]	[49.8]	[119.6]
Desired Sex Ratio× ln(GDP)					-285.3***
					[100.7]
Constant	-476.0	-405.1	-712.6	-1514.3***	-3371.0***
	[358.9]	[325.8]	[494.2]	[483.9]	[734.5]
R-squared	0.09	0.92	0.92	0.93	0.93
Observations	310	310	307	307	307
Country FE		Y	Y	Y	Y
Year FE		Y	Y	Y	Y
Desired Fertility				Y	Y

Gender Bias Measured by Women's Rights (Cingranelli et al., 2013)

Table 2 : MMR and Women's Rights

	(1) MMR	(2) MMR	(3) MMR	(4) MMR	(5) MMR	(6) MMR
Panel A: Political Rights						
Political Rights	-44.19**	-1.79	-2.47	-367.13***	-346.89***	-256.74***
	[18.54]	[17.54]	[17.30]	[74.73]	[77.60]	[80.30]
R-squared	0.93	0.93	0.93	0.94	0.94	0.94
Observations	757	757	757	757	757	757
Panel B: Economic Rights						
Economic Rights	11.11	10.79	6.62	-165.37*	-164.61*	-103.71
	[23.50]	[22.39]	[22.24]	[97.86]	[97.27]	[87.01]
R-squared	0.92	0.93	0.93	0.93	0.94	0.94
Observations	755	755	755	755	755	755
Year FE		Y	Y	Y	Y	Y
Democracy controls			Y		Y	Y
Rights× GDP				Y	Y	Y
Democracy× GDP						Y

Gender Bias and Grammatical Gender

$$MMR_{it} = \beta_0 + \beta_1 GII_i + \beta_2 PercentLang_i + X_{it} + X_i + \nu_{it} \quad (2)$$

- GII is highly pre-determined but it does not vary over time. So we include continent FE rather than country FE.
- The idea is that grammatical gender reflects gender attitudes in society
  - Maternity leave policy differences (Givati & Troiano, 2012).
  - Female labour force and political participation (Gay et al. 2013).
- Example: gender differentiated personal pronouns:
  - English ("He", "She")
  - Spanish (*"El"*, *"Ella"*; *"Ellos"*, *"Ellas"*; *"Nosotros"*, *"Nosotras"*; *"Vosotros"*, *"Vosotras"*)

Table 3 : MMR and Gender Intensity of Language Measures

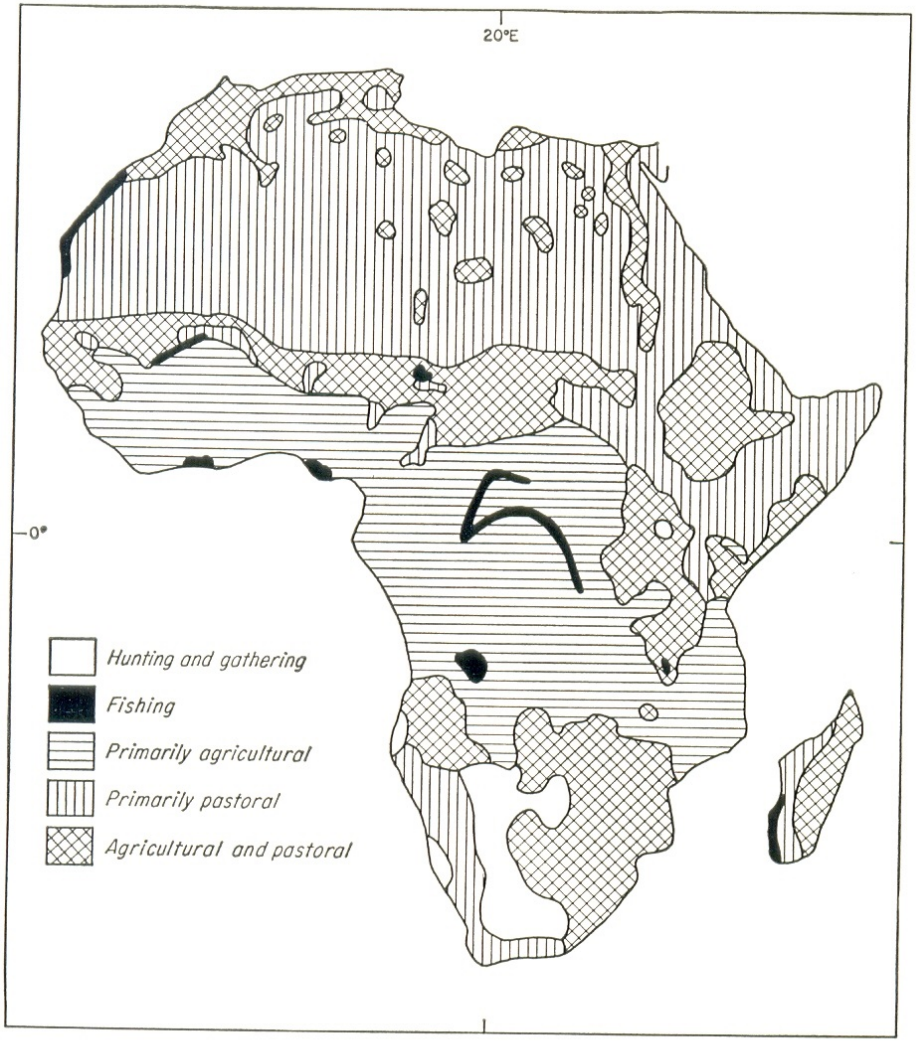
Dep Var:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MMR	NGII	SBII	GPII	GAII	GII0	GII1	GII2	GTroiano
Panel A: No Interaction								
Gender Intensity Index	50.032**	68.523**	56.599*	105.003***	30.239***	40.228***	24.904*	2.832
	[21.609]	[33.752]	[32.010]	[29.018]	[10.236]	[12.186]	[12.575]	[8.682]
ln(GDP)	-71.533***	-72.576***	-66.643***	-77.631***	-71.858***	-74.531***	-68.261***	-69.243***
	[19.646]	[19.677]	[19.013]	[22.857]	[22.323]	[22.307]	[19.056]	[19.972]
R-squared	0.70	0.70	0.70	0.77	0.75	0.76	0.69	0.61
Observations	575	575	562	417	399	417	542	384
Panel B: GDP Interaction								
Gender Intensity Index	368.138**	162.881	499.689***	665.041***	212.984***	249.380***	149.594*	148.173*
	[154.715]	[203.808]	[176.410]	[109.209]	[42.129]	[57.732]	[83.725]	[85.263]
GII × ln(GDP)	-38.316**	-11.884	-55.011***	-69.917***	-23.906***	-27.630***	-16.040	-16.703*
	[17.128]	[23.262]	[20.085]	[12.730]	[5.045]	[6.965]	[9.952]	[9.214]
ln(GDP)	-52.185**	-64.066**	-47.688**	-27.106	-4.747	-14.309	-42.030	-25.525
	[22.837]	[30.760]	[20.280]	[21.565]	[21.371]	[21.372]	[28.600]	[19.437]
R-squared	0.71	0.70	0.72	0.79	0.78	0.78	0.70	0.64
Observations	575	575	562	417	399	417	542	384

(3) Sub-national Variation in Gender Bias

Cross-country evidence above provides suggestive evidence, but concerns given that language is fixed by country, and potential for unobservables in panel results

- We use time and regional variation in MMR to examine whether historically more biased regions progress less towards improvements in female health outcomes
- Examine subsistence types (Michalopoulos et al., 2014), and catholic versus protestant missions (Nunn, 2012)
- We observe local (sub-national) variation in these variables, so can capture-specific factors

(3) Sub-national Variation in Gender Bias



Map. 7. Distribution of Types of Subsistence Economy

Figure 4 : Subsistence Types (Murdoch 1959)

(3) Sub-national Variation in Gender Bias

For example, Michalopoulos et al. (2014):

$$MMR_{itc} = \beta_0 + \beta_1 Pastoral_i + X_{it} + X_i + \alpha_t + \alpha_c + \nu_{it}, \qquad (3)$$

- We use Michalopoulos et al.'s specification to test whether areas which were historically pastoral, have worse female health outcomes today
- Evidence that these were historically areas with more violence towards women and there is lower status of women in these societies
- Using full sister histories from DHS, we construct regional measures of MMR for 306 regions from 32 countries in DHS

Table 4 : Effect of Subsistence Type on MMR

	(1) MMR	(2) MMR	(3) MMR	(4) MMR	(5) MMR	(6) MMR
Pastoral	271.3**	254.7**	254.1**	255.4**	249.9**	298.6**
	(102.1)	(99.13)	(104.7)	(114.3)	(115.0)	(121.7)
N	1976	1843	1780	1780	1780	1638
R-squared	0.298	0.302	0.316	0.320	0.321	0.339
Country & Year FE	Y	Y	Y	Y	Y	Y
Education		Y	Y	Y	Y	Y
Wealth			Y	Y	Y	Y
Land Characteristics				Y	Y	Y
Historical Characteristics					Y	Y
Religion						Y

Standard errors in parentheses are clustered at the level of the DHS cluster.

(4) Gender Neutral Placebo Tests

- Tuberculosis is a "gender neutral" infectious disease
- Frequently occurring (around 9 million cases in 2013). Incidence ranges from less than 10 cases per 100,000 people, to greater than 1,000 per 100,000 (ie a range very similar to MMR)
- We estimate the same set of specifications with the same measures of gender bias, replacing MMR with TB.

Table 5 : TB and Desired Sex Ratio (boys/girls)

	(1) TB	(2) TB	(3) TB	(4) TB	(5) TB
Desired Sex Ratio	-134.6	-98.4	-140.7	-131.9	-794.3
	[143.7]	[269.5]	[272.6]	[301.6]	[478.5]
ln(GDP)			-54.5*	-55.2	-173.9**
			[32.5]	[34.5]	[81.6]
Desired Sex Ratio× ln(GDP)					109.7
					[67.5]
Constant	402.0**	325.7	771.0*	739.9	1473.2**
	[169.5]	[285.2]	[388.0]	[529.0]	[599.3]
R-squared	0.00	0.80	0.81	0.81	0.81
Observations	1407	1407	1393	1393	1393
Country FE		Y	Y	Y	Y
Year FE		Y	Y	Y	Y
Desired Fertility				Y	Y

Table 6 : TB and Women's Rights

	(1) TB	(2) TB	(3) TB	(4) TB	(5) TB	(6) TB
Panel A: Political Rights						
Political Rights	8.84	0.49	0.60	-24.28	-29.22	-29.48
	[9.77]	[9.14]	[9.11]	[52.31]	[50.76]	[49.67]
R-squared	0.86	0.86	0.86	0.86	0.86	0.86
Observations	3163	3163	3163	3163	3163	3163
Panel B: Economic Rights						
Economic Rights	-3.69	-5.74	-5.44	-9.79	-11.02	-10.61
	[9.97]	[10.17]	[10.20]	[34.29]	[33.87]	[32.83]
R-squared	0.86	0.86	0.86	0.86	0.86	0.86
Observations	3152	3152	3152	3152	3152	3152
Year FE		Y	Y	Y	Y	Y
Democracy controls			Y		Y	Y
Rights× GDP				Y	Y	Y
Democracy× GDP						Y

Table 7 : TB and Gender Intensity of Language Measures

Dep Var: TB Incidence	(1) NGII	(2) SBII	(3) GPII	(4) GAII	(5) GII0	(6) GII1	(7) GII2	(8) GTroiano
Panel A: No Interaction								
Gender Intensity Index	-35.418*	-38.718	-70.779**	19.500	-2.428	0.655	-23.346**	-0.365
	[18.025]	[26.189]	[28.896]	[29.072]	[7.586]	[9.328]	[10.351]	[4.403]
ln(GDP)	-40.202***	-39.557***	-49.045***	-21.397**	-21.940**	-21.906**	-38.367***	-27.911***
	[12.645]	[12.493]	[14.762]	[10.676]	[10.279]	[10.760]	[12.174]	[6.210]
R-squared	0.55	0.55	0.52	0.58	0.57	0.57	0.56	0.55
Observations	2619	2619	2561	1893	1812	1893	2469	1742
Panel B: GDP Interaction								
Gender Intensity Index	-113.987	-106.469	-212.387*	49.996	-5.372	2.209	-62.639*	15.251
	[80.285]	[88.634]	[109.688]	[151.564]	[34.552]	[44.033]	[36.067]	[22.170]
GII × ln(GDP)	9.411	8.485	17.487	-3.786	0.384	-0.204	5.032	-1.779
	[8.283]	[9.232]	[12.137]	[16.701]	[3.870]	[5.102]	[3.871]	[2.310]
ln(GDP)	-44.724***	-45.505***	-54.743***	-18.746	-22.978	-21.476	-46.338***	-23.369***
	[14.407]	[16.554]	[16.091]	[16.231]	[14.999]	[15.856]	[15.425]	[8.129]
R-squared	0.56	0.55	0.52	0.58	0.57	0.57	0.56	0.55
Observations	2619	2619	2561	1893	1812	1893	2469	1742

Discussion and Conclusions

- Preventable maternal mortality is still very high in many developing countries, even after falling by almost 50% since 1990.
- It exhibits substantial cross-country variation conditional on income.
- We show that there is a consistent relationship whereby MMR conditional on income varies systematically with measures of gender prejudice.
- Female life expectancy advantage behaves like MMR in this regard
- This result is, in general, robust to alternative measures of gender prejudice
- It is evident within countries over time and in the cross-section of countries, it was evident in 1930s America and is evident in today's poorer countries.

Appendices

The Yentl Syndrome

From the New England Journal of Medicine:

Yentl, the 19th-century heroine of Isaac Bashevis Singer's short story, had to disguise herself as a man to attend school and study the Talmud. Being "just like a man" has historically been a price women have had to pay for equality. Being different from men has meant being second-class and less than equal for most of recorded time and throughout most of the world. It may therefore be sad, but not surprising, that women have all too often been treated less than equally in social relations, political endeavors, business, education, research, and health care.

Table 8 : Early Suffrage Adopters and Disease Burden

	(1) log(MMR)	(2) log(Pneumonia)
Post-1937	-0.0917***	0.00870
	(0.0298)	(0.0215)
Post×Year	-0.0891***	-0.0611***
	(0.00490)	(0.0108)
Year	-0.0230***	-0.0293***
	(0.00246)	(0.00647)
Early Suffrage × Post	-0.0849**	-0.0459
	(0.0365)	(0.0279)
Early Suffrage × Post × Year	-0.0146**	-0.00674
	(0.00642)	(0.0128)
Early Suffrage × Year	0.001000	0.00470
	(0.00335)	(0.00760)
Constant	1.689***	-0.0461***
	(0.0120)	(0.0148)
Observations	868	868
R-squared	0.951	0.780

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Figure 5 : Trends in ln(MMR)

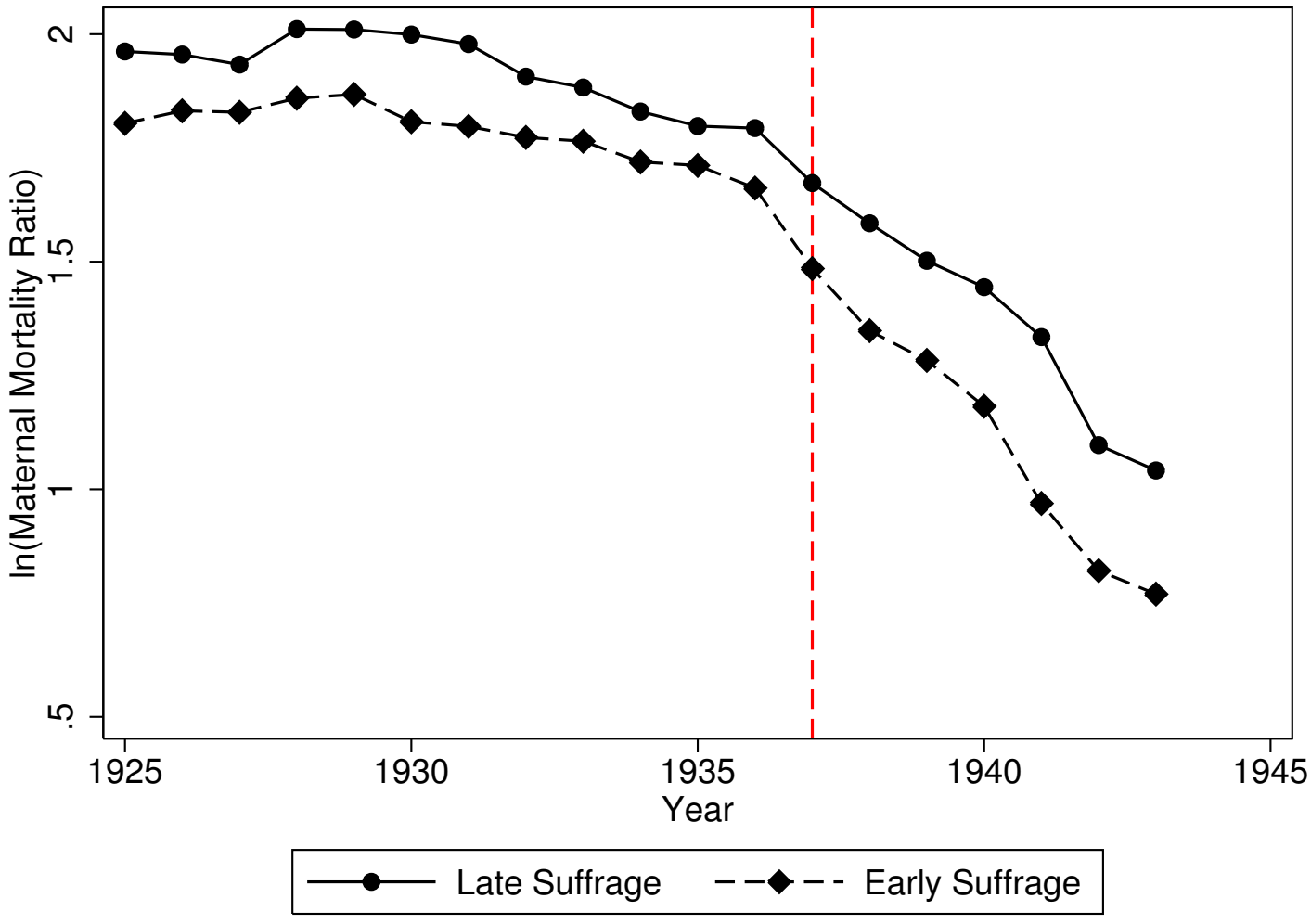

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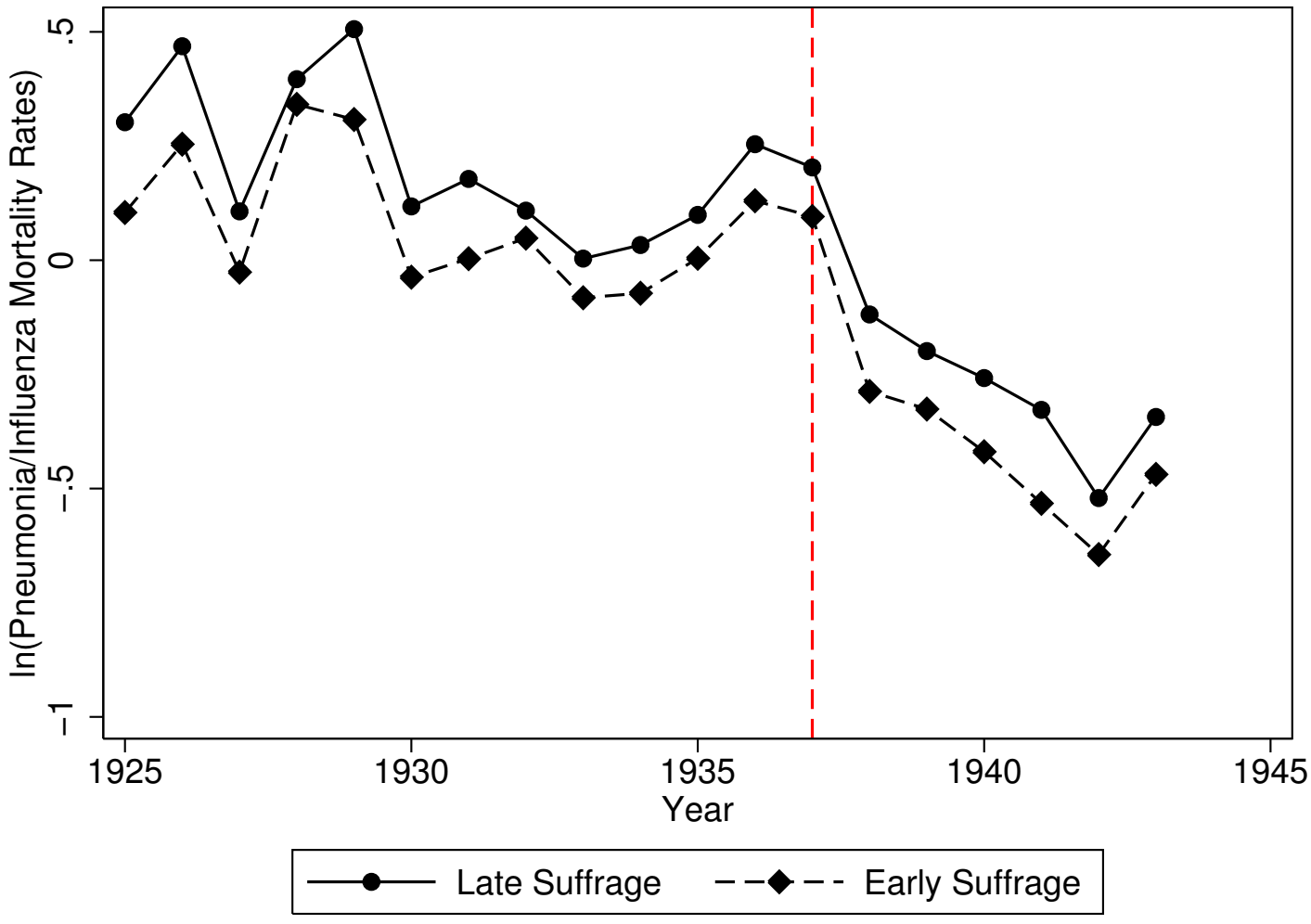
Figure 6 : Trends in ln(IPR)



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Gender Bias Proxied by Desired Sex Ratio

- We construct time profiles of the desired sex ratio of births at the individual level using the DHS
- The DSR in, say, 1990, is the DSR reported by all women who were 20-25 years of age in 1990, irrespective of when their responses are elicited.
  - Low Son Preference countries: Dominican Republic (0.92); Haiti, Ukraine (0.94); Nicaragua (0.96), Colombia (0.99)
  - Medium: Zimbabwe (1.08), Ghana (1.108), Tanzania (1.07)
  - High: India (1.33), Nepal (1.42), Pakistan (1.59)
- We checked that DSR is strongly linked to excess girl infant mortality
- Similar results hold when we use the life expectancy differential instead of MMR

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Figure 7 : Female Life Expectancy and ln(GDP)

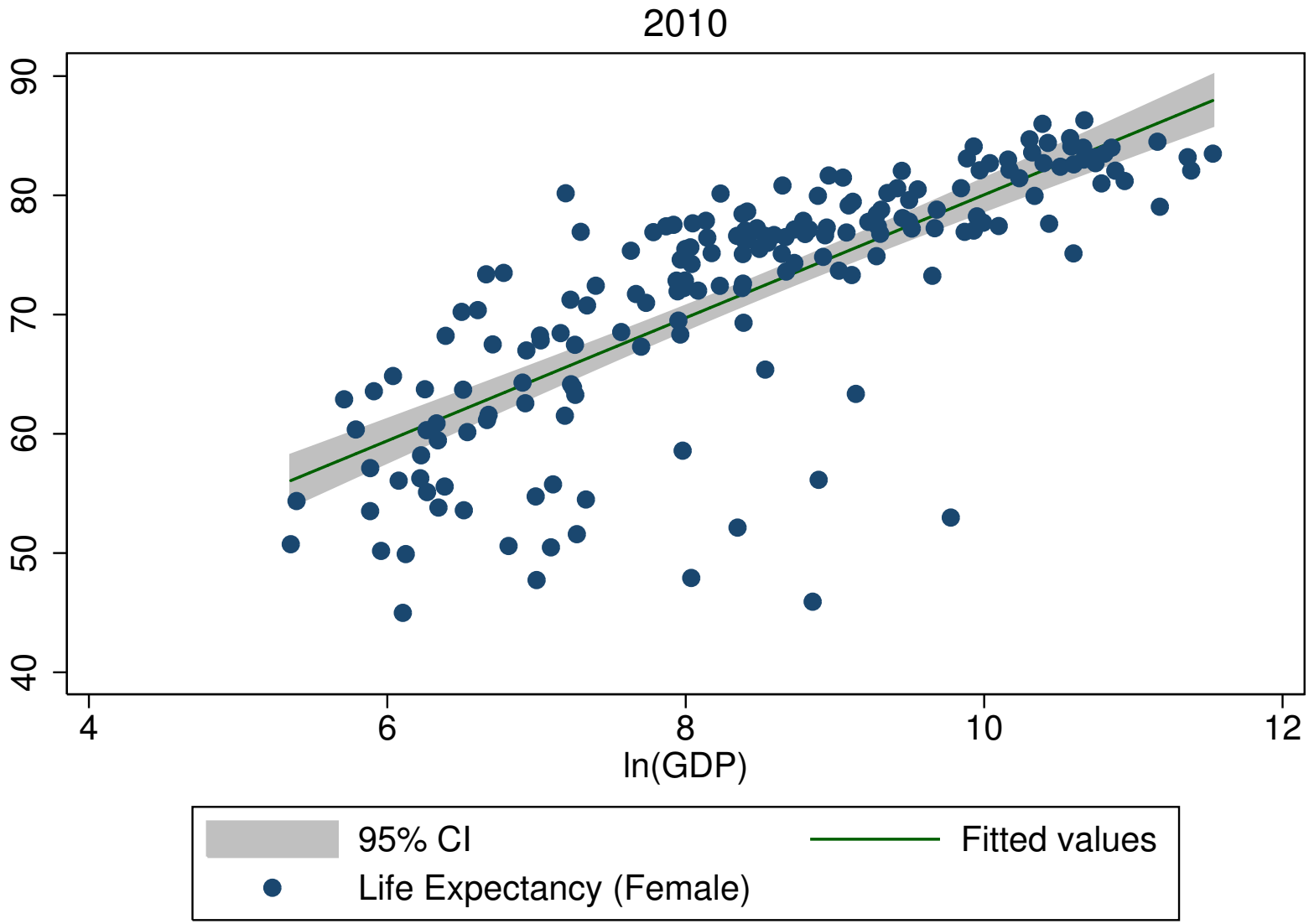

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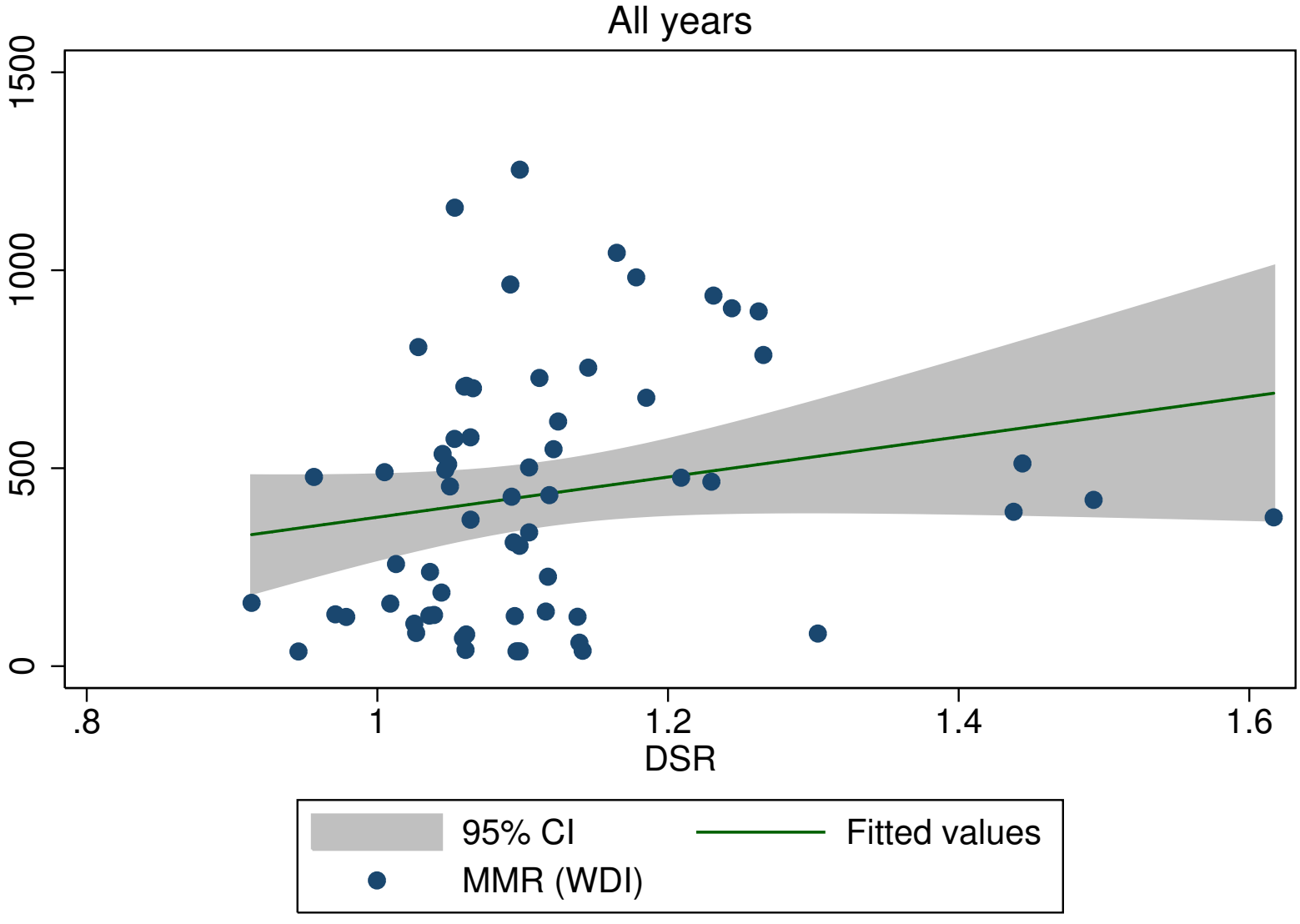
Figure 8 : Maternal Mortality Ratio and gender bias proxy



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