FACULTAD ECONOMÍA Y NEGOCIOS UNIVERSIDAD DE CHILE
DEPARTAMENTO DE ECONOMÍA

SERIE DE DOCUMENTOS DE TRABAJO

SDT 422

Property Rights and Gender Bias: Evidence from Land Reform in West Bengal

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Santiago, Mayo de 2016

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Property Rights and Gender Bias:
Evidence from Land Reform in West Bengal *

18 May 2016

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Abstract

While land reforms are typically pursued in order to raise productivity and reduce inequality across households, an unintended consequence may be increased within-household gender inequality. We analyse a tenancy registration programme in West Bengal, and find that it increased child survival and reduced fertility. However, we also find that it intensified son preference in families without a first-born son to inherit the land title. These families exhibit no reduction in fertility, an increase in the probability that a subsequent birth is male, and a substantial increase in the survival advantage of subsequent sons over daughters.

JEL Classification: I14, I24, J71, O15

Keywords: Land reform, property rights, gender, infant mortality, sex ratio, fertility

*We are grateful to S. Anukriti, Maitreesh Ghatak, Giacomo de Giorgi, Tarun Jain, Stephan Litschig, Pushkar Maitra, Giovanni Mastrobuoni, Patrick Nolen, Imran Rasul, Debraj Ray, Sanchari Roy, Alessandro Tarozzi, and participants at several conferences and seminars for their comments. Funding from the MacArthur Foundation Inequality Network, NSF Grant No. 0418434, and the Centre for Social Conflict and Cohesion Studies (CONICYT/FONDAP/15130009) is greatly acknowledged. All errors remain our own.

1. Introduction

Secure property rights are considered a cornerstone of economic development. Land rights are particularly important in developing countries where large fractions of the population are dependent upon agriculture. During 1955-2000 a billion people and nearly as many hectares were affected by land reform (Lipton, 2009). Previous research demonstrates the importance of land security in increasing agricultural productivity, facilitating access to credit, and reducing poverty and cross-household asset inequality (Besley & Burgess, 2000; Besley, 1995; Besley & Ghatak, 2010; Besley, et al., 2012; Goldstein & Udry, 2008; Hornbeck, 2010). However, where land rights are heritable, and primarily inherited by sons, land reform may exacerbate an underlying preference for sons and thereby increase within-household inequality.

While male-biased land rights have been indicated as a cause of son preference in India and elsewhere, there have been few opportunities to study *changes* in land rights. We present what we think is the first attempt to analyse changes in the exercise of son preference in response to changes in inter-generationally transferable (male-biased) land rights. We exploit variation in land rights created by Operation Barga, a flagship tenancy reform in the Indian state of West Bengal, that previous research shows increased agricultural productivity and farm incomes (Banerjee, et al., 2002). We find a significant intensification of gender inequality, captured by the sex ratio at age one among children of second or higher order. This is only evident in households in which the first birth is a girl, households in which it becomes especially important to have a son (Abrevaya, 2009; Bhalotra & Cochrane, 2010). A common pattern in patrilineal societies is that daughters take their bequest at marriage as dowry and marry some distance from their natal home (Guner, 1999; Rosenzweig & Wolpin, 1985), while sons tend to co-reside with parents, work on the land, and subsequently inherit it. Indeed, Botticini & Siow (2003) postulate that a rationale for the origin and persistence of these arrangements is that they incentivize sons to work on the father's land, contributing to wealth creation as well as old-age security. Primogeniture or the practice that the first son has first command over ancestral land makes the first son particularly important. Overall, it seems plausible that tenant farmers receiving heritable title to land intensified their desire for a son. We discuss competing hypotheses below but, importantly, our results are robust to conditioning on reform-led increases in agricultural yields, so they are unlikely to arise from income effects of land reform.

We primarily study infant mortality of girls relative to boys as this is an established marker of gender-differentiated parental investments. A vast literature documents a) that Indian girls receive fewer investments and b) in an environment in which under-investment and, in particular, under-nutrition interacts with infectious disease to create death, this leads to excess girl mortality after birth (Anderson & Ray, 2010; Sen, 2003; Bhalotra, 2010; Bhalotra & Cochrane, 2010; Chakravarty, 2010). Given evidence of son preference manifested by under-reporting of female births or infanticide (Rose, 1999), we also model the sex ratio at birth. Together, the sex ratio at birth and gender-differentiated infant mortality rates produce modified sex ratios at age one. Since fertility may have responded to land reform and both sex ratios and infant mortality are conditional upon birth, we also model the decision to have another birth.

We focus upon registration of tenant farmers in West Bengal which endowed them with heritable tenurial security and capped landlord shares. The programme was initiated by a Left Front government elected in 1977. It is estimated that 2-3 million sharecropper tenants were registered (half to two thirds of all tenants) by the mid-1990s, after which registration (Bardhan & Mookherjee, 2010). We merge data on the rollout of the reform at the district level with the year and district of birth of children in household survey data. We test for endogeneity of reform rollout using pre-reform data, and find no evidence that it was correlated with pre-trends in girl relative to boy mortality. Simple regressions of the sex of births and childhood deaths on reform rollout may nevertheless be vulnerable to omitted variable bias, for instance because the Left-wing government that instigated land reform also implemented a number of other reforms including decentralizing governance to the village level, and increased subsidies for farming inputs.

So as to generate a valid control group for the estimation, we interact reform rollout with an indicator for the sex of the first-born child in the household. Previous research establishes that the sex of the first-born is quasi-random (which we confirm) and that it predicts son-preferring behaviours (Bhalotra & Cochrane, 2010). In particular, families with a first-born son (who can inherit their land) are more willing to have subsequent daughters than families with a first-born daughter. Since our hypothesis concerns parental investments in the survival of second and higher order births, we further interact with the sex of the index child, a strategy that effectively invokes boys as a control group. This specification allows us to test whether land reform modified girl relative to boy survival in households with a first-born daughter relative to households with a first-born son.

Conditioning upon the main effects and the two-way interaction terms addresses some of the first-order identification concerns. For instance, rollout of land reform within a village or district may have been correlated with the rollout of health interventions, but if these improved the disease environment similarly for boys and girls, then controlling for boy survival will account for this correlation. We nevertheless condition upon relevant district-year varying variables, district-specific linear trends, and district-year fixed effects in one specification (which involves village level data). As the data contain siblings, we are able to introduce mother or household fixed effects in the estimation, which control for possibly endogenous selection into fertility and programme uptake.

On the premise that non-Hindus in India (primarily Muslims and Christians) are, by virtue of religious belief, unlikely to commit abortion or, similarly, the "silent killing" of girls through neglect (Almond, et al., 2013a; Bhalotra & Cochrane, 2010), we estimate the equation separately for the Hindu and non-Hindu samples. We expect land reform to lead to more male-biased sex ratios of surviving children primarily in the Hindu population, whereas we expect all other factors to operate similarly across the two groups. In this way, the non-Hindu sample acts as a further (quasi-) "control". As such, any omitted variables would have to vary not only by region and year (the level at which rollout varies), they would also have to have different effects on boys and girls (and, in the mother fixed effects specification, brothers and sisters), and any such differential effects would have to vary with the sex of the first born in the household, and with the religion of the head.

We use two independent sources of data containing different measures of tenancy reform, the share of tenant farmers registered at the district level and the share of cultivable land area registered at the village level. By conducting the analysis using both, we redress the weaknesses of each. Our finding that the relative survival rates of girls deteriorated as the reform progressed is robust to the measure of reform used and to the use of alternative sources of survey data. The rest of this section elaborates our findings, their implications, and our contribution to the literature.

Our main finding is that survival gains flowing from land reform favoured sons in Hindu families which had not yet had a son. In particular, in families in which the first-born was (by the quasi-random allocation of nature) a daughter, the infant mortality rates of second and higher order sons and daughters diverged as land reform progressed. We estimate that median reform coverage (at least 50% of tenants registered) is associated with either a 0.09 percentage point decrease or a 1.1 percentage point increase in the probability that a girl dies within a year of birth, depending on whether we do or do not condition upon mother fixed effects. This contrasts with a 5.9 to 6 percentage point decrease in infant mortality risk among boys. These households exhibit no reform-led change in the probability of a subsequent birth, consistent with their continuing fertility to achieve a male birth. Conditional upon birth, there is a 5.5 percentage point increase in the probability that a birth of second or higher order is a boy. Thus, land reform appears to stimulate sex selection at birth and in the year after birth, leading to significantly fewer girls surviving to age one.

Among families with first-born sons, land reform is associated with a significant decline in girl infant mortality, in fact a larger decline than among boys, and no change in the sex ratio at birth for second and higher order births. These estimates suggest that even if families in West Bengal have a strong preference for at least one son, conditional upon this, they have a preference for a balanced sex composition of births, similar to families the world over. In first-son families and in all non-Hindu families land reform leads to a significant decline in the chances of proceeding to a third birth. We suggest that this may be explained by heritable land rights securing the attachment of sons to parents in their old age, and with parents investing in quality more than quantity of children.

We sought to corroborate these results using purposively gathered data at the village level which contain household-level information on land holdings and more reliable data on land reform gathered from village registers (Bardhan & Mookherjee, 2010; 2011). The identification strategy is broadly similar, and we are again able to condition upon household fixed effects. As the variation in land reform is now measured at the village level, we can also include district-year fixed effects. We find strikingly similar results. Tenancy reform is associated with a significant decrease in the chances of a surviving girl alongside a significant increase in the chances of a surviving boy. Overall, a 10% increase in the share of cultivable village land registered significantly increases the probability of observing a surviving boy by 0.06 to 0.11 percentage points while reducing the probability of a surviving girl by 0.08 to 0.12 percentage points. The difference is driven by households with a first-born girl, where girl survival rates drop by 0.20 percentage points, and boy survival rates increase by 0.08 percentage points.[1] In general, we see larger differences among immigrant and landless households, consistent with their drawing the largest benefits from tenancy reform. Once again, there is no evidence of land reform creating gender bias in non-Hindu households.

This paper would appear to provide the first evidence that the tendency for land inheritance rights to favour sons in patrilineal societies can mean that land reform may intensify son preference, even as it raises productivity and lowers asset inequality between households. We find fairly compelling evidence of this, amounting to the elimination of girls alongside improved survival of boys in roughly half of the Hindu population (those with first-born daughters). Given that inequality in land rights and gender inequality are among the most egregious forms of inequality in many poor countries, it is a matter of grave concern that son-biased inheritance rules appear to drive a trade-off between them.

[1] The effect sizes we report are not comparable between the two data sets since the first uses district-year variation in the share of tenant farmers registered under the reform and the second uses village-year variation in the share of cultivable land registered.

A closely related paper analysing the Chinese land reform finds a broadly similar result, namely that child sex ratios became more male-biased after land reform (Almond, et al., 2013b). However, the Chinese reform did not privatize land ownership and, importantly, intergenerational transfer of land was impossible.[2] Moreover, men and women had equal rights in the state redistribution of land. This shuts down the mechanism that we argue drives the results for India. The authors argue that income gains from land reform in China raised both the desire to have sons and the feasibility of fulfilling this desire by, for instance, being able to afford travel to provincial capitals for female abortion. As discussed, our findings are conditional on agricultural productivity and household characteristics (including education, caste) that may be correlated with household-specific gains from land reform. Thus, while our results are similar, the mechanisms and hence the substantive implications are different. Almond, et al. (2013b) identify small positive effects of land reform on fertility, consistent with income effects of land reform. We identify negative effects on fertility which are not sensitive to controls for productivity, and our finding that the fertility reduction is restricted to first-son Hindu families fits with the inheritance motive. Together with previous research showing that Operation Barga led to increased investments in children's education (Deininger, et al., 2011), our finding suggests that land reform shifted families along the quantity-quality trade-off frontier.

The rest of the paper is organised as follows. Section 2 provides a background discussion of land reform in India, Operation Barga in West Bengal, and prevailing son preference norms. Section 3 sets out a theoretical framework to motivate the empirical analysis. In Section 4 we discuss the data, Section 5 outlines our empirical methodology, and in Section 6 we present our results and a discussion of mechanisms. Section 7 concludes.

2. Background

2.1 Historical Context

Upon national independence in 1947, the Indian central government initiated three main types of land reforms to address large historical inequalities in land distribution. These were abolition of intermediaries, new tenancy laws to protect against eviction and extraction of excessive rental crop shares by landlords, and land ceilings to limit the amount of land held by any one household with the aim of vesting and redistributing surplus land to small farmers. Implementation of the reforms was left to individual state governments. However, barring intermediary abolition in nearly all states, landlords were able to subvert the remaining reform measures by way of pre-emptive tenant evictions and parcelling land to relatives to avoid state

[2] Initially, the Chinese reform granted a 3-5 year lease to households, extended in 1984, to 15 years.

confiscation of above-ceiling holdings (Appu, 1996). Variation in state-level reform implementation and legislation over time has been used in previous studies to empirically estimate land reform impacts on poverty, equity, and human capital (Besley & Burgess, 2000; Ghatak & Roy, 2007; Ghosh, 2008). West Bengal's land reform was an unusual success amidst myriad failures, and a number of influential studies have analysed economic impacts of Operation Barga (Banerjee, et al., 2002; Bardhan & Mookherjee, 2011; Bardhan, et al., 2012; Bardhan, et al., 2013).

Reforms in the state of West Bengal were spurred by the outcome of the 1977 state assembly election, following a Maoist land-based movement in late 1960s. The Left Front coalition won an absolute majority, which it retained until 2011. This new government created a three-tier system of local governments called *panchayats*, which for the first time would be democratically elected. These tiers in descending order of size of jurisdiction were district, block, and finally the *gram panchayat* that operated at the village level with a jurisdiction of 10-15 hamlets (*mouzas*). Many national development programmes as well as aspects of new state welfare initiatives such as Operation Barga were then decentralised to *gram panchayats*, who were responsible for selecting local eligible beneficiaries and lobbying the upper tiers of the new system for funds (Bardhan & Mookherjee, 2011).

2.2 Operation Barga and the Green Revolution

West Bengal, along with Kerala, was an exceptional state in terms of the effort and success with which the state government pursued land reforms. Registration protected sharecroppers from eviction by landlords, giving them permanent, tenancy rights and capping the share of the crop payable as rent to landlords to 25 percent.[3] The tenancy rights could be used as collateral for loans and could be passed on to their heirs. By 1981 over 1 million sharecropper tenants were registered, and almost 1.5 million by 1990 (Lieten, 1992). Estimates of the fraction of sharecroppers registered in the state range from 45% (Bardhan & Mookherjee, 2011), to 65% (Banerjee, et. al., 2002), to as high as 80% (Lieten, 1992).

Besides Operation Barga, the state also aimed to vest land held by households above the stipulated ceiling of 12.5 acres and redistribute it to the landless and small landowners in small plots (or *pattas*). Most vesting of land had already taken place by 1978, so the Left Front government's main role was in redistributing this land. Appu (1996) estimates that 6.72 percent of state operated area was distributed by 1992; several times the national average of 1.34 percent. However, this land was redistributed in small plots (less than half an acre on average in the sample of farms in Bardhan & Mookherjee (2011)), and was of low quality for cultivation as landlords

[3] This share rose to 50 percent if landlords provided all non-labour inputs.

would only part with their lowest quality above-ceiling holdings. Hence unlike tenant registration, land redistribution had virtually no impact on agricultural productivity (Bardhan & Mookherjee (2011).

There were other government initiatives launched in the state at the same time, including decentralization, local infrastructure investment and programmes aimed at boosting agricultural productivity and reducing poverty. 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*.[4] Land reform in combination with minikit distribution led to a substantial increase in agricultural yields in West Bengal over the 1980s, transforming the state into one of the best agricultural performers in the country and leading this period to be called West Bengal's Green Revolution. This period is also associated with significant declines in poverty and growth in rural employment. Banerjee, et al. (2002) attributed the increase in yields to land reform, citing decreased Marshall-Mill sharecropping distortions from increased tenancy security. Bardhan & Mookherjee (2011) however shows that while decreased inefficiencies played a role in increasing yields, it was largely minikit distribution that was responsible for the agricultural growth in this period.[5] Other programmes administered in the 1980s with *gram panchayats* targeting local beneficiaries include the Integrated Rural Development Programme that provided subsidised credit, and employment initiatives such as the Food for Work programme, the National Rural Employment Programme, and the National Rural Employment Guarantee Programme.

2.3 Son Preference

The majority Hindu community in India traditionally exhibits greater son preference than other religious communities, as evidenced by conditional sex ratios in the population and empirical evidence on child mortality and education that reflect childhood parental investments (Bhalotra & Zamora, 2009; Bhalotra & Cochrane, 2010; Bhalotra, et al., 2010). The literature in this regard has focused on Hindu-Muslim differences, as other religious communities make up a very small part of the population.[6]

[4] The crops for which seeds were distributed were rice, potatoes, oilseeds, and some other vegetables according to Bardhan & Mookherjee (2011).
[5] A companion paper Bardhan, et al., (2012) also shows that tenancy reform crowded in large private investments in irrigation, the growth-inducing effects of which were far greater than those of reduced Marshall-Mill distortions.
[6] We do the same in this section, as Hindu and Muslim children constitute about 98% of our estimation sample.

While no definitive explanation has been agreed upon for the differing degrees of son preference between the Indian Hindu and Muslim communities, existing arguments such as the Dyson-Moore hypothesis base them in marital institutions and inheritance practices. In North India including West Bengal, Hindu marriage is exogamous for women, who leave their natal family village to marry into families in villages much further away to avoid marrying a possible relative. The distance from natal family after marriage reduces Hindu women's bargaining power and also their claim to natal family land, which is seen as bringing no reciprocal benefit and lost to the family when daughters inherit. Sons on the other hand care for parents and natal family members in their old age by remaining with the natal family and working the family land, eventually inheriting it upon the death of the family patriarchs. Cultural taboos against Hindu women sharing public spaces with men and working agricultural land also often prevent them from claiming and cultivating land (Agarwal, 2003). The bridal dowry practice also often entails loss or mortgage of family land at the time of a daughter's marriage. With regard to Operation Barga specifically, Gupta (2002) finds from interviews of 870 households in two West Bengal districts that 99% of households reported dowry being a serious concern, and that mortgaging *barga* land to meet dowry payments was a common practice. She also finds that dowry was largely a Hindu practice, but that the custom has penetrated younger generations of Muslims.

Under the *Mitakshara* Hindu doctrine followed in North India, women in fact have no claim to joint family property, whereas men are entitled at birth to a share of such family property held by their fathers, paternal grandfathers, and paternal great-grandfathers.[7] In South India close-kin marriages are more prevalent for Hindu women, allowing them to inherit a greater share of ancestral land despite prevailing *Mitakshara* doctrine as they reside close enough to participate in cultivation on natal family land after marriage. These marital institutions have been used to explain more favourable female-male sex ratios in South India compared to North India (Chakraborty & Kim, 2010). In West Bengal the *Dayabhaga* Hindu system of inheritance is followed where the concept of joint family property is absent, and all of a Hindu male's property is subject to equal claims by his widow, sons, and daughters upon his intestate death (Lingat, 1973). While this appears more gender-equal than the *Mitakshara* system in theory, in practice Hindu women nearly always relinquish their inheritance claims to their brothers and sons so as to avoid social exclusion, intimidation, and losing the family safety net in times of financial crisis (Agarwal, 2003). Hindu upper caste women also do not physically work agricultural land due to prevailing social norms.

[7] Some Indian states have since made reforms to the Hindu Succession Act of 1956 to give women equal inheritance rights to joint family property, but these reforms still explicitly exclude agricultural land from their purview.

Lower caste women have higher work-force participation rates in agriculture as wage labourers, but still female employment rates in agriculture in the state have been persistently low.[8] Hindu women therefore are very much financially dependent on their male kin, leading them to give up their rights to family land to avoid losing that support.

Muslim communities follow inheritance practices based in the *Shariat*, which guarantees women at least half as much inheritance as their closest male counterpart inheritors. Consanguineous marriage is also practiced to keep all ancestral property within the family, allowing Muslim women to remain close to their natal families after marriage and inherit more family property in practice similar to Hindu women in South India.[9] Marital dowry is also less prevalent among Muslims, and abortion, sex selective or otherwise, is strictly forbidden under the *Shariat*. The effect of these institutions arguably reduces parental neglect of Muslim female children compared to Hindu female children in many parts of the country including West Bengal, despite the fact that the Muslim minority population experience nationally higher levels of poverty than the Hindu majority and Muslim female labour force participation in West Bengal is even lower than that of Hindu women (Nasir & Kalla, 2006; Chakraborty & Chakraborty, 2010).

3. Theoretical Framework

Under Operation Barga, agricultural tenants benefited in two respects, increased land security and a greater share of agricultural output. At the same time, landlords faced reduced land rights and rents and it has been documented that the reform led large landowners to, in some cases, sell some of their landholdings to smaller landowners.[10] In addition, there were positive general equilibrium effects on land productivity across all farm sizes the economy, associated for instance with sharecropper registration crowding-in significant private irrigation investments that generated spill-overs across both tenant and non-tenant farms so that Operation Barga had large indirect impacts on small cultivators and wage labourers who were not involved in sharecropping as landlords or tenants (Bardhan, et al., 2012).

Income gains among tenant farmers will have tended to increase investments in boy and girl survival, although possibly to different extents. We posit that substitution effects were biased

[8] In the 1991 Census of India only 11.1 percent of women in West Bengal reported having any form of employment, and only 54.1% of the employed women were cultivators or agricultural labourers. National Sample Survey data also reflects decreasing female rural employment and increased casualisation of female agricultural labour since the late 1980s.

[9] Bittles (2002) reported that 23% of Muslims in India practiced consanguineous marriages in 1992–1993.

[10] The sale and transfer of land for marriage expenses and dowry of Hindu daughters are thought to have constituted a significant share of land market transactions stimulated by Operation Barga, and this may have contributed to intensifying among new parents a desire to have sons rather than daughters (Gupta, 1993; Kodoth, 2005).

in favour of sons on account of Hindu marriage and inheritance norms (varilocality and male-biased inheritance). We sketch a model to clarify the nature of wealth and substitution effects and how these may vary with household and village characteristics. We can represent the value placed on child i by parents in household j in a given village as follows,

$$v_i = (K - \delta_1 g_i) \exp[(a - \delta_2 g_i)W_j + \pi(1 - f_j)(1 - g_i)\, \theta(\beta)\{l_j + \beta t(l_j)\}] \quad (1)$$

where the first term denotes the wealth effect and the second the substitution effect. We can write household wealth W_j as,

$$W_j = \theta(\beta)\{l_j + \beta t(l_j)\} + F \quad (2)$$

Here g_i is a dummy variable taking value 1 if child i is a girl. $\delta_1 > 0$ indicates intrinsic gender bias against girls. W_j is household wealth, $a > 0$ is a common wealth effect on child values, and $\delta_2 > 0$ indicates gender bias in the wealth effect. θ is village land productivity, which is an increasing function of the fraction β of cultivable land that is tenanted and registered under Operation Barga, consistent with the evidence in the preceding section. l_j is land owned by the household, and $t(l_j)$ is net land leased by the household. F is household non-land wealth. Households owning more land lease in less, so t is a decreasing function of l with $t(0) > 0$, and $t(l^*) = 0$ for some $l^* > 0$. Therefore, those with land holdings less than l^* lease in land from those with land holdings greater than l^*. [11] The parameter π represents the 'substitution' effect (which is larger for Hindus), that is the added value of having a boy to inherit the household tenancy rights valued at $\theta(\beta)\{l_j + \beta t(l_j)\}$. The substitution effect manifests only if the household has no first-born son, i.e. the dummy variable for the first child in household j being male, represented by f_j, equals zero.

The general equilibrium effects of Operation Barga come through increased village land productivity β, which applies uniformly for all landowners. A partial equilibrium property rights effect is represented by the dependence of $l_j + \beta t(l_j)$ on β, which is increasing in l_j for those owning less than l^* and decreasing in l_j for those owning more. We assume that landless households form the bulk of sharecropping tenants that benefit directly from registration. [12]

For these landless households, Operation Barga unambiguously raises household wealth and value placed on children through a direct improvement in property rights on rented land and

[11] As a further restriction, land cultivated by the household is $l + t(l)$ which must be non-negative and increasing in l, so the t function must have a slope less than one in absolute value.

[12] Bardhan, et al. (2014) reports that 80% of surveyed households were landless or marginal landowners.

increased village land productivity β. The curvature of the logistic function in (1) also means that for a unit increase in wealth, there is a larger increase in child value the smaller the size of the household's landholding. However, due to the gender bias parameters δ_1 and δ_2 the value placed on boys will increase more than for girls, especially in Hindu families.

For landowners with holdings greater than l^*, the sign of the wealth effect is ambiguous as the general equilibrium effects and property rights effects operate in different directions: we cannot sign the slope of $\theta(\beta)\{l_j + \beta t(l_j)\}$ with respect to β, unless the θ function is assumed to be rising fast enough. Likewise, the substitution effect cannot be signed. In any case, the curvature of the logistic function implies that a unit increment in wealth will lead to smaller increases in child value for this category of households than for landless households.[13] Additionally, larger landowning households are wealthier than the landless, and therefore place a higher value on children to begin with.

Increasing values placed on children will translate into reductions in infant mortality rates. Effects on fertility are more complicated, owing to possible quantity-quality trade-offs of the sort emphasized by Becker and Lewis (1973). Son preference and male-biased inheritance patterns also may lead to a fertility decline that manifests through son-biased fertility stopping, which would increase infant survival amongst children who grow up in smaller families.

Predictions testable with the available data are as follows. We expect that in landless Hindu families with a first-born daughter, parental investments will modify the sex ratio by age one in favour of males, relative to landowning Hindu families with first-born daughters, relative to Hindu families with first-born sons, and relative to non-Hindu (Muslim or Christian) families. Averaging across households at the village or district level, if the share of landless and small landowning households was large enough, then we may expect predictions for these households to dominate.

4. Data and Descriptive Statistics

We use two independently gathered household survey data sets, the all-India National Family Health Survey (NFHS) and a household panel survey of 2,400 households across 89 villages of West Bengal conducted for the purpose of gathering reliable data on land reform (Bardhan & Mookherjee, 2011). We merge the district level share of tenant farmers registered

[13] We include marginal landowners with l_j less than l^* in the same category as large landowners in the empirical analysis. This allows for clean estimation of the effects of improved property rights on infant mortality among the landless without confounding wealth effects from landholdings, and serves only to bias estimated coefficients towards zero among landed households.

(from Banerjee, et al., 2002) with the NFHS household data, and the village level share of cultivable land area registered with the West Bengal survey data. This way, we test robustness of our results to different measures of reform. In all of the analysis, the dependent variables are at the individual level. Since the treatment is at the village or district level, we account for the non-independence of the errors within the treatment unit.

A particular advantage of the NFHS for our purposes is that it is representative of the state of West Bengal and it records the entire birth history of all women aged 13 or 15 to 49 at the time of the survey, allowing us to identify the exact date of birth and death for children. Moreover, we have fertility histories for biological mothers, so although many Indian households have a complex structure, we can unambiguously identify the birth order and sex of every child, which is important in constructing an indicator for the sex of the first born child. While the West Bengal survey data do not have these strengths, they contain a more reliable measure of tenancy reform and unique information on household-level land holdings and migration histories which help us test whether the effects of tenancy reform were larger in sub-groups where we predict they are larger. They also contain data on village-level exposure to other programs, and on farm-level agricultural productivity, which are important controls. We introduced similar controls in the NFHS data analysis using further data sources described in the next section.

4.1 District level rollout and NFHS household data

We pool the 1992-93 and 1998-99 waves of the National Family Health Survey (NFHS) data as these rounds contain a district identifier for every household. The data are transposed to create identifiers for the district and year of birth of every child, and these data are then merged with district-level sharecropper registration rates for the 14 districts that the state had at the time. The rollout data are from Banerjee, et al. (2002).

Panels A and B of Table 1 outline descriptive characteristics of children in the NFHS sample born during 1967-93 and their mothers. Neonatal and infant mortality rates are 6.4% and 9.4% respectively. The probability that a child is male is 51.1%, and the probability the child has a younger sibling is 71.8%. As many as 68% of mothers reside in rural areas, and the average age at which they give birth is 19.03 years. The average years of education of mothers in the sample is 3.42 years and they have an average of 3.39 births. 75% of mothers are Hindu.

We obtained district-level data on yields and area under cultivation of rice in West Bengal from the ICRISAT Village Dynamics in South Asia (VDSA) database to construct measures of annual district rice productivity in thousands of tonnes of output per one thousand hectares for the years

1977-1990.[14] We also collected district time series information from the annual Economic Survey reports of the West Bengal government to control for the effects of other programmes and infrastructure. Specifically, we gathered information on the number of medical institutions per capita, kilometres of surfaced roads per capita, and hectares of *patta* land distributed per capita. Descriptive statistics for the district-year varying controls are in Panel C of Table 1.[15]

Figure 1 shows the evolution of the tenant registration rate over time. There is no positive registration recorded in the data prior to 1978, although registration of tenants has begun under the previous government.[16] Sharecropper registration occurred most rapidly up until 1985, after which the pace slowed considerably. The analysis sample includes births during 1978-1991, as we do not have information on district-level programmes other than land reform after this year.

4.2 Village-level rollout and primary survey data

The primary household survey data collected in West Bengal include family histories, land ownership, immigration status, and other household characteristics since 1967[17] The questionnaire elicited information from the head about all members residing in the household in 2004, including the year they were born or joined the household. It reports the births of all children in the household, but only for those that survived till 2004. We therefore have a compound measure of sex of birth and gender-differentiated survival. We define an indicator for the first-born child being a son somewhat crudely using the sex of the first child in the household, who may or may not be the child of the household head.

The survey data were used to construct a household panel for 2,400 households from 89 villages. For approximately two-thirds of this sample, a consistent history of household landholdings and demographics could be constructed (we call this the 'restricted sample'; details are in Bardhan & Mookherjee (2011)). For the rest a consistent history could be constructed under specific assumptions on the nature of recall errors. While we report only results from the restricted sample, we verify that the results do not differ qualitatively in the full sample.[18]

Information on land reform implemented in each of the 89 surveyed villages during 1971-2003 for both the land distribution and tenant registration arms of the land reform programme

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14 We construct and control for similar productivity measures for other cereals, but we do not report these coefficients as these crops form a very small part of total crop yields in West Bengal as described in Section 3.

15 These are the years for which these measures enter the regressions as controls; see Section 5.

16 We allow for pre-1978 registration when we move on to analyse the West Bengal survey data that contain more reliable data acquired by Bardhan & Mookherjee (2011) from village land registers.

17 Further details on this survey data are in Bardhan & Mookherjee (2010), Bardhan & Mookherjee (2011), and Bardhan, et al. (2014).

18 The results from the full sample are in Table A.12 in the Appendix.

was collected from Block Land Records Offices. It is unusual to have data compiled firsthand from official land records rather than from indirect sources. Data quality aside, the share of cultivable village land registered is probably a better measure than the share of tenants registered. A concern with using the share of tenants registered is that where the potential number of tenants is small, but most of them are registered, we would get a misleadingly high measure of the intensity of the program.

Table 2 shows descriptive statistics from these primary survey data for the years 1978-99, which are the years we include in our regression sample.[19] Panel A shows that as in the NFHS sample, a majority 79.7% share of households are Hindu, and there are more surviving boys (1.051) than surviving girls (0.937). This difference is also visible in Panel B, which reports the average probability of survival conditional upon birth for boys and girls in a household-year during 1978-99. Panel C shows the average percent of village cultivable land registered (*barga)* and distributed (*patta*).

So as to smooth over measurement error and also to allow for a lag in household behavioural responses, in the estimation we measure the extent of reform activity as the percentage of village cultivable land registered under sharecropping (*barga*) in the three years preceding the birth year of a surviving birth. We control for the land re-distribution component of the program, which involved awarding small plots (*pattas*) to farmers. The survey data show that approximately 15% of surveyed households had received *patta* land by 1998. However, the distributed plots were small and of poor quality, and were not eligible to be used as collateral for subsidised credit. Land distribution was therefore largely ineffective in increasing rice productivity. In contrast, plots registered under *barga* (the tenancy reform) were of a much larger size (1.5 acres on average), and could be used as collateral for loans from state financial institutions, yielding much greater positive impacts on rice productivity (Bardhan & Mookherjee, 2011). The survey data show that about 48% of sharecropper tenants, or 6% of surveyed households, had been registered by the late 1990s. Figure 2 shows the average cumulative share of village cultivable land registered over the years 1967-1998 for the 89 surveyed villages. As in Figure 1, we see that registration peaks in 1985. The decline in average share of cultivable land thereafter is due to a slowdown in registration, combined with an increase in village cultivable land (the denominator) on average over the 1980s.

5. Empirical Strategy

[19] We start the sample in 1978 so as to make the estimates more comparable with those from the NFHS data. The year 1999 is the last year for which we have complete data on land registered in the village in the previous three years, which is our measure of reform intensity using these data.

We first specify a test for pre-trends in the outcomes, and then the estimating equations for birth, sex at birth and sex-differentiated mortality after birth as a function of land reform.

5.1. Test for targeting of sharecropper registration

If the rate of tenant registration was correlated with pre-reform trends in the outcome variables, the estimated impacts of registration on the outcomes may be spurious. For instance, registration may have progressed more rapidly in districts where male infant mortality was already declining faster than female infant mortality (and more so in households with first-born daughters). To investigate this, we use pre-reform data on the outcomes. Since registration is a continuous variable we discretize it by assigning districts as "*treated*" or not depending on whether they had achieved above or below-median levels of registration by 1985. We chose 1985 because registration occurred most rapidly up until 1985 (Figure 1). We use a sample of children of birth order 2 or higher born *before* the programme, during 1958-77. We then regress the outcomes of interest on "*treated*" interacted with a linear time trend. A significant coefficient on this interaction term will reveal whether district pre-programme trends in the outcomes were correlated with a district becoming a "treated" (or high intensity reform) district in the future. Since the main equations are estimated with first-son interactions, the stricter test of pre-trends includes this interaction. The estimated equation for infant mortality for instance is,

$$\begin{aligned} y_{ihjt} = a &+ \beta_1\, treated_j * trend_t * firstson_h * female_i \\ &+ three\text{-}way\ interactions + two\text{-}way\ interactions + main\ effects \\ &+ \lambda\, x_{ihjt} + d_t + \theta_j + \varepsilon_{ihjt} \end{aligned} \tag{3}$$

where y_{ihjt} is the infant mortality outcome for child *i* of mother or household *h,* born in district *j* in year *t*. *treated* is the indicator for above-median district registration in 1985, *trend* is a linear time trend for the pre-reform years 1958-77 and we include all three and two-way interactions and main effects though these are not displayed. The covariates included in x_{ihjt} are the same as in (4), except that controls for other district programmes and infrastructure are not included here as they are not available for the pre-reform years. We estimate analogous equations for the other outcomes, fertility and the sex ratio at birth.

5.2 Strategy using NFHS households and district rollout

We estimate equations for infant mortality, the probability of a male birth and fertility-stopping using OLS on the sample of children of birth order two or higher born during 1978-

91.[20] We carry out separate estimations for Hindu and Non-Hindu children for reasons discussed earlier. As the indicator of reform varies at the district level and there are only 14 districts, the standard errors are wild cluster-bootstraped (Cameron, et al., 2008), using the procedure in Busso et al. (2013).

On the premise that the sex of the first child is random (established in Bhalotra & Cochrane, 2010) and that households with first-born sons (who can inherit land titles) have limited incentive to manipulate the sex ratio of their children, we interact the land reform indicator with an indicator for the gender of the first-born child. Since our hypothesis is that exposure to land reform leads parents to manipulate the survival chances of sons relative to daughters, we further interact this term with the gender of the index child. The first outcome we analyse is **infant mortality**. The estimated specification is

$$\begin{aligned} y_{ihjt} = a &+ \beta_{1k}\, R_{kjt-1} * firstson_h * female_i \\ &+ \delta_{1k}\, R_{kjt-1} * female_i \\ &+ \eta_{1k}\, R_{kjt-1} * firstson_h \\ &+ \varphi_1\, firstson_h + \varphi_2\, female_i + \varphi_3\, firstson_h * female_i \\ &+ \gamma_{1k}\, R_{kjt-1} + \lambda\, x_{ihjt} + d_t + \theta_j + \varepsilon_{ihjt} \end{aligned} \tag{4}$$

where y_{ihjt} is a dummy variable taking value 1 if child i of mother or household h, born in district j in year t died aged 0-12 months and 0 otherwise, R_{kjt-1} is a vector of dummies which take the value 1 if sharecropper registration rate in district j reaches at least 25% or 50% respectively (we set k=2) in the year preceding the child's birth year, and 0 otherwise. These measures are cumulative, such that the indicator for 25% coverage is always equal to 1 when the indicator for 50% coverage is equal to 1. The omitted category of children constitutes those born in districts where registration was less than 25% in the year preceding birth. We chose these threshold rates based on estimates from a more flexible specification.[21] Note that we would only expect linearity in the registration rate if all districts had the same tenancy rates at baseline, which was not the case. The variable $firstson_h$ indicates households with a first born son and $female_i$ indicates that the index child is female. We exclude first-born children from the sample.

[20] We also check for consistency of estimates by including first-born children in the sample and coding the first-born son indicator as zero for these first-borns, and also by restricting the sample to the first two children only. The results do not change, and are available from the authors upon request.

[21] We tested for significant effects of cumulative sharecropper registration rates in 10 percent increments, and we tested for a quadratic in registration rates. These results are available from the authors upon request.

Table 2 shows the evolution of sharecropper registration rates for the 14 districts in our sample. The light grey cells indicate the year that 25% registration of all sharecroppers is achieved, and dark grey cells indicate the year when 50% registration is achieved. The figure shows sufficient variation across districts in the years in which these thresholds in programme implementation are achieved. Since all districts in West Bengal experienced tenant registration and the variation is only in rates of progression, we also report results from estimating (4) including children born in bordering districts in the neighbouring state of Bihar as a control group, as these children are never exposed to land reform.[22]

There are effectively four dimensions across which we exploit differences to achieve identification, which are district, year of birth, child gender, and the gender of the first-born child in the household. The impacts are identified independently of child birth year and district fixed effects captured in dummies d_t and θ_j. We test robustness to including district-specific linear trends in child birth year to control for district specific unobservable trends that may be simultaneously correlated with sharecropper registration rates and infant mortality risk. The covariate vector x_{ihjt} includes indicators for child birth order, household religion and caste, whether the household is rural, mother's educational attainment, and linear and quadratic terms in the age of the mother at the birth of the child. So as to allow for individual selection into programme uptake or fertility, we also estimate the specification with mother fixed effects. Mother fixed effects absorb district fixed effects since mothers typically do not migrate between births.

Productivity was increasing in West Bengal in the period studied. To some degree this was the result of land reform incentivizing improved input use, including investments in irrigation, and some of it flowed from a contemporaneous programme which involved distribution of subsidized inputs for high-yielding variety seeds that were being adopted as the Green Revolution swept through the area (Banerjee, et al. 2002; Bardhan & Mookherjee, 2011). To control for increased agricultural yields in this era, we estimate specifications including the log of district productivity of rice ($ln\ rice\ yield_{jt-1}$) in the year prior to the child's birth as a regressor, interacted with indicators for the sex of the first-born child and the sex of the second or higher-order index child. Rice is the major crop in West Bengal, accounting for more than 70% of gross cropped area during 1971-1991 according to state government economic reviews, but we also controlled for yield of all other cereals.

To further control for any confounding effects of public health improvements, infrastructural development, and the other arm of the land reform, we include controls for the

[22] These specifications do not include district health and infrastructure programme controls, as these are not available for (or relevant for) Bihar.

logarithm of medical institutions per capita, kilometres of surfaced road per capita, and hectares of *patta* land distributed per capita in the district in the year preceding the child's birth, and their interactions with index child gender and the gender of the first-born child.

We investigated impacts of tenancy reform on the **sex ratio at birth**. Although prenatal sex detection technology was not widely or cheaply available in the late 1970s and early 1980s, previous work has identified tendencies towards female infanticide and under-reporting of girl births. We define an outcome variable taking value 1 if child *i* is male and 0 otherwise. The regressor of interest, as before, is the tenant registration rate interacted with an indicator for a first-born son. We first estimate these equations for first births so as to test our assumption that the sex of first births is quasi-random. We then estimate the equation for second and higher order births to test whether sex at birth is modified by land reform in the same direction as sex after birth (via infant mortality). The sex of a birth is, of course, conditional upon fertility. We assess any selection bias by estimating fertility responses to tenancy reform, which are also of substantive interest.

So as to investigate whether tenancy reform influenced **fertility**, we estimate an equation with the dependent variable an indicator taking value 1 if index child *i* has a younger sibling and 0 otherwise. Given evidence that fertility-stopping behaviour at any time is sensitive to the sex composition of preceding children, and evidence that the sex of the first born is quasi-random, we interact the sharecropper registration rate with the first-born son indicator. We estimated these specifications sequentially for separate samples of children by birth order, so as to identify the margin at which households alter childbearing in response to land reform. We found no impact of land reform on fertility-stopping after the first birth (Appendix Table A.1) and also no impacts on stopping after the third birth (available upon request). We therefore present estimates for stopping after the second birth, which is plausibly the relevant margin.

5.3 Strategy with village rollout and household data

These data do not contain full birth histories or exact dates of death so we are unable to directly identify either infant mortality or fertility. Instead, we model as outcomes the probability of a surviving girl, and a surviving boy being observed in 2004 (the last round of the village survey) in response to land registered under Operation Barga during 1978-99.[23] We have their dates of birth but since we only observe a birth if it survives, the outcome compounds having a birth, the sex ratio at birth, and the sex ratio of survival, outcomes that earlier we separated. We expect that

[23] The last year for which land registration data is available from block records offices is 1998.

most of the observed differences in survival rates of boys and girls reflect differences in childhood mortality. The estimated specification is,

$$y_{ihjt} = a + \beta_1 R_{jt-1} * firstson_h + firstson_h + \lambda x_{ihjt} + d_t + \theta_h + \varepsilon_{ihjt} \quad (5)$$

where the outcome y_{ihjt} takes the value 1 if a surviving boy (or girl) i is born in household h in village j in year t and 0 otherwise. The outcome variable takes value 1 when the surviving child born in year t is a boy (girl), and value 0 if there is no birth in year t, *or* if there is a surviving birth in year t that is a girl (boy).[24] The indicator R_{jt-1} measures the share of cultivable land in village j that was registered in the three years preceding year t.[25] The terms d_t and θ_h are year and household fixed effects respectively, and ε_{ihjt} is an idiosyncratic error term. Household fixed effects absorb village fixed effects since mothers typically do not migrate between births. Using household fixed effects is a powerful means of accounting for potentially correlated regional heterogeneity and household level selection.

The regressors x_{ihjt} include (lagged) land owned by the household, an above-ceiling indicator (whether it owned more land than permitted by the land ceiling), patta land distribution, and immigrant status indicators (whether the household immigrated after 1967 (the earliest records we have), and year of immigration) which are available for the full time period of 1971-1999[26] In alternative specifications we include controls constructed from the farm-level dataset of Bardhan & Mookherjee (2011), which include the logarithm 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. These regressors control for potential confounding effects of local public spending on other programmes and economic shocks. This information is only available for years 1982-95 but using this shorter sample we show that including these controls does not qualitatively change the results. We define landowning classes, household land holdings, and the land ceiling indicator using pre-reform reported household landholdings in 1977, to avoid endogenous sample selection on landholdings that may change due to the reform.

[24] Hence estimating (5) separately for surviving male and female births will capture increases in gender-specific survival rates in positive coefficients, and declines in fertility combined with reduced survival rates in negative coefficients.

[25] The results are robust to alternative definitions of registration intensity in these data, and these additional results are available upon request.

[26] In some specifications we include the share of cultivable village land transacted in the three years preceding year t to examine if income effects from these post-reform transactions explain any impacts we find. The results do not change significantly, and are available upon request.

Importantly, we also estimate (5) including district-year fixed effects, which control flexibly for any relevant time-varying unobservables at the district level. This is relevant since a majority of public infrastructural and health spending decisions affecting individual villages are made at by the district level of government.[27]

As with specification (4), we present separate estimates for Hindu and Non-Hindu households. We further disaggregate results by whether households own land, and by household immigrant status. This is because landless immigrant households are the most likely beneficiaries of tenancy registration, while native landed households are the most likely to lose privileges on land.

6. Results

6.1 Was sharecropper registration targeted?

Estimates of equation (3) for infant mortality are in Table 4 and estimates of the same equation for the probability of a younger sibling and the probability of a male birth are in Table 5. We find no statistically significant correlations in any of the three samples of children between the pre-reform trend in infant mortality and the intensity of registration in the district in 1985, by either the gender of the child or the first-born sibling. The coefficients are all also nearly identical to zero.

6.2 Results for infant survival

Table 6 reports estimates of equation (3). Column 1 includes district and year fixed effects and the individual, household, and district-year controls indicated earlier. Controls for agricultural productivity are added in column (2) and district-specific linear trends in column (3). In general, coefficient size and significance is robust to the addition of controls.[28] The estimated coefficients are different in the Hindu and non-Hindu samples in the manner predicted. The coefficients for all children resemble the coefficients for Hindus since they constitute about 80% of the sample. As the estimates are not significantly changed by addition of controls, we discuss here the richest specifications, column (6) for Hindus and column (9) for non-Hindus.

Consider Hindus first. Boys in families with a first-born girl show an infant mortality decline of 5.9 percentage points once district registration exceeds 50% (coefficient on *R*), and

[27] Results from specifications including district-year fixed effects are in Appendix Tables A.11. The results including the full set of controls are available from the authors upon request.

[28] The results including children from untreated border districts in neighbouring state Bihar are in Appendix Table A.2, and show identical patterns. We display coefficients on rice productivity interacted with gender in Appendix Table A.5.

though a positive coefficient suggests a smaller decline in families with a first-born son, there is no statistically significant difference. In contrast, there is a sharp divergence in the effects for girls. In families with a first-born daughter, land reform elevates the risk that girls of second and higher birth order die in infancy by 1.1 (7.0 minus 5.9) percentage points. Girls with first-born older brothers are, however, protected and they exhibit a decline in infant mortality of 5.4 (9.7 minus 4.3) percentage points. A specification that incorporates mother fixed effects (Appendix Table A.4), produces broadly similar estimates, with boys exhibiting a 6% point reduction in infant mortality while girls exhibit a much smaller reduction (rather than an increase) in infant mortality of 0.09 percentage points. We split the sample into children of birth order 2 and children of higher birth order and found stronger impacts for children of orders three and higher (Appendix Table A.8). This is consistent with most families being happy with one girl, especially if they already have a son (see Bhalotra and Cochrane 2010, for example).

In the non-Hindu sample, land reform is associated with reductions in infant mortality irrespective of the sex of the first child, and the reductions are not significantly different for boys and girls. These are primarily Muslim (and Christian) communities and our findings are consistent with previous research which suggests that for religious reasons Muslims and Christians are less likely to engage in abortion and "silent killing" of girls than Hindus (Bhalotra, et al., 2010; Bhalotra & Cochrane, 2010; Almond, et al., 2013a).

Observe that every district in West Bengal was treated and that what we capture are the impacts of varying progression of tenancy reform across districts. We tested robustness to have a strict control group in which no tenants were registered, by introducing into the sample all districts of the neighbouring state of Bihar that are contiguous to West Bengal. The controls are as before (except for district-level infrastructure and healthcare measures, which are unavailable for Bihar) and include district-specific trends. The estimates are essentially unchanged, and this holds for the other outcomes too (Appendix Table A.2).

So, overall, we find that land reform led to an intensification of son preference expressed in manipulation of the sex ratio of second and higher order children surviving to age one in Hindu families in which the first child is a girl. Families that, at first birth, have had a son, show no tendency to manipulate the relative survival chances of subsequent sons and daughters. These estimates are robust to controlling for gender-specific impacts of productivity.

6.3 Results for sex ratio at birth

In Table 7 we report the estimated impact of sharecropper registration on the probability a birth is male.[29] First, we verify the assumption made earlier that the sex of the first born is exogenous to tenancy reform (columns (1), (4), (7)). For birth orders 2+, we find that tenancy registration is associated with more male-biased sex ratios at birth (column (2)), although only in Hindu families with first-born girls. In these families, once district registration is at least 50%, the probability that a birth is male rather than female is 5.5 percentage points higher (column (6)).[30] There is no change in sex at birth in non-Hindu families.

6.4 Results for son-biased fertility stopping

The estimated impacts of sharecropper registration on the probability a child of birth order 2 has a younger sibling are in Table 8.[31] The estimates are stable across specifications with successively richer controls. There are two relevant patterns. First, the overall tendency is for land reform to lower the probability of transition to a third birth, and this is not sensitive to conditioning on yield, a measure of income. Second, this reduction in fertility is evident among Hindu families with first-born sons and all non-Hindu families, but not in Hindu families with first-born daughters. These results are consistent with heritable land rights securing the attachment of sons to the father's property.[32] The left-wing government that progressed land reform also decentralized and extended public services so this was a time when the shadow price of child quality was probably falling, encouraging the trade-off of quantity in favour of quality. However, we cannot test these speculations.

Among Hindus with a first son, the probability of a third birth declines by a statistically significant 10.8 percentage points (13.4% of the mean pre-reform probability) once district registration exceeds 25% (and there is no further reduction at 50% coverage). There are no perceptible effects on fertility stopping after the second birth if the first child is a daughter, consistent with these families continuing fertility to achieve a son. This ties in with a previous literature showing that fertility stopping rules are sensitive to the sex of previous births, with

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[29] The sex ratio results displaying estimates on the rice productivity terms are in Appendix Table A.6. For brevity, we only report estimates from the full specification inclusive of rice productivity controls and district-linear time trends in Table 7. The results including children from untreated border districts in neighbouring state Bihar are similarly available upon request.

[30] The increased male bias at birth is primarily at birth order 2 (Appendix Table A.9).

[31] The results including children from untreated border districts in neighbouring state Bihar are in Appendix Table A.3, and show identical patterns to those reported here. The estimates for rice productivity controls along with those in Table 4 are in Appendix Table A.7.

[32] By tradition, this would involve adult sons co-residing with parents on family land and providing old-age security. It seems plausible that this limits the need for parents to diversify their risks across a greater number of children, and incentivizes them to invest in their first son.

families tending to continue fertility till they have achieved the desired sex composition of births (e.g. Rosenblum, 2013). First-son families are smaller at baseline because of underlying son-biased fertility stopping. Our results show that, after land reform, sibship size differences between first-son and first-daughter families widened.

Among non-Hindus, we see no evidence that land reform leads to changes in the sex ratio at birth or after, but we see similar son-biased fertility stopping behaviour. This is consistent with previous research which shows that Muslim households (which dominate the non-Hindu sample) exhibit a preference for sons by continuing fertility to achieve them rather than by practicing foeticide, infanticide or post-natal discrimination designed to eliminate girls. In fact non-Hindus exhibit a greater decline in fertility, consistent with their higher baseline levels of fertility and this is irrespective of the gender of the first child. At 25% coverage, the decline is, as for Hindus, restricted to first-son families, and as large as 18.2 percentage points (19.1% of the mean). Once coverage reaches 50%, there is further fertility decline of 9.6 percentage points.

Note that the sample in which we find land reform induced changes in the sex ratio of births and the sex ratio of infant deaths (Hindus with first-born girls) is the sample in which we find no fertility reduction. This suggests that fertility decline did not contribute to the documented changes in boy and girl mortality. To *summarize*, land reform appears to increase both sex selection and postnatal discrimination in favour of male children in Hindu families with first-born daughters, while having no impact on fertility in this sub-sample. However, among Hindu families with first-sons and non-Hindus, land reform leads to fewer (third) births.

6.5 Results for gender of surviving births and village-level tenancy registration

We now move to analysis of the purposively conducted survey of households in West Bengal villages. See Table 9. As discussed, the dependent variable measures the likelihood of observing surviving children of either gender. We present estimates with and without conditioning upon average farm-level rice productivity in the village in the year prior to the child's birth (results are similar if we take a three-year average). This controls for increased incomes following tenancy reform and productivity increases flowing from other programmes such as minikit distribution. These data are only available for years 1982-95, which reduces the sample substantially, but the results are robust to the added control and the smaller sample. The controls consistently include household fixed effects (which encompass village fixed effects), year fixed effects, indicators for immigrant status, total land owned, an indicator of whether land owned in 1977 was above the ceiling set by the state for redistribution, the share of village cultivable land re-distributed under the contemporaneous *patta* programme and, in separate specifications, also rice productivity at the farm level.

Overall, we see that a 10% increase in registration results in a significant decline of 0.08 to 0.12 percentage points in the likelihood of observing a surviving girl, alongside a 0.06 to 0.11 percentage point increase in the chances of observing a surviving boy. Productivity increases, in this sample, act in the same direction as tenancy reform, worsening prospects for girls and improving them for boys. This makes it important to check whether controlling for productivity substantially depresses the coefficient on land registration which, in general, it does not.

An advantage of these data is that they contain agricultural land holdings at the household level. We control for total land holdings, as they evolve with time. In addition, we use pre-reform household-level landholdings (in the year 1977) to split the sample into households with no land vs some land prior to reform. This is potentially instructive because landless households benefited more from tenancy reform. Consistent with this, we see that the impacts of registration on survival emerge mostly from landless households. Moreover, consistent with the preceding analysis of NFHS data, we find the widening of gender gaps in survival is primarily in households with a first-born daughter. Specifically, we see a large increase of 0.26 to 0.54 percentage points (following a 10% increase in village area registered) in the chances of observing surviving boys, and no change at all in the chances of observing surviving girls in landless households, consistent with boys gaining from tenancy reform, as documented using the NFHS data (Table 9).[33]

Once we include interactions of registration with an indicator for the sex of the oldest child in the household, the pattern is clearer (Appendix Table A.10). Exactly as we saw earlier with the other data, it is only in families with a first-born daughter that there is a deterioration of survival chances of girls.

Households that owned some land prior to reform are a mixed group, some may have lost by transferring title to their tenants, while smaller land-owners that also leased in land may have benefited, making it hard to offer firm predictions for this sample. We see smaller overall gains in child survival from land reform in this (otherwise richer) group than in the landless group. Indeed, conditional upon productivity, we see a deterioration in survival; a 10% increase in registration is associated with a 0.05 (0.16) percentage point decline in the survival chances of boys (girls). The distribution of survival chances still favours boys but the differences are smaller.

[33] The results in Table 9 are sensitive to the existence of one outlier village with an unusually high registration rate. Alternative ways of treating this village, such as trimming registration rates, assuming registration for this village was reported in a unit of measure different from acres, or dropping all observations from the village, leaves our main result (namely a gap in the survival rate of boys and girls, particularly among landless households) unaffected in the main specification. However, when we control for productivity, the estimates are sensitive to inclusion of this village (estimates available on request).

Tables 10 and 11 explore heterogeneity of effects by religion, classifying the sample as Hindu and non-Hindu households using the name of the household head.[34] The results show that the findings in Table 9 are driven entirely by Hindu households, similar to the findings in the NFHS data. Among Hindus, there is a positive and significant effect on male surviving births, a 10% increase in registered land associated with a 0.25 percentage point and 0.07 percentage point decrease in landless and landed Hindu households respectively. The landless show a stronger response consistent with our predictions. The negative effect of land registration on surviving Hindu girls of 0.11 percentage points emerges from land-owning households. In non-Hindu households, the coefficient estimates indicate large (but imprecisely) estimated increases in survival probability for both sons and daughters, again consistent with what we find in the NFHS data.

In Tables 12 and 13 we examine estimates by household immigrant status, restricting now to the Hindu sample where we consistently find effects of registration. The largest marginal effects are seen among landless immigrant households, the group that benefited most from tenancy reform. In this sample, a 10% increase in village land registered is associated with a 0.38 percentage point increase in boy survival chances alongside no change (the coefficient is zero) in girl survival chances. Among natives to the area, the only significant responses are among land-owners. In this group, there is a 0.06 percentage point increase in boy survival and a 0.11 percentage point deterioration in girl survival. So, in both groups, tenancy reform widened the girl-boy survival gap, and the largest absolute changes in survival occurred among immigrants who were landless pre-reform.

6.6 Mechanisms

Using two entirely independent sources of data, we have documented compelling evidence that in Hindu households and in particular those that had not had a son at first birth, tenancy reform encouraged a systematic tendency to favour sons over daughters, resulting in more male-biased sex ratios by the age of one year. We think the most likely interpretation of this behaviour is that it was driven by male-biased inheritance rights.

As discussed in the Introduction, Almond, et al. (2013b) is the only related study we know, looking at the impact of changes in land rights on son preference in China, but a crucial difference is that the Chinese land rights were gender-neutral and not transferable across generations.

[34] Since controlling for rice productivity shrinks the sample a lot, we do not report the results from specifications including average farm rice productivity in further results from the village data. These specifications show qualitatively identical results, and are available upon request.

Almond, et al. argue that land reform increased income and this raised the demand for sons and hence the sex ratio of surviving births.

Income is an important potential omitted variable in our analysis. Previous work has documented that, at the same time as land reform was implemented in West Bengal, there were other programmes that increased productivity and that, in addition, land reform led to increased productivity (Bardhan & Mookherjee, 2011; Banerjee, et al., 2002). We therefore condition on productivity. Since it is endogenous, we report results with and without it. In general, we find that the coefficient on tenancy registration is not significantly different (and that the point estimate is often larger) upon controlling for productivity.[35]

Two further pieces of evidence suggest that our findings are not driven by income effects of land reform. First, we find that land reform has opposite effects in families with first-sons *vs* first-daughters. In particular, if as in the China study, income raised the demand for sons because they are normal goods, we would not expect to see contrasting effects by sex of first birth. In other words, income effects cannot explain our finding that girls benefit from land reform in first-son families much more than in first-daughter families, but male-biased inheritance can. Second, Almond, et al. (2013b) find a small positive effect of land reform on fertility (after controlling for the negative effects of the One Child Policy), which is consistent with income effects being a dominant mechanism in China because income tends to raise fertility in low-income settings (Currie & Schwandt, 2014; Vogl, 2013; Bhalotra & Rocha, 2013). In contrast, we find a negative effect of land reform on fertility. In the non-Hindu sample where the sex ratio of births appears not to be manipulated by parents, we find across-the-board reductions in fertility after land reform. In the Hindu sample, fertility reduction is restricted to families that have a first-son, consistent with the first-daughter families continuing fertility to achieve a son.

An alternative explanation of land reform strengthening the desire to have sons is that it raises the returns to labour, and males are more likely to be employed as farm labour. Using detailed farm-level data gathered alongside the West Bengal village survey data, we estimated whether the ratio of male to female labour was modified by land reform and find no evidence that it was (see Table A.13). We cannot conclusively rule out that the greater share of males among farm labour at *baseline* drives some of the identified effects of land reform on son preference. In any case, this links in ultimately with our preferred explanation, elucidated in the Introduction, in which the labour supply of sons on family farms and their inheritance rights are closely tied. In particular,

[35] Moreover, the coefficients on district-level productivity and its interaction with gender indicate no significant gender difference in effects in the NFHS sample (except for non-Hindus, where girls benefit more), although the coefficients on farm-level productivity suggest a favour for boys in the village survey sample.

patrilocality involves married sons co-residing with or living very close to their parents, while married daughters marry some distance away from the natal home, so that it is primarily sons who work on family land and subsequently inherit it.

In their discussion of alternative interpretations of their findings for China, Almond, et al. (2013b) observe that land reform in China destroyed the financial basis of the "state pension system," forcing parents to rely on sons instead of the collective or state for old age support, and that the rural medical system also ended after Mao. In India, parents have always relied upon sons, but the reform providing tenants with rights to land that were heritable (by sons) will have strengthened this reliance. However, in contrast to the case of China, land reform in West Bengal coincided with an expansion of public services including public health, rural credit and other agricultural subsidies.

7. Conclusions

We find that increased property rights security exacerbates gender discrimination in Hindu families, with parents manipulating sex ratios at birth and after birth until the age of one, so as to have at least one son. Land reform is also associated with greater son-biased fertility-stopping, leading to the sibship size difference between first-son and first-daughter families widening. There is evidence from other settings that land reform alters existing gender-unequal institutions in favour of women, for instance, tenure regularisation is argued to have significantly improve women's tenurial and inheritance claims to land in Rwanda (Ali, et al., 2014), and joint spousal titling increased women's intra-household bargaining power in Peru (Wiig, 2013). Male-biased inheritance law in India appears to have thwarted its success in reducing poverty and improving child survival by skewing gains in favour of one half of the population.

Our results illustrate the importance in principle of ensuring that women benefit directly from the formalisation of property rights. However, in practice, evidence of the effectiveness of equalization of inheritance rights for women is ambiguous. Most worrying, is evidence that the equalization of inheritance rights for women in India led to increased female foeticide, suggesting that when faced with the prospect of being legally obliged to give daughters an equal share of ancestral property, parents seem to want all the more to eliminate daughters (Bhalotra, et al., 2015).[36] It seems, overall, that it may be difficult to engender compliance with legal reform unless

[36] For girls that had already survived to school-age, Deininger, et al. (2013) and Roy (2015) find that the equalization of property rights increased investment in girls' education. Looking not at parental investments in children but rather at the impact of inheritance rights on married adults, Anderson and Genicot (2015) find increased suicides of men and women and especially men, indicating that the inheritance reform stimulated intra-household conflict.

the passage of reform reflects changes in social preferences (Doepke & Zilibotti, 2005; also see Aldashev, et al., 2011).

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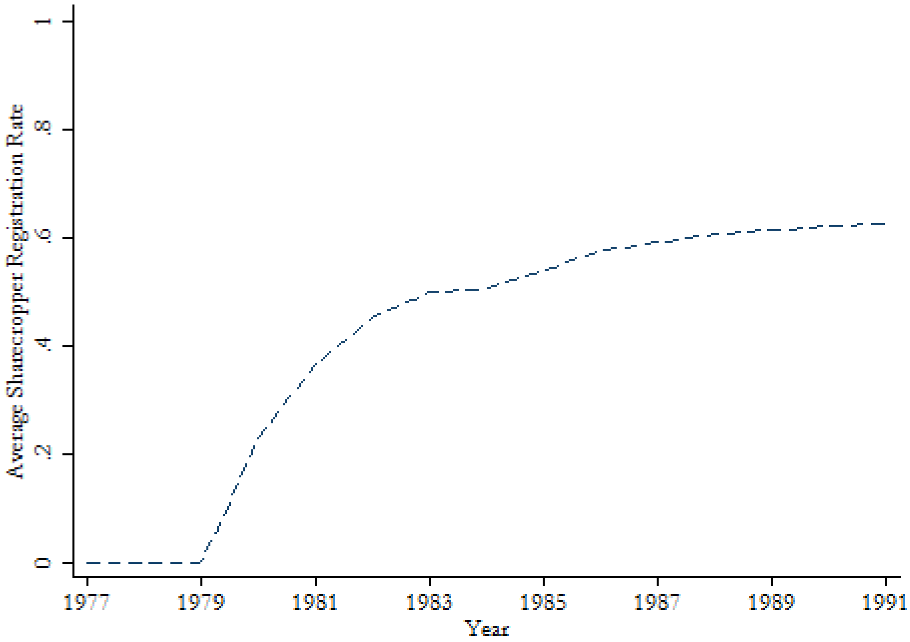
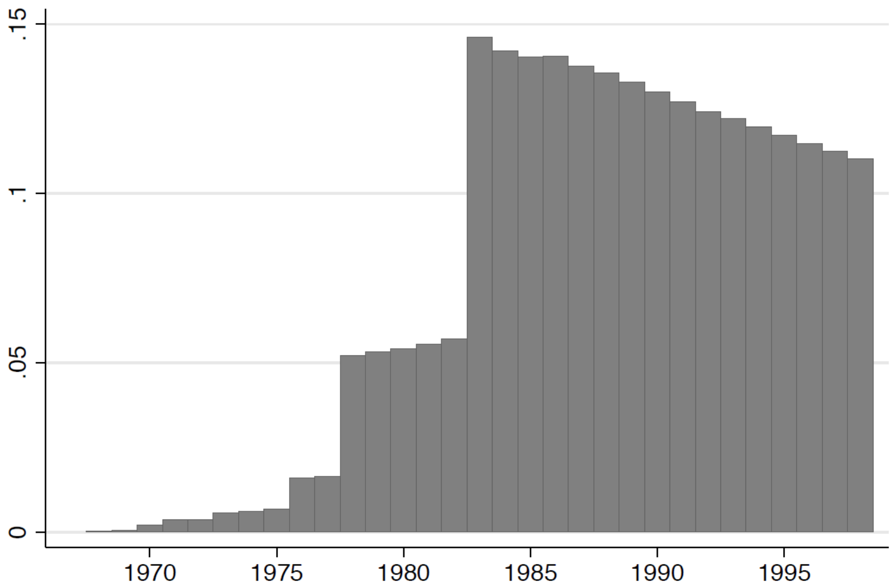
Figure 1: Cumulative Share of Tenants Registered by Year



Notes: The figure shows the average rate of completed sharecropper registration across the 14 West Bengal districts in the Banerjee at al. (2002) data during 1975-1991.

Figure 2: Cumulative Share of Village Land Registered by Year



Notes: The figure shows the average percent of village cultivable land registered across the 89 villages from the household panel data survey during the years 1967-1998. The percent of cultivable land registered declines after 1985 as registration slowed during this period, while the amount of cultivable land increased on average.

Table 1: NFHS and District Summary Statistics

	Freq.	*Mean*	*S.D.*	*Min.*	*Max.*
	(1)	(2)	(3)	(4)	(5)
Panel A	*Mother Characteristics: 1967-1993*				
Years of Education	6,443	3.416	4.297	0	18
Age at Birth	6,468	19.034	3.532	5	40
Total Births	6,468	3.386	2.010	1	11
Hindu	6,468	0.750	-	0	1
Rural	6,468	0.680	-	0	1
Panel B	*Child Outcomes: 1967-1993*				
Infant Death	20,148	0.094	-	0	1
Neonatal Death	20,148	0.064	-	0	1
Male Child	20,148	0.511	-	0	1
Has Younger Sibling	20,148	0.718	-	0	1
Panel C	*District Productivity and Programmes: 1977-1990*				
Rice Productivity	196	1.473	0.434	0.720	2.595
Patta Area Per Capita	196	6.518	4.937	0.321	17.986
Surfaced Roads Per Capita	196	0.208	0.067	0.115	0.392
Medical Institutions Per Capita	196	0.056	0.016	0.033	0.115

Notes: Panel A shows mother characteristics, and Panel B shows child outcomes for cohorts born during 1967-1993. Panel C shows productivity and programme statistics in the 14 districts with sharecropper registration data for years 1977-1990, which are the years for which they enter as controls in the regressions. Neonatal death takes value 1 if the child dies aged 0-1 months, and infant death takes value 1 if the child dies aged 0-12 months.

Table 2: Village Data Summary Statistics

	Freq.	*Mean*	*S.D.*	*Min.*	*Max.*
	(1)	(2)	(3)	(4)	(5)
Panel A	*Household Characteristics: 1978-1999*				
Hindu	2,334	0.797	-	0	1
Immigrant	2,334	0.258	-	0	1
Landless in 1977	2,334	0.511	-	0	1
Household size	2,334	5.157	2.098	1	22
Boys	2,334	1.051	1.051	0	7
Girls	2,334	0.937	1.025	0	7
Panel B	*Household-Year Characteristics: 1978-1999*				
Boy birth and survival	46,167	0.053	-	0	1
Girl birth and survival	46,167	0.047	-	0	1
Agricultural Land (acres)	46,167	1.824	3.414	0	83.32
Panel C	*Village-Year Characteristics: 1978-1999*				
Proportion Land Registered (last 3 years)	1,958	0.021	0.279	0	6.623
Proportion Land Distributed (last 3 years)	1,958	0.011	0.074	0	1.814
Log(farm productivity)	306	6.94	0.448	5.165	8.284

Notes: Panel A shows household characteristics, and Panel B shows household-year characteristics for years 1978-1999. Panel C shows village-year characteristics for the same years. Boys and Girls in Panel A are the numbers of both who survive until the survey date.

Table 3 – District Sharecropper Registration Rates by Year

	1980	*1982*	*1984*	*1986*	*1988*	*1990*	*1992*
Kochibihar	19.96	39.42	42.34	50.54	54.65	57.46	58.31
Jalpaiguri	18.44	30.88	32.30	34.95	40.25	40.25	40.25
Darjeeling	14.49	23.40	24.52	28.22	28.84	28.84	28.84
West Dinajpur	34.88	66.41	70.77	73.86	75.63	76.74	76.77
Maldah	44.15	60.93	69.75	74.40	76.57	78.32	79.24
Murshidabad	15.82	43.01	44.69	53.09	56.80	58.89	60.79
Nadia	22.99	37.20	42.79	49.52	52.74	53.35	55.71
24-Parganas	15.22	38.54	42.84	47.67	49.51	49.84	54.05
Howrah	31.05	44.56	48.67	54.63	56.12	57.32	58.22
Hooghly	25.50	40.94	46.26	55.11	58.60	61.62	63.45
Midnapur	16.79	44.89	55.70	61.09	62.84	63.64	63.82
Bankura	29.69	68.67	74.48	84.46	89.66	92.56	93.83
Burdwan	11.00	35.64	39.45	45.74	49.60	51.42	53.31
Birbhum	25.01	59.26	72.49	91.37	95.67	98.30	100.00
Mean	23.21	45.27	50.50	57.48	60.53	62.04	63.33

Notes: The table shows district sharecropper registration rates by year as reported in Banerjee et. al. (2002).

Table 4 – Test of Targeted Registration: Infant Mortality

	Infant Death								
	All Children			Hindu Children			Non-Hindu Children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
*treated * trend*	-0.002	-0.005	-0.001	-0.000	-0.004	-0.002	-0.009	-0.011	-0.004
	(0.005)	(0.007)	(0.008)	(0.004)	(0.008)	(0.009)	(0.009)	(0.012)	(0.012)
*treated * trend * female*	-	0.007	0.006	-	0.008	0.008	-	0.006	0.001
		(0.008)	(0.008)		(0.009)	(0.011)		(0.009)	(0.009)
*treated * trend * firstson * female*	-	-	0.003	-	-	0.001	-	-	0.007
			(0.006)			(0.006)			(0.007)
District FE	x	x	x	x	x	x	x	x	x
Observations	3,389	3,389	3,389	2,428	2,428	2,428	961	961	961
Cohorts	1958-77	1958-77	1958-77	1958-77	1958-77	1958-77	1958-77	1958-77	1958-77
Districts	14	14	14	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. Samples include children of birth order 2 or higher. All specifications also include the female child and first-born son indicators and their three-way and two-way interactions with the trend and treatment indicator, 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. *** p<0.01, ** p<0.05, * p<0.1

Table 5 – Test of Targeted Registration: Male Births and Fertility

	All Children		Hindu Children		Non-Hindu Children	
	Male Child	Younger Sibling	Male Child	Younger Sibling	Male Child	Younger Sibling
	(1)	(2)	(3)	(4)	(5)	(6)
*treated * trend*	0.001	0.001	0.001	0.001	0.002	0.002
	(0.004)	(0.004)	(0.005)	(0.005)	(0.008)	(0.004)
*treated * trend * firstson*	-	-0.009	-	-0.012	-	0.003
		(0.007)		(0.008)		(0.008)
District FE	x	x	x	x	x	x
Observations	3,389	1,369	2,428	1,015	961	961
Cohorts	1958-77	1958-77	1958-77	1958-77	1958-77	1958-77
Districts	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. Samples for the sex ratio regressions include children of birth order 2 or higher, and of birth order 2 for the fertility regressions. The specifications for the probability of having a younger sibling also include the first-born son indicator and its interaction with the trend and treatment indicator, 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. *** p<0.01, ** p<0.05, * p<0.1

Table 6 – Infant Mortality

	Infant Death								
	All Children			Hindu Children			Non-Hindu Children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$R50_{t-1}$ * *firstson* * *female*	-0.060*	-0.075*	-0.073*	-0.074**	-0.097**	-0.097**	-0.033	-0.029	-0.028
	(0.029)	(0.039)	(0.039)	(0.032)	(0.046)	(0.048)	(0.048)	(0.054)	(0.055)
$R25_{t-1}$ * *firstson* * *female*	0.033	0.030	0.031	0.021	0.017	0.019	0.062	0.063	0.046
	(0.033)	(0.038)	(0.038)	(0.05)	(0.051)	(0.051)	(0.041)	(0.045)	(0.044)
$R50_{t-1}$ * *female*	0.051***	0.046**	0.046**	0.063***	0.069**	0.070**	0.028	-0.001	-0.001
	(0.02)	(0.022)	(0.023)	(0.023)	(0.03)	(0.029)	(0.039)	(0.046)	(0.046)
$R25_{t-1}$ * *female*	-0.025	-0.029	-0.029	-0.024	-0.025	-0.027	-0.039	-0.046	-0.036
	(0.03)	(0.032)	(0.032)	(0.033)	(0.034)	(0.033)	(0.045)	(0.046)	(0.048)
$R50_{t-1}$ * *firstson*	0.028	0.040	0.039	0.015	0.043	0.043	0.046*	0.029	0.029
	(0.023)	(0.029)	(0.028)	(0.028)	(0.031)	(0.032)	(0.026)	(0.031)	(0.031)
$R25_{t-1}$ * *firstson*	-0.037	-0.035	-0.034	-0.041	-0.034	-0.035	-0.027	-0.031	-0.016
	(0.023)	(0.024)	(0.023)	(0.036)	(0.035)	(0.036)	(0.029)	(0.034)	(0.03)
$R50_{t-1}$	-0.050***	-0.050***	-0.063***	-0.040*	-0.052*	-0.059**	-0.072**	-0.046	-0.078**
	(0.02)	(0.021)	(0.023)	(0.021)	(0.025)	(0.026)	(0.035)	(0.029)	(0.035)
$R25_{t-1}$	0.019	0.012	0.001	0.006	0.000	-0.003	0.051	0.035	-0.005
	(0.023)	(0.021)	(0.020)	(0.03)	(0.029)	(0.031)	(0.030)	(0.036)	(0.039)
firstson * *female*	-0.019	-0.025	-0.022	-0.062	-0.104	-0.022	0.045	0.087	0.079
	(0.13)	(0.143)	(0.140)	(0.163)	(0.178)	(0.140)	(0.222)	(0.236)	(0.232)
female	0.192	0.163	0.164	0.181	0.170	0.164	0.209	0.178	0.179
	(0.152)	(0.132)	(0.126)	(0.147)	(0.134)	(0.126)	(0.247)	(0.259)	(0.256)
firstson	0.024	0.038	0.032	0.011	0.070	0.032	0.016	-0.026	-0.024
	(0.114)	(0.132)	(0.134)	(0.17)	(0.198)	(0.134)	(0.127)	(0.148)	(0.142)
District FE	x	x	x	x	x	x	x	x	x
District Rice Productivity		x	x		x	x		x	x
District-Year Trend			x			x			x
Observations	8,367	8,367	8,367	5,448	5,448	5,448	2,919	2,919	2,919
Pre-Reform *y* Mean	0.098	0.098	0.098	0.107	0.107	0.107	0.074	0.074	0.074
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: NFHS data. *y* refers to the dependent variable. Wild cluster bootstrapped standard errors in parentheses. Samples include children of birth order 2 or higher. All specifications also include birth year fixed effects, birth order fixed effects, year of interview 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. District covariates include logs of *patta* land area distributed, number of medical institutions, and kilometres of surfaced road per capita and their interactions with the female child and the first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table 7 – Sex Ratio at Birth

	Child is Male								
	All Children			Hindu Children			Non-Hindu Children		
	B. Ord. 1	*B. Ord. >1*	*B. Ord. >1*	*B. Ord. 1*	*B. Ord. >1*	*B. Ord. >1*	*B. Ord. 1*	*B. Ord. >1*	*B. Ord. >1*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$R50_{t-1}$ * *firstson*	-	-	-0.011	-	-	-0.014	-	-	0.004
			(0.020)			(0.019)			(0.047)
$R25_{t-1}$ * *firstson*	-	-	-0.005	-	-	0.005	-	-	-0.033
			(0.027)			(0.031)			(0.062)
$R50_{t-1}$	-0.020	0.039*	0.045*	-0.065	0.048**	0.055**	0.091	0.042	0.039
	(0.037)	(0.022)	(0.025)	(0.050)	(0.024)	(0.029)	(0.064)	(0.035)	(0.041)
$R25_{t-1}$	-0.010	0.048	0.051	0.063	0.031	0.030	-0.149	0.096	0.111
	(0.034)	(0.047)	(0.058)	(0.053)	(0.050)	(0.054)	(0.098)	(0.077)	(0.095)
firstson	-	-0.007	0.094	-	-0.008	0.186	-	-0.007	-0.005
		(0.009)	(0.096)		(0.010)	(0.113)		(0.017)	(0.262)
District FE	x	x	x	x	x	x	x	x	x
District Covariates	x	x	x	x	x	x	x	x	x
District-Year Trend	x	x	x	x	x	x	x	x	x
Observations	3,248	8,367	8,367	2,323	5,448	5,448	925	2,919	2,919
Pre-Reform *y* Mean	0.449	0.494	0.494	0.433	0.493	0.493	0.488	0.498	0.498
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: NFHS data. B.Ord refers to birth order. Wild cluster bootstrapped standard errors in parentheses. All specifications also include birth year fixed effects, birth order fixed effects, year of interview 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 rice yield, *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 first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table 8 – Son-Biased Fertility Stopping

	Child Has a Younger Sibling								
	All Children			Hindu Children			Non-Hindu Children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$R50_{t-1}$ * *firstson*	-0.007	0.009	0.012	-0.011	0.003	0.008	0.011	0.020	0.019
	(0.045)	(0.044)	(0.044)	(0.050)	(0.052)	(0.051)	(0.053)	(0.049)	(0.050)
$R25_{t-1}$ * *firstson*	-0.118***	-0.114**	-0.116**	-0.106**	-0.104**	-0.108**	-0.179***	-0.179***	-0.182**
	(0.053)	(0.053)	(0.055)	(0.051)	(0.049)	(0.052)	(0.078)	(0.082)	(0.086)
$R50_{t-1}$	-0.037	-0.048*	-0.048	-0.024	-0.035	-0.038	-0.079*	-0.087**	-0.096*
	(0.029)	(0.028)	(0.032)	(0.033)	(0.034)	(0.039)	(0.04)	(0.037)	(0.051)
$R25_{t-1}$	0.022	-0.001	-0.020	0.016	-0.008	-0.058	0.010	0.000	0.036
	(0.041)	(0.042)	(0.056)	(0.058)	(0.062)	(0.079)	(0.063)	(0.06)	(0.083)
firstson	-0.315	-0.223	-0.201	-0.436	-0.343	-0.347	0.108	0.150	0.205
	(0.209)	(0.192)	(0.193)	(0.258)	(0.251)	(0.251)	(0.133)	(0.119)	(0.138)
District FE	x	x	x	x	x	x	x	x	x
District Rice Productivity		x	x		x	x		x	x
District-Year Trend			x			x			x
Observations	2,686	2,686	2,686	1,919	1,919	1,919	767	767	767
Pre-Reform *y* Mean	0.839	0.839	0.839	0.808	0.808	0.808	0.952	0.952	0.952
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: NFHS data. Wild cluster bootstrapped standard errors in parentheses. The sample in every column is children of birth order 2 only. All specifications also include birth year fixed effects, year of interview 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 *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 first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Gender Differentiated Surviving Births

Dep. Variable:	1=surviving girl, 0=no birth or surviving boy						1=surviving boy, 0=no birth or surviving girl					
Land category:	*All*		*Landless*		*Some land*		*All*		*Landless*		*Some land*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Agricultural land	-0.001	-0.001	-	-	-0.001*	-0.001	-0.000	0.003	-	-	-0.000	0.003
	(0.001)	(0.005)			(0.001)	(0.005)	(0.001)	(0.004)			(0.001)	(0.004)
% Land registered	-0.008***	-0.012***	0.000	0.001	-0.011***	-0.016***	0.011***	0.006***	0.026***	0.054***	0.007***	-0.005*
	(0.001)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.009)	(0.002)	(0.001)	(0.003)
Farm Productivity	-	-0.023**	-	-0.002	-	-0.044***	-	0.024*	-	0.029*	-	0.023
		(0.011)		(0.016)		(0.016)		(0.012)		(0.016)		(0.015)
Household FE	x	x	x	x	x	x	x	x	x	x	x	x
Observations	44,590	7,869	19,548	3,627	25,042	4,242	44,590	7,869	19,548	3,627	25,042	4,242
Households	2,286	1,928	1,144	892	1,142	1,036	2,286	1,928	1,144	892	1,142	1,036
Years	1978-99	1982-95	1978-99	1982-95	1978-99	1982-95	1978-99	1982-95	1978-99	1982-95	1978-99	1982-95

Notes: Primary survey data. Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include land ceiling and immigrant status indicators, and year and household fixed effects, and % land distributed calculated the same way as % land registered. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. *** p<0.01, ** p<0.05, * p<0.1

Table 10: Surviving Male Births by Religion

Dep. Variable:	1=surviving boy, 0=no birth or surviving girl					
Religion:	Hindu			Non-Hindu		
Land category:	*All*	*Landless*	*Some land*	*All*	*Landless*	*Some land*
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural land	0.001	-	0.001	-0.006	-	-0.005
	(0.001)		(0.001)	(0.004)		(0.004)
% Land registered	0.010***	0.025***	0.007***	0.223	0.317	0.152
	(0.002)	(0.007)	(0.001)	(0.145)	(0.385)	(0.212)
Household FE	x	x	x	x	x	x
Observations	35,018	15,549	19,469	9,572	3,999	5,573
Households	1,822	934	888	464	210	254
Years	1978-99	1978-99	1978-99	1978-99	1978-99	1978-99

Notes: Primary survey data. Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include a land ceiling indicator, land ceiling and immigrant status indicators, and year and household fixed effects, and % land distributed calculated the same way as % land registered. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. Religion of the household is the religion of the household head. *** p<0.01, ** p<0.05, * p<0.1

Table 11: Surviving Female Births by Religion

Dep. Variable:	1=surviving girl, 0=no birth or surviving boy					
Religion:	Hindu			Non-Hindu		
Land category:	*All*	*Landless*	*Some land*	*All*	*Landless*	*Some land*
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural land	-0.000	-	-0.000	-0.005***	-	-0.005***
	(0.001)		(0.001)	(0.002)		(0.002)
% Land registered	-0.009***	-0.001	-0.011***	0.179	0.116	0.222
	(0.001)	(0.003)	(0.001)	(0.187)	(0.266)	(0.183)
Household FE	x	x	x	x	x	x
Observations	35,018	15,549	19,469	9,572	3,999	5,573
Households	1,822	934	888	464	210	254
Years	1978-99	1978-99	1978-99	1978-99	1978-99	1978-99

Notes: Primary survey data. Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include a land ceiling indicator, land ceiling and immigrant status indicators, and year and household fixed effects, and % land distributed calculated the same way as % land registered. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. Religion of the household is the religion of the household head. *** p<0.01, ** p<0.05, * p<0.1

Table 12: Surviving Hindu Male Births by Immigrant Status

Dep. Variable:	1=surviving boy, 0=no birth or surviving girl					
Native/Immigrant:	Native			Immigrant		
Land category:	*All*	*Landless*	*Some land*	*All*	*Landless*	*Some land*
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural land	0.001	-	0.001	-0.012	-	-0.005
	(0.001)		(0.001)	(0.010)		(0.009)
% Land registered	0.008***	0.011	0.006***	0.039***	0.038***	0.564
	(0.002)	(0.013)	(0.001)	(0.005)	(0.003)	(0.481)
Household FE	x	x	x	x	x	x
Observations	29,099	10,471	18,628	5,919	5,078	841
Households	1,340	491	849	482	443	39
Years	1978-99	1978-99	1978-99	1978-99	1978-99	1978-99

Notes: Primary survey data. Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include a land ceiling indicator, year of immigration controls, and year and household fixed effects, and % land distributed calculated the same way as % land registered. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. Religion of the household is the religion of the household head. *** p<0.01, ** p<0.05, * p<0.1

Table 13: Surviving Hindu Female Births by Immigrant Status

Dep. Variable:	1=surviving girl, 0=no birth or surviving boy					
Native/Immigrant:	Native			Immigrant		
Land category:	*All*	*Landless*	*Some land*	*All*	*Landless*	*Some land*
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural land	0.000	-	-0.000	-0.014	-	-0.004
	(0.001)		(0.001)	(0.009)		(0.008)
% Land registered	-0.010***	-0.003	-0.011***	0.001	-0.000	-0.103
	(0.001)	(0.006)	(0.001)	(0.003)	(0.003)	(0.465)
Household FE	x	x	x	x	x	x
Observations	29,099	10,471	18,628	5,919	5,078	841
Households	1,340	491	849	482	443	39
Years	1978-99	1978-99	1978-99	1978-99	1978-99	1978-99

Notes: Primary survey data. Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include a land ceiling indicator, year of immigration controls, and year and household fixed effects, and % land distributed calculated the same way as % land registered. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. Religion of the household is the religion of the household head. *** p<0.01, ** p<0.05, * p<0.1

Appendix A: Additional Tables

Table A.1: Infant Mortality of First Borns and Probability of Second Birth

	All Children		Hindu Children		Non-Hindu Children	
	Infant Death	*Younger Sibling*	*Infant Death*	*Younger Sibling*	*Infant Death*	*Younger Sibling*
	(1)	(2)	(3)	(4)	(5)	(6)
$R50_{t-1} * female$	0.014	0.007	0.011	0.026	0.025	-0.025
	(0.025)	(0.021)	(0.026)	(0.032)	(0.042)	(0.044)
$R25_{t-1} * female$	-0.041	-0.005	-0.029	-0.003	-0.052	-0.022
	(0.031)	(0.017)	(0.037)	(0.026)	(0.062)	(0.039)
$R50_{t-1}$	0.000	-0.015	0.017	-0.039	-0.033	0.038
	(0.025)	(0.030)	(0.028)	(0.034)	(0.043)	(0.04)
$R25_{t-1}$	0.016	0.008	0.053	0.025	-0.057	-0.032
	(0.048)	(0.037)	(0.053)	(0.052)	(0.055)	(0.027)
female	-0.044	-0.245	-0.117	-0.286	0.169	-0.093
	(0.12)	(0.181)	(0.17)	(0.268)	(0.288)	(0.156)
District FE	x	x	x	x	x	x
District Covariates	x	x	x	x	x	x
District-Year Trend	x	x	x	x	x	x
Observations	3,248	3,248	2,323	2,323	925	925
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. Specifications also include birth year fixed effects, year of interview 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 first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table A.2: Infant Mortality: Including Bihar Control Districts

	Infant Death								
	All Children			Hindu Children			Non-Hindu Children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
*R50 $_{t-1}$ * firstson * female*	-0.058*	-0.067*	-0.067*	-0.077**	-0.090**	-0.089**	-0.023	-0.027	-0.030
	(0.029)	(0.033)	(0.033)	(0.033)	(0.040)	(0.038)	(0.045)	(0.048)	(0.048)
*R25 $_{t-1}$ * firstson * female*	0.020	0.007	0.008	0.010	-0.009	-0.007	0.044	0.048	0.040
	(0.030)	(0.035)	(0.036)	(0.039)	(0.046)	(0.046)	(0.042)	(0.05)	(0.05)
*R50 $_{t-1}$ * female*	0.051**	0.051**	0.051**	0.066**	0.071**	0.071**	0.024	0.017	0.017
	(0.024)	(0.025)	(0.023)	(0.029)	(0.031)	(0.031)	(0.032)	(0.035)	(0.036)
*R25 $_{t-1}$ * female*	-0.006	-0.009	-0.010	-0.002	0.000	-0.001	-0.030	-0.044	-0.041
	(0.023)	(0.028)	(0.029)	(0.026)	(0.029)	(0.029)	(0.033)	(0.046)	(0.047)
*R50 $_{t-1}$ * firstson*	0.027	0.031	0.031	0.020	0.030	0.030	0.041	0.035	0.035
	(0.019)	(0.023)	(0.022)	(0.024)	(0.028)	(0.028)	(0.025)	(0.03)	(0.03)
*R25 $_{t-1}$ * firstson*	-0.024	-0.019	-0.017	-0.029	-0.012	-0.013	-0.005	-0.020	-0.010
	(0.024)	(0.025)	(0.026)	(0.034)	(0.033)	(0.033)	(0.028)	(0.034)	(0.032)
R50 $_{t-1}$	-0.043**	-0.042**	-0.061***	-0.035	-0.040*	-0.054**	-0.068**	-0.055	-0.082**
	(0.021)	(0.021)	(0.023)	(0.022)	(0.022)	(0.025)	(0.036)	(0.034)	(0.038)
R25 $_{t-1}$	0.015	0.016	-0.009	-0.001	-0.004	-0.016	0.051	0.051	-0.003
	(0.02)	(0.021)	(0.022)	(0.027)	(0.025)	(0.03)	(0.033)	(0.034)	(0.037)
*firstson * female*	-0.003	-0.004	-0.003	0.019	0.016	0.016	-0.052	-0.049	-0.044
	(0.029)	(0.028)	(0.029)	(0.033)	(0.033)	(0.033)	(0.034)	(0.034)	(0.035)
female	-0.023	-0.023	-0.023	-0.048*	-0.047*	-0.043	0.042	0.037	0.030
	(0.025)	(0.023)	(0.024)	(0.026)	(0.027)	(0.026)	(0.038)	(0.035)	(0.038)
firstson	0.014	0.014	0.012	0.010	0.013	0.012	0.006	0.002	-0.006
	(0.023)	(0.024)	(0.023)	(0.03)	(0.031)	(0.031)	(0.026)	(0.027)	(0.029)
District FE	x	x	x	x	x	x	x	x	x
District Rice Productivity		x	x		x	x		x	x
District-Year Trend			x			x			x
Observations	9,355	9,355	9,355	6,236	6,236	6,236	3,119	3,119	3,119
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	19	19	19	19	19	19	19	19	19

Notes: Wild cluster bootstrapped standard errors in parentheses. Samples include children of birth order 2 or higher. All specifications also include birth year fixed effects, birth order fixed effects, year of interview 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. Specifications also include the district productivity controls and their corresponding interaction terms with the first-born son and female child indicators. *** p<0.01, ** p<0.05, * p<0.1

Table A.3: Fertility: Including Bihar Control Districts

	Child Has a Younger Sibling								
	All Children			Hindu Children			Non-Hindu Children		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
*$R50_{t-1}$ * firstson*	0.001	-0.001	-0.001	0.001	0.000	0.004	0.004	-0.010	-0.015
	(0.044)	(0.044)	(0.043)	(0.049)	(0.052)	(0.051)	(0.053)	(0.046)	(0.046)
*$R25_{t-1}$ * firstson*	-0.094***	-0.096**	-0.099**	-0.085**	-0.083*	-0.091**	-0.158**	-0.183**	-0.176**
	(0.036)	(0.044)	(0.045)	(0.037)	(0.043)	(0.044)	(0.065)	(0.077)	(0.078)
$R50_{t-1}$	-0.036	-0.034	-0.040	-0.018	-0.017	-0.033	-0.085*	-0.078*	-0.070
	(0.027)	(0.026)	(0.031)	(0.032)	(0.033)	(0.039)	(0.049)	(0.044)	(0.043)
$R25_{t-1}$	0.027	0.015	-0.019	0.032	0.019	-0.048	0.011	0.003	0.044
	(0.032)	(0.038)	(0.053)	(0.045)	(0.052)	(0.076)	(0.042)	(0.037)	(0.065)
firstson	-0.008	-0.008	-0.003	-0.029	-0.029	-0.023	0.081**	0.076*	0.065
	(0.022)	(0.021)	(0.02)	(0.026)	(0.025)	(0.022)	(0.039)	(0.042)	(0.047)
District FE	x	x	x	x	x	x	x	x	x
District Rice Productivity		x	x		x	x		x	x
District-Year Trend			x			x			x
Observations	2,935	2,935	2,935	2,126	2,126	2,126	809	809	809
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 standard errors in parentheses. The sample in each specification is children of birth order 2. All specifications also include birth year fixed effects, year of interview 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. Specifications also include the district productivity controls and their corresponding interaction terms with the first-born son.*** p<0.01, ** p<0.05, * p<0.1

Table A.4: Infant Mortality: Mother Fixed Effects

	Infant Death		
	All Children	Hindu Children	Non-Hindu Children
	(1)	(2)	(3)
*R50 $_{t-1}$ * firstson * female*	-0.085**	-0.084	-0.074
	(0.038)	(0.050)	(0.057)
*R25 $_{t-1}$ * firstson * female*	0.020	0.010	0.056
	(0.03)	(0.045)	(0.058)
*R50 $_{t-1}$ * female*	0.039**	0.051*	0.007
	(0.021)	(0.027)	(0.043)
*R25 $_{t-1}$ * female*	-0.023	-0.038	-0.012
	(0.024)	(0.034)	(0.04)
*R50 $_{t-1}$ * firstson*	0.047	0.064*	-0.001
	(0.029)	(0.033)	(0.041)
*R25 $_{t-1}$ * firstson*	-0.022	-0.017	-0.059*
	(0.015)	(0.03)	(0.034)
R50 $_{t-1}$	-0.050***	-0.060**	-0.021
	(0.019)	(0.028)	(0.025)
R25 $_{t-1}$	0.007	0.013	0.017
	(0.021)	(0.035)	(0.032)
*firstson * female*	0.004	-0.009	-0.080
	(0.049)	(0.076)	(0.086)
female	0.019	0.026	0.072
	(0.037)	(0.040)	(0.069)
Mother FE	x	x	x
District Covariates	x	x	x
District-Year Trend	x	x	x
Observations	8,367	5,448	2,919
Cohorts	1978-91	1978-91	1978-91
Districts	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. Samples include children of birth order 2 or higher. All specifications also include birth year fixed effects, birth order fixed effects, year of interview fixed effects, and linear and quadratic terms of the mother's age at which the child is born. The district covariates include logs of 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 first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table A.5: Infant Mortality: Showing Covariates including Rice Productivity

	Infant Death					
	All Children		Hindu Children		Non-Hindu Children	
	B. Or. 1	*B. Or. >1*	*B. Or. 1*	*B. Or. >1*	*B. Or. 1*	*B. Or. >1*
	(1)	(2)	(3)	(4)	(5)	(6)
*$R50_{t-1}$ * firstson * female*	-	-0.073*	-	-0.097**	-	-0.028
		(0.039)		(0.048)		(0.055)
*$R25_{t-1}$ * firstson * female*	-	0.031	-	0.019	-	0.046
		(0.038)		(0.051)		(0.044)
*$R50_{t-1}$ * female*	0.014	0.046**	0.011	0.070**	0.025	-0.001
	(0.025)	(0.023)	(0.026)	(0.029)	(0.042)	(0.046)
*$R25_{t-1}$ * female*	-0.041	-0.029	-0.029	-0.027	-0.052	-0.036
	(0.031)	(0.032)	(0.037)	(0.033)	(0.062)	(0.048)
*$R50_{t-1}$ * firstson*	-	0.039	-	0.043	-	0.029
		(0.028)		(0.032)		(0.031)
*$R25_{t-1}$ * firstson*	-	-0.034	-	-0.035	-	-0.016
		(0.023)		(0.036)		(0.03)
$R50_{t-1}$	0.000	-0.063***	0.017	-0.059**	-0.033	-0.078**
	(0.025)	(0.023)	(0.028)	(0.026)	(0.043)	(0.035)
$R25_{t-1}$	0.016	0.001	0.053	-0.003	-0.057	-0.005
	(0.048)	(0.020)	(0.053)	(0.031)	(0.055)	(0.039)
*ln rice yield $_{t-1}$ * firstson * female*	-	0.043	-	0.087	-	0.087
		(0.049)		(0.068)		(0.068)
*ln rice yield $_{t-1}$ * female*	-0.058	0.035	-0.020	-0.009	-0.170*	-0.009
	(0.042)	(0.044)	(0.049)	(0.053)	(0.093)	(0.053)
*ln rice yield $_{t-1}$ * firstson*	-	-0.041	-	-0.109	-	-0.109
		(0.048)		(0.065)		(0.065)
ln rice yield $_{t-1}$	0.085*	-0.102**	0.062	0.006	0.206**	-0.308***
	(0.046)	(0.046)	(0.053)	(0.048)	(0.09)	(0.121)
*firstson * female*	-	-0.025	-	-0.096	-	0.085
		(0.141)		(0.177)		(0.219)
female	-0.044	0.163	-0.117	0.171	0.169	0.174
	(0.12)	(0.131)	(0.170)	(0.131)	(0.288)	(0.247)
firstson	-	0.034	-	0.061	-	-0.017
		(0.137)		(0.197)		(0.150)
District FE	Yes	Yes	Yes	Yes	Yes	Yes
District Covariates	x	x	x	x	x	x
District-Year Trend	x	x	x	x	x	x
Observations	3,248	8,367	2,323	5,448	925	2,919
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. All specifications also include birth year fixed effects, birth order fixed effects, year of interview 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 *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 first-born son indicators. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.6: Sex Ratios: Showing Covariates including Rice Productivity

	Child is Male					
	All Children		Hindu Children		Non-Hindu Children	
	B. Or. 1	*B. Or. >1*	*B. Or. 1*	*B. Or. >1*	*B. Or. 1*	*B. Or. >1*
	(1)	(2)	(3)	(4)	(5)	(6)
$R50_{t-1}$ * *firstson*	-	-0.011	-	-0.014	-	0.004
		(0.020)		(0.019)		(0.047)
$R25_{t-1}$ * *firstson*	-	-0.005	-	0.005	-	-0.033
		(0.027)		(0.031)		(0.062)
$R50_{t-1}$	-0.020	0.045*	-0.065	0.055**	0.091	0.039
	(0.037)	(0.025)	(0.050)	(0.029)	(0.064)	(0.041)
$R25_{t-1}$	-0.010	0.051	0.063	0.030	-0.149	0.111
	(0.034)	(0.058)	(0.053)	(0.054)	(0.098)	(0.095)
ln rice yield $_{t-1}$ * *firstson*	-	-0.014	-	-0.034	-	-0.010
		(0.029)		(0.039)		(0.084)
ln rice yield $_{t-1}$	-0.064	-0.009	-0.010	0.023	-0.241*	-0.062
	(0.098)	(0.051)	(0.131)	(0.050)	(0.136)	(0.098)
firstson	-	0.094	-	0.186	-	-0.005
		(0.096)		(0.113)		(0.262)
District FE	x	x	x	x	x	x
District Covariates	x	x	x	x	x	x
District-Year Trend	x	x	x	x	x	x
Observations	3,248	8,367	2,323	5,448	925	2,919
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. All specifications also include birth year fixed effects, birth order fixed effects, year of interview 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 *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 first-born son indicators. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.7: Fertility : Showing Covariates including Rice Productivity

	Child has a Younger Sibling					
	All Children		Hindu Children		Non-Hindu Children	
	B. Ord. 1	*B. Ord. 2*	*B. Ord. 1*	*B. Ord. 2*	*B. Ord. 1*	*B. Ord. 2*
	(1)	(2)	(4)	(5)	(7)	(8)
*$R50_{t-1}$ * firstson*	-	0.012	-	0.008	-	0.019
		(0.044)		(0.051)		(0.05)
*$R25_{t-1}$ * firstson*	-	-0.116**	-	-0.108**	-	-0.182**
		(0.055)		(0.052)		(0.086)
*$R50_{t-1}$ * female*	0.007	-	0.026	-	-0.025	-
	(0.021)		(0.032)		(0.044)	
*$R25_{t-1}$ * female*	-0.005	-	-0.003	-	-0.022	-
	(0.017)		(0.026)		(0.039)	
$R50_{t-1}$	-0.015	-0.048	-0.039	-0.038	0.038	-0.096*
	(0.030)	(0.032)	(0.034)	(0.039)	(0.04)	(0.051)
$R25_{t-1}$	0.008	-0.020	0.025	-0.058	-0.032	0.036
	(0.037)	(0.056)	(0.052)	(0.079)	(0.027)	(0.083)
*ln rice yield $_{t-1}$ * firstson*	-	-0.086	-	-0.083	-	-0.050
		(0.072)		(0.085)		(0.052)
*ln rice yield $_{t-1}$ * female*	0.026	-	0.036	-	0.001	-
	(0.038)		(0.045)		(0.067)	
ln rice yield $_{t-1}$	-0.030	-0.061	-0.051	-0.047	0.090	-0.093
	(0.066)	(0.075)	(0.081)	(0.09)	(0.103)	(0.086)
female	-0.245	-	-0.286	-	-0.093	-
	(0.181)		(0.268)		(0.156)	
firstson	-	-0.201	-	-0.347	-	0.205
		(0.193)		(0.251)		(0.138)
District FE	Yes	Yes	Yes	Yes	Yes	Yes
District Covariates	x	x	x	x	x	x
District-Year Trend	x	x	x	x	x	x
Observations	3,248	2,686	2,323	1,919	925	767
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. Specifications also include birth year fixed effects, year of interview 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 *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 first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table A.8: Infant Mortality by Birth Order

	Infant Death					
	Birth Order 2			*Birth Order >2*		
	All	Hindu	Non-Hindu	All	Hindu	Non-Hindu
	(1)	(2)	(3)	(4)	(5)	(6)
*R50 $_{t-1}$ * firstson * female*	-0.029	-0.068	-0.025	-0.091**	-0.110**	-0.032
	(0.05)	(0.063)	(0.115)	(0.038)	(0.049)	(0.051)
*R25 $_{t-1}$ * firstson * female*	-0.03	0.006	-0.125	0.056	0.018	0.103*
	(0.064)	(0.087)	(0.120)	(0.043)	(0.050)	(0.057)
*R50 $_{t-1}$ * female*	0.007	0.030	0.007	0.060**	0.089***	0.000
	(0.031)	(0.046)	(0.082)	(0.024)	(0.03)	(0.044)
*R25 $_{t-1}$ * female*	-0.024	-0.034	0.006	-0.032	-0.022	-0.056
	(0.042)	(0.045)	(0.058)	(0.032)	(0.037)	(0.058)
*R50 $_{t-1}$ * firstson*	0.037	0.064	0.011	0.037	0.028	0.038
	(0.037)	(0.053)	(0.035)	(0.029)	(0.032)	(0.038)
*R25 $_{t-1}$ * firstson*	-0.059	-0.115*	0.106	-0.023	0.006	-0.058**
	(0.042)	(0.065)	(0.076)	(0.024)	(0.034)	(0.032)
R50 $_{t-1}$	-0.058	-0.042	-0.119	-0.061***	-0.066**	-0.056*
	(0.042)	(0.059)	(0.068)	(0.024)	(0.025)	(0.037)
R25 $_{t-1}$	0.032	0.045	-0.040	-0.009	-0.029	0.025
	(0.045)	(0.070)	(0.061)	(0.026)	(0.036)	(0.043)
*firstson * female*	0.021	-0.278	0.963	-0.010	0.055	-0.231
	(0.22)	(0.270)	(0.535)	(0.168)	(0.232)	(0.371)
female	-0.222	0.005	-0.778	0.320	0.237	0.553
	(0.165)	(0.171)	(0.399)	(0.195)	(0.165)	(0.427)
firstson	0.019	0.107	-0.207	0.008	-0.028	0.094
	(0.213)	(0.362)	(0.295)	(0.106)	(0.150)	(0.146)
District FE	x	x	x	x	x	x
District Covariates	x	x	x	x	x	x
District-Year Trend	x	x	x	x	x	x
Observations	2,686	1,919	767	5,681	3,529	2,152
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. All specifications also include the birth year fixed effects, birth order fixed effects, year of interview 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 *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 first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table A.9: Sex Ratio at Birth: by Birth Order

	Child is Male					
	Birth Order 2			*Birth Order >2*		
	All	Hindu	Non-Hindu	All	Hindu	Non-Hindu
	(1)	(2)	(3)	(4)	(5)	(6)
*$R50_{t-1}$ * firstson*	0.000	-0.018	0.025	-0.021	-0.024	0.004
	(0.048)	(0.045)	(0.109)	(0.033)	(0.037)	(0.044)
*$R25_{t-1}$ * firstson*	0.032	0.043	-0.046	-0.017	-0.010	-0.027
	(0.051)	(0.056)	(0.128)	(0.038)	(0.032)	(0.078)
$R50_{t-1}$	0.055	0.135***	-0.131	0.044	0.022	0.100
	(0.043)	(0.052)	(0.135)	(0.032)	(0.031)	(0.064)
$R25_{t-1}$	0.039	0.061	0.033	0.060	0.019	0.159
	(0.054)	(0.065)	(0.129)	(0.07)	(0.071)	(0.117)
firstson	-0.063	-0.038	-0.018	0.167	0.280	0.014
	(0.209)	(0.357)	(0.395)	(0.194)	(0.186)	(0.284)
District FE	x	x	x	x	x	x
District Covariates	x	x	x	x	x	x
District-Year Trend	x	x	x	x	x	x
Observations	2,686	1,919	767	5,681	3,529	2,152
Cohorts	1978-91	1978-91	1978-91	1978-91	1978-91	1978-91
Districts	14	14	14	14	14	14

Notes: Wild cluster bootstrapped standard errors in parentheses. All specifications also include birth year fixed effects, birth order fixed effects, year of interview 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 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 first-born son indicators. *** p<0.01, ** p<0.05, * p<0.1

Table A.10: Gender Differentiated Surviving Births: Interaction with First-born Gender

Dep. Variable:	1=surviving girl, 0=no birth or surviving boy			1=surviving boy, 0=no birth or surviving girl		
Land category:	*All*	*Landless*	*Some land*	*All*	*Landless*	*Some land*
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural land	-0.001	-	-0.001	-0.000	-	-0.001
	(0.001)		(0.001)	(0.001)		(0.001)
% Land registered	-0.009***	0.002	-0.014***	0.005**	0.014***	0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
*firstson * % Land registered*	0.003	-0.038	0.007***	0.011*	0.656***	0.011***
	(0.003)	(0.117)	(0.002)	(0.006)	(0.218)	(0.003)
firstson	0.037***	0.025**	0.044***	-	-0.120***	-0.107***
	(0.005)	(0.008)	(0.006)	(0.004)	(0.007)	(0.007)
Household FE	x	x	x	x	x	x
Observations	44,590	19,548	25,042	44,590	19,548	25,042
Households	2,286	1,144	1,142	2,286	1,144	1,142
Years	1978-99	1978-99	1978-99	1978-99	1978-99	1978-99

Notes: Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include land ceiling and immigrant status indicators, and year and household fixed effects, and % land distributed calculated the same way as % land registered, and its interaction with the first-born son indicator. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. *** p<0.01, ** p<0.05, * p<0.1

Table A.11: Gender-Differentiated Surviving Births – Adding District-Year Fixed Effects

Dep. Variable:	1=surviving girl, 0=no birth or surviving boy			1=surviving boy, 0=no birth or surviving girl		
Land category:	*All*	*Landless*	*Some land*	*All*	*Landless*	*Some land*
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural land	-0.001	-	-0.001	-0.000	-	-0.000
	(0.001)		(0.001)	(0.001)		(0.001)
% Land registered	-0.007***	0.000	-0.009***	0.009***	0.020***	0.008***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.007)	(0.001)
Household FE	x	x	x	x	x	x
District-Year FE	x	x	x	x	x	x
Observations	42,304	18,404	23,900	42,304	18,404	23,900
Households	2,268	1,126	1,142	2,268	1,126	1,142
Years	1978-99	1978-99	1978-99	1978-99	1978-99	1978-99

Notes: Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include a land ceiling indicator, immigrant status indicators, and year and household fixed effects, and % land distributed calculated the same way as % land registered. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. *** p<0.01, ** p<0.05, * p<0.1.

Table A.12: Gender-Differentiated Surviving Births – Full Sample

Dep. Variable:	1=surviving girl, 0=no birth or surviving boy			1=surviving boy, 0=no birth or surviving girl		
Land category:	*All*	*Landless*	*Some land*	*All*	*Landless*	*Some land*
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural land	-0.001	-	-0.001	-0.000	-	0.000
	(0.000)		(0.000)	(0.001)		(0.001)
% Land registered	-0.009***	-0.003	-0.010***	0.009***	0.042***	0.005***
	(0.001)	(0.006)	(0.001)	(0.002)	(0.011)	(0.001)
Household FE	x	x	x	x	x	x
Observations	56,461	23,154	33,307	56,461	23,154	33,307
Households	2,286	1,230	1,403	2,286	1,230	1,403
Years	1978-99	1978-99	1978-99	1978-99	1978-99	1978-99

Notes: Robust standard errors in parentheses, adjusted for clustering on villages. The variable % land registered is 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. All regressions also include a land ceiling indicator, immigrant status indicators, and year and household fixed effects, and % land distributed calculated the same way as % land registered. The land category of the household is defined based on year 1977 landholdings, and regressions include data for years 1978–1999. *** p<0.01, ** p<0.05, * p<0.1.

Table A.13: Hours of Family Farm Labour Supplied by Males vs Females

Dep. Variable:	Difference in Logarithms of Male and Female Hours of Labour		
Land category:	*Family*	*Hired*	*Family + Hired*
	(1)	(2)	(3)
% Land registered	-0.029	0.052	-0.004
	(0.039)	(0.043)	(0.035)
Household FE	x	x	x
Observations	2,595	2,595	2,595
Households	656	656	656
Years	1981-96	1981-96	1981-96

Notes: Robust standard errors in parentheses, adjusted for clustering on villages. The variable % The outcome variable is defined as the log of (1+hours worked). Land registered is 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. All regressions also include year and household fixed effects, area of the farm worked by the household, and % land distributed calculated the same way as % land registered. Regressions include data for years 1981–1996. *** p<0.01, ** p<0.05, * p<0.1.