Property Rights and Gender Bias:

Evidence from Land Reform in West Bengal *

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Motivation

- Secure property rights are a cornerstone of economic development. There is an extensive body of work on the importance of tenancy and ownership security on agricultural land in increasing agricultural productivity, facilitating access to credit, and reducing poverty
  - (Besley & Burgess, 2000; Besley & Ghatak, 2010; Besley et al., 2012; Goldstein & Udry, 2008).

- However there is limited recognition of the potential impact of formalised land rights on gender inequality in communities in which sons have stronger property rights.

- Especially given evidence that gender differences in health, education, and mortality respond to changes in the gender gap in income and rights over property in developing countries
  - (Deininger et al., 2013; Jensen, 2010; Almond et al., 2013).

- There is documented parental discrimination against girl children in health and educational investments in India, and sex selective abortions in favour of sons. Postnatal investments in children might be critical in determining Indian sex ratios
  - (Anderson and Ray, 2010).

Contributions

- We contribute to these literatures by investigating how improved land rights may exacerbate existing gender inequalities if these are not accounted for. We find significant male-biased infant survival improvements flowing from sharecropper registration under Operation Barga.

- The male bias is concentrated in Hindu households, who are more son-preferring, and arises from postnatal discrimination. These are arguably driven by male-biased inheritance patterns (Roy, 2012; Rosenblum, 2015), and higher dependence on leased land.

- The results are consistent across two independent datasets. We use the NFHS 1992/3 and 1998/9 surveys and model impacts of within-district progression of registration reform over time in West Bengal. The sharecropper registration data comes from Banerjee, Gertler, and Ghatak (2002).

- We also use data from a survey of 2400 households in 89 villages in West Bengal conducted in 2004 (Bardhan et al. 2014), which gathered histories of land ownership and tenancy status during 1967-95, and information on land registered in the village.

Background: Operation Barga

- The Left Front carried out higher sharecropper registration in areas where it faced greater electoral competition (Bardhan & Mookherjee, 2010). Estimates of the fraction of sharecroppers registered range from 45% (Bardhan & Mookherjee, 2011), to 65% (Banerjee et. al., 2002), to 80% (Lieten, 1992).

- As part of Operation Barga, the state also aimed to redistribute vested land to the landless and small landowners. Appu (1996) estimates that 6.72 percent of state operated area was distributed by 1992. However this land was redistributed in very small plots (Bardhan & Mookherjee, 2011), and was of low quality for cultivation.

- Alongside Operation Barga, the state government also distributed minikits containing high yield variety (HYV) seeds, fertilisers, and insecticides to farmers throughout the state via *gram panchayats*. Minikit distribution was instrumental in the substantial increase in agricultural yields in West Bengal over the 1980s.

Mechanisms

- Operation Barga increased sharecropper security on rented land and bargaining power over the share of output paid as rent. This increased future expected returns to rented land, even if land productivity is held constant.

- The income effect benefits both sons and daughters. The substitution effect leads parents to invest more in sons at the cost of daughters if sons are perceived as a "better" investment. Which effect dominates depends on whether girls are "close" substitutes for boys.

- For land owning households, registration reduced the rent they get from tenants. Hence landlordism had lower profitability, and sons arguably became more important than daughters to keep remaining land holdings in the family and maximise returns from own-cultivation.

- Bardhan et. al. (2013) show that registration increased land purchases by smaller farmers, and land sales by larger landowners. In both sets of households division rates declined. Son preference likely responded to changing land ownership distribution.

Mechanisms

- The described channels of impact affect fertility as well as child mortality, so we analyse both.

- Village dataset: We do not observe child birth order or death outcomes, so we analyse birth-cum-survival probabilities separately for boys and girls in response to the land reform.

- DHS dataset: We analyse birth order specific probabilities of having more children in response to the reform, and also gender differences in infant mortality outcomes.

  - We exploit the gender of the firstborn child of the mother, which has been shown to be exogenous and random. We then examine what happens to the outcomes of following births in response to firstborn sons versus firstborn daughters as registration increases.

Village Dataset

- The data comes from surveys conducted of household heads in West Bengal regarding their family history, land ownership, and immigration status. The survey asks the household head about all members residing in the household in 2004, and the year they were born or joined the household.

- The survey data was used to construct a household panel for a sample of 2400 households from 89 villages (Bardhan et al, 2014). For about two-thirds of this sample, a consistent history of household landholdings and demographics could be constructed (comprising the 'restricted sample').

- We combine the household data with village level data on land reforms implemented for each year from 1971-2003 (collected from Block Land Records offices) for both *patta* and *barga* programs. We measure the extent of reform as percent village land distributed (as pattas), and registered (under barga) in the past three years.

Table 1: Descriptive statistics on surviving births

Religion:	Hindu household			Non-Hindu household		
Land category:	All	Landless	Some land	All	Landless	Some land
	(1)	(2)	(3)	(4)	(5)	(6)
Boys	1.36	1.05	1.57	1.76	1.51	1.88
Girls	1.19	0.90	1.38	1.43	1.32	1.48
Total	2.54	1.95	2.95	3.18	2.83	3.35
Girls/Boys	0.875	0.857	0.879	0.813	0.874	0.787

Notes: Boys (Girls) is the mean number of surviving boys (girls) in a household in 1967–2004. All figures are household averages.

DHS Dataset

- The DHS survey uses interviews with women aged 15-49 to collect information on their fertility history, their children's health and mortality outcomes, household wealth, and their own health and education.

- We use the 1992-93 and 1998-99 waves of survey data for West Bengal women and children, and match their district of residence to district level data on sharecropping registration. The sharecropper registration data is the same as in Banerjee et. al. (2002), kindly granted to us by the authors.

- We use district-level data on yields and area under cultivation of rice and all other cereals in West Bengal from the ICRISAT Village Dynamics in South Asia (VDSA) database to construct measures of land productivity.

- We also collect information from the annual Economic Survey reports of West Bengal to control for the effects of the annual number of medical institutions, kilometres of surfaced roads, and the amount of *patta* land distributed in each district.

Table 2: Sex Ratio at Birth and Infant Mortality Rate

	Hindu		Non-Hindu	
B. Order	SR	IMR	SR	IMR
1	0.482	0.108	0.483	0.129
2	0.489	0.089	0.470	0.093
3	0.505	0.090	0.482	0.093
4	0.478	0.103	0.507	0.074
5	0.494	0.098	0.481	0.084
6	0.478	0.091	0.484	0.085

Notes: Sex ratios of reported births and infant mortality rates are shown by child birth order and community.

Village Dataset Regression

$$y_{ijt} = a + \beta_1 BARGA\_LAND_{jt-1} + \beta_2 PATTA\_LAND_{jt-1} + \lambda X_{ijt} + d_t + \theta_i + \varepsilon_{ijt} \quad (1)$$

- y_{it} takes value 1 if a surviving boy (girl) is born in household i in village j in year t and 0 otherwise.
- $BARGA\_LAND_{jt-1}$ and $PATTA\_LAND_{jt-1}$ measure the share of cultivable land in village j that was registered and distributed respectively under Operation Barga in the three years preceding year t.
- The terms d_t and θ_i are year and household fixed effects respectively, and ε_{ijt} is an idiosyncratic error term.
- X_{ijt} includes lagged land owned by the household, an above-ceiling dummy and immigrant status indicators which are available for the full time period of 1971-2003.
- Logs of annual village rainfall, village land productivity, price of rice, local government expenditures on roads and irrigation, and kilometres of surfaced road and area irrigated by canals in the district (1982-95).

Table 3: Determinants of surviving children, land measures, years 1982–1995

	1=surviving girl 0=no birth/surviving boy			1=surviving boy 0=no birth/surviving girl		
	All	Landless	Some Land	All	Landless	Some Land
BARGA_LAND	-0.013***	0.000	-0.014***	0.006***	0.108***	-0.002
	(0.002)	(0.005)	(0.002)	(0.002)	(0.003)	(0.002)
PATTA_LAND	0.107	-0.012	0.148*	0.011	0.149	-0.038
	(0.083)	(0.076)	(0.081)	(0.026)	(0.109)	(0.055)
Observations	7378	3395	3983	7378	3395	3983
Household Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Prod. and Prog. Controls	Yes	Yes	Yes	Yes	Yes	Yes
Cohorts	1982-95	1982-95	1982-95	1982-95	1982-95	1982-95
Number of Households	1772	827	992	1772	827	992

Notes: Robust standard errors in parentheses, adjusted for clustering on villages. All regressions include year dummies and household fixed effects. The variables % land registered and % land distributed are computed as the sum over the previous three years of the share of land affected by each program over the total cultivable land in each village, using official land records. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Table 4: Determinants of surviving children, Hindu and Non-Hindu Households

	1=surviving girl 0=no birth/surviving boy			1=surviving boy 0=no birth/surviving girl		
Hindu	All	Landless	Some Land	All	Landless	Some Land
BARGA_LAND	-0.009***	-0.004	-0.010***	0.009***	0.041***	0.006***
	(0.001)	(0.005)	(0.001)	(0.002)	(0.010)	(0.001)
Observations	44178	18150	26028	44178	18150	26028
Number of Households	1822	979	1089	1822	979	1089
Non-Hindu	All	Landless	Some Land	All	Landless	Some Land
BARGA_LAND	0.161	0.036	0.269	0.221*	0.029	0.250
	(0.181)	(0.330)	(0.213)	(0.130)	(0.391)	(0.151)
Observations	44178	18150	26028	12132	4947	7185
Number of Households	458	248	310	458	248	310
Household Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Cohorts	1967-95	1967-95	1967-95	1967-95	1967-95	1967-95

Notes: Robust standard errors in parentheses, adjusted for clustering on villages. All regressions include year dummies and household fixed effects. The variables % land registered and % land distributed are computed as the sum over the previous three years of the share of land affected by each program over the total cultivable land in each village, using official land records. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Table 5: Determinants of surviving children, Immigrant and Native Households

	1=surviving girl 0=no birth/surviving boy			1=surviving boy 0=no birth/surviving girl		
Immigrant	All	Landless	Some Land	All	Landless	Some Land
BARGA_LAND	-0.002	0.001	-0.225	0.040***	0.036***	0.748
	(0.002)	(0.002)	(0.312)	(0.007)	(0.004)	(0.472)
Observations	7344	5162	2182	7344	5162	2182
Number of Households	1730	808	1236	1730	808	1236
Native	All	Landless	Some Land	All	Landless	Some Land
BARGA_LAND	-0.009***	-0.037	-0.009***	0.006***	0.058	0.005***
	(0.001)	(0.033)	(0.001)	(0.002)	(0.058)	(0.001)
Observations	49117	17992	31125	49117	17992	31125
Number of Households	1730	808	1236	1730	808	1236
Household Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Cohorts	1967-95	1967-95	1967-95	1967-95	1967-95	1967-95

Notes: Robust standard errors in parentheses, adjusted for clustering on villages. All regressions include year dummies and household fixed effects. The variables % land registered and % land distributed are computed as the sum over the previous three years of the share of land affected by each program over the total cultivable land in each village, using official land records. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

DHS Dataset Regression

$$y_{it} = a + \beta_1 SCROP50_{it-1} * FIRSTSON_i * FEMALE_i + \beta_2 SCROP25_{it-1} * FIRSTSON_i * FEMALE_i$$
$$+ \delta_1 SCROP50_{it-1} * FEMALE_i + \delta_2 SCROP25_{it-1} * FEMALE_i$$
$$+ \eta_1 SCROP50_{it-1} * FIRSTSON_i + \eta_2 SCROP25_{it-1} * FIRSTSON_i$$
$$+ \varphi_1 FIRSTSON_i + \varphi_2 FEMALE_i + \varphi_3 FIRSTSON_i * FEMALE_i$$
$$+ \gamma_1 SCROP50_{it-1} + \gamma_2 SCROP25_{it-1} + \lambda X_{it} + d_t + \theta_i + \varepsilon_{it} \quad (2)$$

- y_{it} takes value 1 if child *i* born in year *t* dies aged 0-12 months and 0 otherwise.
- $SCROP25_{it-1}$ and $SCROP50_{it-1}$ take value 1 if sharecropper registration in the district where child *i* resides reaches at least 25% or 50% respectively in the year preceding his birth, and 0 otherwise.
- Indicator $FEMALE_i$ takes value 1 if child *i* is a girl, and the indicator $FIRSTSON_i$ taking value 1 if the firstborn child born to the mother of child *i* is male.
- X_{it} includes indicators for child birth order, household religion and caste, whether the household is rural, mother's educational attainment, and linear and quadratic terms of the mother's age at which the child is born. Child birth year and district fixed effects are captured in d_{it} and θ_i. ε_{it} is an idiosyncratic error term.

Table 6 – Infant Mortality, Firstborn Sons, and Registration

	Infant Death								
	All Children			Hindu Children			Non-Hindu Children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
*SCROP50 $_{t-1}$ * FIRSTSON * FEMALE*	-0.057*	-0.080*	-0.080*	-0.077**	-0.106**	-0.106**	-0.022	-0.033	-0.039
	(0.074)	(0.056)	(0.054)	(0.032)	(0.020)	(0.020)	(0.665)	(0.615)	(0.549)
*SCROP25 $_{t-1}$ * FIRSTSON * FEMALE*	0.036	0.030	0.031	0.024	0.017	0.019	0.065	0.061	0.046
	(0.396)	(0.480)	(0.493)	(0.659)	(0.803)	(0.763)	(0.268)	(0.292)	(0.392)
*SCROP50 $_{t-1}$ * FEMALE*	0.051**	0.048**	0.048**	0.067**	0.071**	0.072***	0.024	0.002	0.005
	(0.026)	(0.026)	(0.028)	(0.030)	(0.012)	(0.006)	(0.569)	(0.979)	(0.933)
*SCROP25 $_{t-1}$ * FEMALE*	-0.022	-0.029	-0.029	-0.023	-0.026	-0.028	-0.032	-0.045	-0.040
	(0.557)	(0.406)	(0.390)	(0.589)	(0.454)	(0.396)	(0.504)	(0.370)	(0.454)
SCROP50 $_{t-1}$	-0.049***	-0.050***	-0.064***	-0.041*	-0.050*	-0.058**	-0.075**	-0.053*	-0.084**
	(0.008)	(0.010)	(0.006)	(0.086)	(0.084)	(0.050)	(0.050)	(0.098)	(0.014)
SCROP25 $_{t-1}$	0.019	0.011	-0.001	0.008	0.000	0.000	0.047	0.031	-0.012
	(0.504)	(0.639)	(0.909)	(0.869)	(0.959)	(0.983)	(0.236)	(0.432)	(0.743)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Covariates		x	x		x	x		x	x
District-Birth Year Trend			x			x			x
Observations	8,367	8,367	8,367	5,448	5,448	5,448	2,919	2,919	2,919
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14	14	14	14

Notes: Wild cluster bootstrapped p-values in parentheses. All specifications also include the female child and firstborn son indicators and their interaction, birth year fixed effects, indicators for household religion and caste, whether the household is rural, mother's educational attainment, and linear and quadratic terms of the mother's age at which the child is born. The district covariates include logs of for rice and cereal productivity, *patta* land area distributed, number of medical institutions, and kilometres of surfaced road per capita and their full set of interactions with the female child and the firstborn son indicators.. *** p<0.01, ** p<0.05, * p<0.1

Table 7 – Younger Siblings and Sharecropper Registration

	Has a Younger Sibling								
	All Children			Hindu Children			Non-Hindu		
	B. Order 2	*B. Order 3*	*B. Order 4*	*B. Order 2*	*B. Order 3*	*B. Order 4*	*B. Order 2*	*B. Order 3*	*B. Order 4*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
*SCROP50 $_{t-1}$ * FIRSTSON*	-0.004	0.013	0.058	-0.012	0.002	0.031	0.013	0.025	0.118
	(0.933)	(0.821)	(0.410)	(0.893)	(0.999)	(0.763)	(0.871)	(0.769)	(0.330)
*SCROP25 $_{t-1}$ * FIRSTSON*	-0.114***	-0.035	-0.012	-0.104***	-0.010	-0.005	-0.177***	-0.046	-0.077
	(0.002)	(0.505)	(0.913)	(0.002)	(0.873)	(0.979)	(0.002)	(0.611)	(0.470)
SCROP50 $_{t-1}$	-0.061**	0.003	-0.073	-0.053	-0.011	-0.059	-0.095*	-0.032	-0.082
	(0.046)	(0.961)	(0.316)	(0.160)	(0.803)	(0.569)	(0.078)	(0.771)	(0.631)
SCROP25 $_{t-1}$	-0.011	0.013	-0.055	-0.074	0.013	-0.077	0.082	-0.094	0.069
	(0.823)	(0.831)	(0.478)	(0.390)	(0.837)	(0.557)	(0.390)	(0.505)	(0.505)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Covariates	x	x	x	x	x	x	x	x	x
District-Birth Year Trend	x	x	x	x	x	x	x	x	x
Observations	2,686	2,012	1,378	1,919	1,381	891	767	631	487
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14	14	14	14

Notes: Wild cluster bootstrapped p-values in parentheses. All specifications also include the female child and firstborn son indicators and their interaction, birth year fixed effects, indicators for household religion and caste, whether the household is rural, mother's educational attainment, and linear and quadratic terms of the mother's age at which the child is born. The district covariates include logs of for rice and cereal productivity, *patta* land area distributed, number of medical institutions, and kilometres of surfaced road per capita and their corresponding interactions with the female child and the firstborn son indicators.. *** p<0.01, ** p<0.05, * p<0.1

Other Work

- DHS regressions
  - Mother FE
  - Rule out sex selective abortions as the form of parental gender discrimination
  - We rule out targeting of registration to districts with higher female infant mortality.
  - Use neighbouring Bihar districts to rule out differential pre-trends in mortality
- To-do:
  - Use households registered measure from village dataset in DHS regressions.
  - Examine how share of land leased in village prior to the programme affects its impact. This determines "treatability" of a village.
  - Similar robustness checks with the village survey regressions.
  - Examine impact of programme by low/high caste households.

Conclusions

- We find using two independent datasets that Operation Barga increased female infant mortality relative to male mortality in West Bengal.

- This is the first study (of India) that finds improved property rights are not universally beneficial. Institutions that perpetuate gender inequalities in property ownership and inheritance, particularly agricultural land, need to be addressed in the context of property rights reform.

- This is particularly important in the context of the Land Acquisition Act.