Complete the Incompleteness of Land Reform:

Household Level Evidence from West Bengal

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Land Reform Effects on Human Capital Investment and Productivity: Household Level Evidence from West Bengal

(Abstract)

Land reforms were successfully implemented in the state of West Bengal through a special program undertaken in 1978 by the then state government. These reforms brought large amount of land under permanent and inheritable tenancy. We use a survey data of more than 9000 plots from 2000 households in 142 villages in West Bengal to ascertain that both productivity and long-term investments on such land are significantly lower than the land under ownership. We also find evidence for disparate levels of input usage on the tenancy plots as compared to those which are fully owned by the cultivator. Programs to allow land reform beneficiaries to acquire full ownership could thus have significant benefits.

1. Introduction

Land holdings in India were historically distributed in a highly unequal fashion, and have always been used as a source of social power. Ensuring secure access to land for the poor and landless had been the key motivation for India's land reform since independence. Since then a number of land reforms have been carried out by the government – abolition of '*Zamindari*' or middlemen as revenue collectors, imposing ceiling on landholdings and awarding of the surplus land's rights to landless, and tenancy reforms (Mearns, 1998). While abolition of intermediaries has been implemented swiftly and successfully without much obstacle, the implementation of ceiling and tenancy reforms are vehemently challenged.

Land reforms have impacted 12.4 mn tenants on 15.6 mn acres of land through redistribution of ownership rights or by providing them secure access as per the Government of India records until 2002 (Hanstad et al., 2008). Total area affected in India is more than three times what was involved in the well-known land reforms of Japan, Korea, and Taiwan together (King 1977). However, the implementation of the land reform in India has varied vastly across states. The two states that have been most successful in implementing tenancy and ceiling reforms are West Bengal and Kerala (Ghatak and Roy, 2007). In West Bengal this was achieved by the launch of a tenant registration drive in 1978, popularly known as "Operation Barga". This was a program

designed to implement tenancy laws that regulated rent and provided security of tenure to sharecroppers. Due to subsequent successful implementation of the tenancy laws in West Bengal, we look at the evidence of impact of reforms in this state.

Despite considerable interest in the topic at the policy level and a large literature documenting the way land reforms were put in practice at the state level (Yugandhar 1996, Thangaraj 2004), quantitative evidence on their impact is limited. Up to now all of the evidence on land reform impacts has been at a highly aggregate level (state or district level) and failed to distinguish the types of reform with varying outcomes. The high aggregation clearly limits the policy relevance of these studies.

Besley and Burgess (2000) using all-India data exploit interstate variations and find that the number of identifiable land reform laws across states is positively related to the extent of poverty reduction but not agricultural productivity. Using the same data, Ghatak and Roy (2007) find that the impact of land reform on agricultural productivity depends on the type of reform. They also check the robustness of results by using additional measures of productivity from alternate datasets. Banerjee, Gertler and Ghatak (2002) use district level data from West Bengal to conclude reforms improved productivity, and can explain 28 percent of the agricultural productivity growth occurring post reforms. Similarly, Bardhan and Mookherjee (2007) use a village level land reform data to conclude a positive impact on productivity. Reforms also affect the accumulation of human and physical capital of the beneficiary households (Deininger et al. 2008). Given the evidence that poor and landless are likely to benefit most from land reform (Besley and Burgess 2001; Deininger et al. 2008), role of tenancy reforms in enhancing human capital investment of children of bargadars household is an important long-term impact of these reform.

The policy relevance of studying the impact of land reform at individual beneficiary level has well emphasized in the literature (Ghatak and Roy, 2007; Bardhan and Mookherjee, 2007). Data limitation is probably the single most important reason why almost all the studies on this

topic are based on aggregate data. In this paper, we are able to fill in this knowledge gap by using plot level production and investment data from a large sample of households from West Bengal, one of the Indian state where land reform implementation, through the award of permanent tenancy rights to *barga* land following the ascent to power of the Communist Party in 1978, has made the greatest advances. We test whether there is Marshallian inefficiency associated with the tenancy land by comparing crop productivity, input use intensity and land investment between barga land and land with ownership after household fixed effects and plot characteristics are controlled for. We find that the differentials between the output values and yield exist because of tenancy status. These differences are of the magnitude of -.217 to -.07, depending upon the season and crop under investigation. We also find the tenancy land is negatively related to input use intensity and farmers decisions of land investments. Our results suggest that land under reform is less productive as compared to owned land under cultivation due to the disincentives associated with sharing contracts. These results suggest awarding full ownership to beneficiaries could be efficiency-enhancing.

The paper is structured as follows. Section two discusses land reform in a global context. Section three describes data sources and discusses descriptive statistics on reform targeting, and the comparison in productivity, input use and long-term investments between reform land and own land. The econometric results are presented in section four and section five concludes by briefly discussing policy implications.

2. Background and relation to the literature

This section reviews the rationale and level of land reform implementation -globally and in India- highlighting main types of land reform and the quantitative accomplishments under each of them. We use this as a basis to formulate hypotheses on the impact of different types of land reform and their evolution over time and to outline our strategy that will allow us to assess these empirically using the data at hand.

2.1 Land reform in a global context

A large body of empirical literature on agricultural production has shown that, due to the transaction costs involved in supervising hired labor (Carter 1984, Feder 1985, Eswaran and Kotwal 1985, Benjamin 1995), a farm structure based on owner-operated units is more efficient than one based on wage labor (Berry and Cline 1979, Binswanger *et al.* 1995). Although market mechanisms can, in principle, help to equalize the operational land distribution and thus maximize aggregate production, challenges remain. First, transaction costs and borrowing constraints may reduce the number of market transactions well below the optimum. Second, to the extent that transactions in rental and sales markets require transfers of resources among the parties involved even productivity-enhancing transactions may have undesirable distributional implications. At low levels of development, and especially with high inequality in the land ownership distribution, landlords may be able to reduce the benefits to tenants by exerting market power. At higher levels of development, speculative elements may cause a discrepancy between the market value of land and its underlying 'fundamental' value based on profits from agricultural production, thereby preventing movement of land to the most productive producers. Third, with imperfections in other markets, e.g. those for labor or credit, market transactions may not achieve first best outcomes in terms of production. As a result, government interventions that aim to provide the most productive producers with land access can have significant social and economic benefits (Chau 1998, Carter and Zimmerman 2000).

In addition to its potential to increase productivity, land reform can, through its possible effect on credit markets, also affect productive investment. It can have additional impacts by overcoming some of the negative consequences of a highly unequal distribution of asset ownership and economic opportunities. One frequently cited issue is that, with credit market imperfections, the poor may not be able to attain the level of indivisible investment in human or physical capital that would correspond to their innate ability (Galor and Zeira 1993, Gersbach and Siemers 2005). In

such situations, exogenous increases of asset endowments can bring the level of investment closer to the social optimum and also be beneficial to the individuals concerned. A second possible reason is that limited access to economic resources is likely to translate into limited political influence, possibly giving rise to a vicious and self-perpetuating circle of high inequality, bad institutions, and low economic growth (Acemoglu *et al.* 2004). Also, a tendency towards segregation may affect communities' ability to supply local public goods and, to the extent that these are essential inputs into private production, trap the poor in an undesirable equilibrium (Durlauf 1996, Cardenas 2003). This can be pronounced in cases where what is produced are public "bads" such as violence, social unrest, and strife, which are associated with significant economic as well as social costs.[1]

The potential productivity and social benefits from a more egalitarian distribution of land, often combined with arguments in favor of historical justice, have provided a justification for redistributive policies in many countries. The goal was to establish a foundation for an inclusive and broad-based pattern of economic development in some of the world's most unequal societies. The review of land reform episodes in table 1 illustrates that the magnitude of such efforts, in terms of the number of beneficiaries and the size of area redistributed, was enormous.[2] Well-known land reforms in Japan, Korea, and Taiwan at the end of World War II redistributed between 30% and 40% of the cultivated area, affecting about two thirds of rural households. Although they were drawn out over longer time periods, reforms in Bolivia, Nicaragua, Peru, and Mexico, affected sizeable portions of their countries' arable land endowment and benefited up to a third of the rural population.

[1] For a theoretical underpinning for the relationship between distribution and provision of public goods, including social cohesion, see (Bardhan and Ghatak 1999). It has also been shown that, especially in rural environments where other markets are imperfect, such interventions can help improve their nutritional status, risk-bearing capacity, and investment incentives, in addition to enhancing their ability to access credit markets (Burgess 2001).

[2] The purpose of this table is illustrative, to provide an indication of the orders of magnitude involved. Figures on area redistributed and number of beneficiary households are taken from the cited sources and percentages have been calculated by taking the total area of arable land (from FAO statistics) and the rural population divided by 5 (to obtain an estimate of the number of rural households).

Compared to the magnitude of these efforts, evidence on their effect is scant and often focused on outputs rather than impact based on a rigorous counterfactual. In Japan, Korea, and Taiwan, land reforms helped improve productivity and set the stage for an impressive increase in non-agricultural development (Jeon and Kim 2000). In the Philippines, early land reforms that benefited more than 0.5 million households and green revolution technology, improved household welfare (Otsuka 1991, Balisacan and Fuwa 2004) and increased investment and human capital accumulation (Deininger and Olinto 2001). Although quite effective, land reforms undertaken immediately after independence in some African countries, e.g. Kenya and Zimbabwe (Scott 1976, Gunning and et al 2000, Deininger *et al.* 2004) were often abandoned for political reasons (Kinsey and Binswanger 1993). In Latin America, reforms distributed comparatively large amounts of land (Barraclough 1970, Eckstein and Horton 1978, Jarvis 1989) but often failed to improve productivity and were insufficient to help overcome deep-rooted structural inequalities (de Janvry and Sadoulet 1989). Following a relative decline of interest in the topic during the late 1970s, it received renewed attention recently,[3] partly due to the fact that, even if accompanied by high levels of growth, macro-economic reforms in countries characterized by high land inequality often failed to narrow the gap between the rich and the poor. More importantly, the task which the original reforms set out to accomplish remains in many respects unfinished (Lipton 1993). Together with a strong political appeal of land redistribution, this has recently prompted countries as diverse as Brazil, Bolivia, South Africa, the Philippines, Venezuela, and Zimbabwe to renew their land reform efforts.

2.2 Land reform implementation in India

In India, land reform, implementation of which is the responsibility of individual states, has occupied a central stage in the policy debate for long time, given inequality in the distribution of productive assets, especially land, which the country inherited from its colonial masters. Reforms

[3] For recent contributions on land reform see (Boyce *et al.* 1998, Bandiera 2003, Bobrow-Strain 2004, Borras, Jr. 2005, Bradstock 2005, Eastwood *et al.* 2006).

had three main elements (Mearns 1999), namely (i) abolition of intermediaries (*zamindars*) shortly after independence; (ii) tenancy laws to increase tenure security by sitting tenants by registering them and often imposing restrictions on the amount of rent they had to pay or the scope for new rental transactions;[4] (iii) ceiling laws that provided a basis for expropriating land held by any given owner in excess of a state-specific ceiling and subsequently transferring it to poor farmers or landless agricultural workers. While the first of these is considered to have been highly successful, progress on the remainder was initially very slow, accelerating only during the 1970s and slowing down again in the 1980s. Still, both types of intervention resulted in the transfer of rights to almost 10 mn hectares of land, an area more than three times what was involved in the well-known land reforms of Japan, Korea, and Taiwan together (King 1977). With the exception of few states, the political commitment to implement reforms was limited and sometimes outcomes were counter to what had been desired, as with large-scale tenant evictions to prevent them from gaining more permanent land rights in anticipation of tenancy laws (Appu 1997).

Table 2 provide summary statistics for the level of land reform implementation, measured as the share of rural population who received land through tenancy reform, the area transferred as a result of ceiling legislation, or the number of ceiling laws, by state based on a summary report that draws together official data from various annual reports by the Ministry of Agriculture (Kaushik 2005). Over and above the large amounts of land affected by *zamindari* abolition and private initiatives such as donations of land under the Bhoodan movement,[5] direct land distribution affected about 2.5 mn hectares under programs to redistribute of ceiling surplus land, and 7.35 mn hectares under tenancy reform, implying a direct transfer of 5.45% of the area to about 5.35% of the agricultural population for the country as a whole. Comparing this to what has been involved in other land

[4] Many states combined legislation to improve the situation of tenants with either a complete prohibition of land leasing or provisions to provide tenants who had been on the land for some time with very strong property rights, something that is likely to have limited new supply of land to the rental market (Deininger *et al.* 2007).

[5] The amount of land donated voluntarily and distributed under the Bhoodan movement amounted to 0,7 mn ha by 2004, with focus on Bihar, Orissa, and Uttar Pradesh(Government of India 2006a). While some of these donations may have been motivated by a desire to avoid being affected by ceiling laws, we subsume all of these under the indirect effects of legal measures.

reforms internationally illustrates the size of India's land reform.[6] Ceiling and tenancy laws together resulted in the redistribution of about 10% of arable land, about the level of the Philippines, Brazil, or Zimbabwe before 2000, but below Asian countries such as Japan, Korea, and Taiwan (33.3%, 27.3%, and 26.9%) or even El Salvador, Bolivia, and Mexico (27.9%, 32.3%, and 13.5%). In terms of the share of rural households benefiting, India's accomplishment is at the lower end of the scale; while it exceeds what has been accomplished in the pre-1994 period in Kenya, Zimbabwe, and Brazil (1.6%, 3.1%, and 5.4% of the rural population, respectively), it remains considerably below other Asian countries such as the Philippines (24%), Japan (60.9%), and Taiwan (62.5%) or Latin American ones such as Mexico (67.5%), Bolivia (47.5%), and El Salvador (16.8%).

Comparing the share of beneficiary households to that of the area transferred points towards considerable variation across states. In some cases, e.g. Kerala or West Bengal, 12.5% and 10.8% of the population benefited from transfer of 8.5% and 6.4% of the land area, respectively, plot sizes for land transferred remained considerable below the state average. While some states (e.g. Gujarat or Tamil Nadu) provided beneficiaries with plots of about average size, in most of the states the fact that the share of beneficiaries remains significantly below the area share points towards transfer of above-average plot sizes, as in Maharashtra (27% of area distributed to 10.7% of population), Karnataka (15.4% and 5.3%), AP and MP (3.5% and 2.2% to 0.75% and 0.61% of population, respectively).

With 4.4% and 2.3%, the share of area redistributed overall or share of households benefiting from ceiling laws has been below the figures for tenancy reform. Although some states such as Rajasthan, UP, Bihar, and AP transferred more land (6.6%, 5.8%, 4.4%, and 8.3%) under ceiling legislation than through tenancy reform, results seem to have been biased towards transfer of above-average sized plots of land, suggesting that even where it was possible to acquire above

[6] Note that the two measures considered here, i.e. tenancy reform and distribution of above-ceiling land, are in addition to any lands transferred through *zamindari* abolition.

ceiling land by the state, overcoming political pressures in the distribution of such land may have been difficult. In West Bengal, on the other hand, a state that ranks at or near the top for both measures and that counts with a formidable level of grassroots-level organization, land reform land appears to have been transferred in a very pro-poor fashion.

For the country as a whole, an average of 2.1 land reform laws had been passed per state with the mean law being about 13 years old in 1999. Despite the fact that the highest number of laws was passed in West Bengal where reform-induced transfers were also highest, the correlation between number of laws and the share of area transferred through or of rural households benefiting from reform is, with 0.28, low throughout. This supports the notion that legal provisions alone did not automatically translate into action on the ground, consistent with arguments that there is no *a-priori* reason to expect a positive link between passage of laws -which could be a result of an objective need for land reform and political mobilization or even lack of actual progress- and their actual implementation. In fact, in a number of states, high levels of legal activity appear to have been used to deflect attention from lack of progress on the ground.

While not differentiated in the table, a detailed look at the time dimension of reform measures allows a number of conclusions (Kaushik 2005): After a spurt of land transfers in the 1970s and 1980s, progress has slowed down considerably; in fact between 1995/96 and 2003/04, i.e. for almost a decade, progress in awarding land rights to tenants had come to a complete standstill; the increment in ceiling surplus land transferred during the period amounted to only 10,800 hectares. The latter represents about one tenth of the land declared ceiling surplus, with the remainder being tied up in litigation. This suggests that, unless there are significant changes in the overall parameters, progress in achieving further redistribution of ceiling land could be slow -it would take almost 90 years to dispose of remaining ceiling surplus cases if the current pace is maintained- but also that, by clogging up the court system and preventing it from quickly dispensing justice in other urgent matters, the ceiling legislation may impose external effects

beyond land rental markets (Moog 1997).[7] While broader changes in the legal framework could make much additional land available, they do not seem to be too likely in the current political environment.

Despite considerable interest in the topic at the policy level and a large literature documenting the way land reforms were put in practice at the state level (Yugandhar 1996, Thangaraj 2004), attempts to quantitatively assess their economic impacts at a national scale are surprisingly scant. One study finds that the number of identifiable land reform laws across states is positively related to the extent of poverty reduction but not agricultural productivity (Besley and Burgess 2000). While this could be used to make the case for land reform as a redistributive measure, e.g. through a wage effect, use of a measure only weakly linked to implementation of reforms is a shortcoming. Studies using data on implementation have only been conducted in individual states, mainly West Bengal. District level data point towards a positive impact of land reform on productivity (Banerjee *et al.* 2002), a finding that receives support from household level evidence taking into account other political factors (Bardhan and Mookherjee 2006). However, as the policy environment in West Bengal is likely to be uniquely conducive to land reform, a national assessment of land reform impact based on actual implementation would be very desirable in view of the continued relevance of the topic in India's policy debate (Government of India 2006b).

2.3 Hypotheses on land reform impact

Contrary to most empirical studies that have derived estimates of land reform impact from aggregate data at the district of state level, we use plot and household level information collected from a large survey in West Bengal. We expect the reform land to have lower productivity than land with full ownership due to the fact that tenancy reform land (*barga land*) is also sharecropped land. As tenants will be rewarded with a proportional of crop production, their incentive to

[7] Two main reasons for court cases are contestation by landlords and instances where beneficiaries were allocated land but were either unable to establish effective possession or were subsequently evicted. A field survey to explore this issue in Andhra Pradesh pointed to at least 20% of beneficiaries who were not able to access the property they had received although the number of those who are able to file court cases calling for their (re)instatement is much more limited.

undertake (non-contractible) land investment, to use adequate inputs, and to exert effort in cultivating it will be reduced, compared to what would be the case under full ownership. This will reduce the productivity of land use at any given point in time, thereby implying an indirect cost of this type of land reform. The fact that the reform land cannot be subleased is expected to further discourage tenants to make long-term investments.

3. Data and Estimation Strategy

A listing exercise of the entire population from more than 200 selected villages in 10 districts of West Bengal was carried out, in which 94,000 households are listed. This listing contained information on the beneficiary status and current tenure status, and was used as a sample frame for the next round survey. Data used in this on productivity and investments comes from a detailed survey of households in 142 villages in the 10 districts. Altogether, about 2000 household were interviewed, and detailed plot level data on nearly 9,585 plots were collected. An official list of 1978 land reform beneficiaries was used to draw the village sample in which the bargadars were over sampled to make sure enough beneficiaries are included. The listing exercise collected detailed information on land tenure, plots (both own and reform land), main physical assets as well as household demographic characteristics both at the initial period of 1978 and at present, detailed history of land change (either through inheritance or through market transactions), literacy and years of education attained for all the members of the dynasty households (i.e. for the head of 1978 household, head of the current household and all the children) is available. The listing data provide a unique opportunity to understand the targeting and historical background of the reform which we will describe in more detail in the section to follow. In the follow up survey, detailed information on input, output of crop production and various types of land investment for all the agricultural plots were collected to test the inefficiency hypotheses.

3.1. Household characteristics of Reform Beneficiaries in 1978

Land reform was targeted towards the poor and landless households at the time of reform. By comparing household initial characteristics between land beneficiaries (bargadars or pattadars) with those who were not affected by either type of the reform, we are able to assess whether the tenancy and ceiling reforms indeed served the redistributive role as initially intended. The descriptive evidence as obtained from the first round listing data from Table 3 suggests that the beneficiaries of both types of reform are indeed those households who had endowed with little or no land and were relatively poorer and whose livelihood was more dependent upon agricultural sector. In 1978, the average land endowment, inclusive of patta land, for barga and patta beneficiary was respectively 1.92 acres and 1.31 acres, which was considerably lower than 2.54 acres, the average land endowment of those households who were not affected by the reform. While share of landless households between barga beneficiaries and non-beneficiaries is about the same in 1978 (55% and 57%, respectively), the share of landless households among the patta beneficiaries are considerably higher (75%), which is as expected as ceiling land is mainly to support the landless households.

Examining the occupational structure of the beneficiaries, it can be seen that both patta and barga households heavily rely on agricultural sector. While 91 percent of barga households and 87 percent of patta households reported that their head's main occupation is either working for agricultural wage or farming, 76 percent of the households who were not affected by reform reported so. The limited number of indicators for welfare that were included in the survey (i.e. namely the condition of roof and wall) tends to suggest that reform beneficiaries were poorer than non-beneficiaries. For example, 83 percent of barga and 90 percent of patta beneficiaries reported to have bad quality roof (ie. identified as thatched, or of plastic or mud) as compared to 70 percent of non-beneficiaries who reported so.

Finally, land reform also benefited more households from lower castes, as indicated by the fact that 56 percent of barga beneficiaries and 73 percent of patta beneficiaries are from the most

marginalized Scheduled Castes & Scheduled Tribes (SC/ST) as compared to as compared to 43 percent of households who were not affect by reform were from SC/ST.

3.2. Descriptive evidence on productivity, input use intensity and land investments

By comparing productivity by land reform status, we try to gain some insights regarding the differentials in productivity which exist between tenant and owner cultivated land. We find there exist significant negative correlation between crop productivity and tenancy.

Table 4 shows that the average plot size of tenants is 0.36 acres respectively as compared to 0.46 acres those of owner occupied plots. Data on production at the plot level suggests considerable difference between tenancy plots and owner plots. For example, average annual gross revenue of crop production on own plots is 33 percentage points higher than that for tenancy plots (22059 Rs. vs. 16578 Rs.). The difference is consistent for the two main crop seasons (Rabi season and Kharif seasons – Check the number??? This is not really the case in the table). A similar pattern can be observed if we focus on the yield of rice crop (the most important staple crop in West Bengal, with own plot yield at 1925 kgs and that of tenancy plots at 1843 kgs). We also see that input usage of all the inputs used in cultivation is lower on tenancy land as compared to the land under full ownership. In addition, plot level characteristics suggest poorer irrigation conditions for tenancy land than for own land. On average, as we see from table 4, 74% of tenancy land has access to irrigation as compared to 83% on owned land.

Table 5 shows different types of land investments by tenancy status. The investment data suggests some consistent evidence that the proportion of plots received land related investment is much higher for own land than for tenancy land. While 43% and 10% of own plots have access to bore wells and ponds respectively, the corresponding figures for tenancy land is only 38% and 6%, respectively, The difference is even more striking in other land improvements. Farmers made soil improvements on 40% of own plots, but the same type of investment was made only on 10% of tenancy plots.

3.3. Estimation Strategy

The descriptive data given in table 4 and 5 is in general consistent with our hypothesis of low productivity and investment of reform land. The average crop productivity, input use intensity and investment in land, are all lower for tenancy plots than for own land. The descriptive evidence while informative, they are not casual and therefore have limited policy relevance. In order to test whether the descriptive evidence also holds after the household fixed effects and plot level characteristics are controlled for, we rely on more rigorous econometrics analysis to test our hypotheses. We use the methods employed by Shaban (1987) to investigate the impact of tenancy reform on productivity, input use intensity and long-term investment.

The equation to estimate the Marshallian inefficiency with the plot level production and investment data is:

$$Y_i = \alpha + \beta R_{ik} + \sum \phi X_{ij} + \delta D_r + \varepsilon_{ij} \qquad (1)$$

Where Y_i is the gross yield or revenue of the cultivated plot (or input usage on the plot or investment variables), the variable R_{ik} is a dummy to indicate whether land is under tenancy. D measures the distance of the plot from the household dwelling. The identification strategy used compares the crop yield or inputs use between the tenancy plots (barga plots) and owned plots after controlling for the cultivator household fixed effect. We also control for the soil characteristics using a number of indicators of soil quality.

4. Empirical Results

To determine whether the productivity and long-term investment of reform land is indeed lower than that of land with full ownership as suggested in the descriptive analysis, we regress production variables (yield, value and net value) and investment variables (whether certain type of investment was made) of a plot on plot characteristics including area size, distance to homestead, and a large number of variables on soil characteristics, and tenure status and we control for household fixed effects.

Table 6 reports regression results for productivity when productivity is measured by the gross revenue receipts from all crops on a given plot. We further divided productivity into annual productivity (columns 1 and 2), productivity for the Rabi season (columns 3 and 4) and for Kharif season (columns 5 and 6). For each type of productivity, we have two specifications; a base model and an augmented model. In the base model, productivity is regressed on only two variables - the tenancy dummy and plot size. In the augmented model, additional plot characteristics variables such as irrigation status and distance to homestead and a large number of soil characteristics (such as soil types, soil color, soil salinity, percolation and drainage) are also added to the explanatory variables. The regression results are highly consistent with the descriptive findings as illustrated by the fact that the coefficient on the tenancy dummy variable is negative and significant at 1% level of significance for all columns. We find that the annual productivity based on the base model is 22 percentage points lower for the tenancy land than own land. Adding plot and soil characteristics reduced the magnitude of productivity difference between own and tenancy land to 15 percentage points. The significant productivity difference exists in both crop seasons. In Kharif season, the seasonal productivity is eight percentage lower in tenancy land than own land. The difference in Rabi seasons is even larger, 13.4 percentage points or 12.3 percentage points depending on the model specifications.

In Table 7, we include regression using log of Net Value measured in Rupees. The net value was reached after netting all input costs. Here we find that the net value of output again differs substantially between the tenancy and owned plots, and the difference is as high 18% for aggregate, 8% for Kharif, and 13% for Rabi season, where all are statistically significant at 1%. In Table 8, we limit the estimates to one main crop of rice. The estimates show the yield measured in Kgs and value of rice. in rupees to be statistically different between tenancy land and own land with the magnitude of difference between 6% and 7%.

The reason production differences arise partially from differences in application of inputs as seen from the regression of inputs usage. The input cost is divided into a number of heads

depending upon the physical factors, and are used to estimate the input intensity on the tenancy plots as compared to the owner cultivated plot. These regressions with inputs as dependent variables are shown in columns of Table 9 and 10. Table 9 is Linear Probability Model, capturing the likelihood that a particular input will be used in cultivation on the plot. We find that inputs like pesticide and irrigation are less likely to be used on the tenancy plots, even after controlling for the cultivator household fixed effect. We find that the farming on tenancy plots reduces the probability of pesticide use by 2.2% and that of irrigation by nearly 8%. We estimate the intensity of usage of inputs in Table 10, and find tenancy status reduces the usage of inputs on average by 11% for fertilizer and manure, 3% for pesticides, 6% for seeds, and 9% for casual labor hired. Given these results we find that if the plot is under tenancy, cultivator is likely to use fewer inputs, and we also find that the productivity of these plots is less than those of owner occupied.

Finally, Table 11 reports the regression results on land investment. The regression results show that larger plots or plots that are closer to homestead are more likely to receive land investment, which is not surprising. The regression results are also highly consistent with the descriptive findings, as illustrated by the negative and significant coefficients on tenancy land dummy for all the regressions. The base model results suggest that compared to own land, barga land is 6.5% less likely to receive private irrigation investment or even more strikingly 29% less likely to receive land conservation or other types of land investment. The results also do not change much as the model is augmented by a large set of soil type and soil physical characteristics.

5. Conclusion

A wide scale reform of cultivable land was legislated in India several decades ago. However, these reforms still have implications for the households which are cultivating reform land. The land under reform, which provides inheritable and permanent tenancy on these plots, is found to be less productive than the land which is owner cultivated. This study found lower yield, less gross value and less net value on the plots which are cultivated by a tenant compared to that on own

plots by the same tenant. These differences in productivity on the two types of plots, after controlling for land quality and irrigation facilities, are found to be attributable to differences in input usage and labor used on the two types of plot. The divergence between optimal use of inputs and labor under when land is owner cultivated or cultivated by a tenant generating the loss of productivity on this land. We also found that tenants have less incentive to make long-term land investment on reform land than their own land. Therefore tenancy land is also associated with long-term dynamic inefficiency, an important aspect that has been mostly neglected in previous impact studies on India tenancy reform. Appropriate policy to address this loss of productivity on reform land needs to be devised. These differences in productivity can be mitigated by making changes in tenancy status which prevents sufficient use of labor, inputs and investment in the plots.

Reference:

Acemoglu, D., S. Johnson, and J. Robinson. 2004. "Institutions as the Fundamental Cause of Long-Run Growth." NBER Working Paper 10481. Cambridge, MA: National Bureau of Economic Research.

Aghion, P. and P. Bolton. 1997. "A Theory of Trickle-Down Growth and Development." *Review of Economic Studies 64* (2): 151-72.

Appu, P. S. 1997. *Land Reforms in India: A Survey of Policy, Legislation and Implementation*. New Delhi: Vikas Publishing House.

Balisacan, A. M. and N. Fuwa. 2004. "Going beyond Crosscountry Averages: Growth, Inequality and Poverty Reduction in the Philippines." *World Development 32* (11): 1891-907.

Bandiera, O. 2003. "Land Reform, the Market for Protection, and the Origins of the Sicilian Mafia: Theory and Evidence." *Journal of Law, Economics, and Organization 19* (1): 218-44.

Banerjee, A. and L. Iyer. 2005. "History, Institutions, and Economic Performance: The Legacy of Colonial Land Tenure Systems in India." *American Economic Review 95* (4): 1190-213.

Banerjee, A. V., P. J. Gertler and M. Ghatak. 2002. "Empowerment and Efficiency: Tenancy Reform in West Bengal." *Journal of Political Economy 110* (2): 239-80.

Bardhan, P., S. Bowles and H. Gintis. 2000. "Wealth Inequality, Wealth Constraints and Economic Performance." In Atkinson, A. B. and F. Bourguignon, eds., *Handbook of income distribution*. Amsterdam: North-Holland.

Bardhan, P. and M. Ghatak. 1999. "Inequality, Market Imperfections, and Collective Action Problems." *University of California, Berkeley, Center for International and Development Economics Research (CIDER) Working Paper: C99/108*.

Bardhan, P. and D. Mookherjee. 2006. "Land Reform, Decentralized Governance, and Rural Development in West Bengal." . Stanford, CA: Paper prepared for the Stanford Center for International Development Conference on Challenges of Economic Policy Reform in Asia, May 31–June 3 2006.

Bardhan, P., and D. Mookherjee (2007) Land Reform and Farm Productivity in West Bengal. Stanford Center for International Development

Barraclough, S. L. 1970. "Agricultural Policy and Land Reform." *Journal of Political Economy 78* (4): 906-47.

Barro, R. J. 2000. "Inequality and Growth in a Panel of Countries." *Journal of Economic Growth 5* (1): 5-32.

Benjamin, D. 1995. "Can Unobserved Land Quality Explain the Inverse Productivity Relationship?" *Journal of Development Economics 46* (1): 51-84.

Berry, R. A. and W. R. Cline. 1979. *Agrarian Structure and Productivity in Developing Countries*. Baltimore: Johns Hopkins University Press.

Besley, T. and R. Burgess. 2000. "Land Reform, Poverty Reduction, and Growth: Evidence from India." *Quarterly Journal of Economics 115* (2): 389-430.

Besley, T., and R. Burgess. "Halving global poverty." *Journal of Economic Perspectives* 17, no. 3(2003): 3-22.

Binswanger, H. P., K. Deininger and G. Feder. 1995. "Power, Distortions, Revolt and Reform in Agricultural Land Relations." *Handbook of development economics 3B* 2659-772.

Bobrow-Strain, A. 2004. "(Dis)Accords: The Politics of Market-Assisted Land Reforms in Chiapas, Mexico." *World Development 32* (6): 887-903.

Borras, S. M., Jr. 2005. "Can Redistributive Reform Be Achieved via Market-Based Voluntary Land Transfer Schemes? Evidence and Lessons from the Philippines." *Journal of Development Studies 41* (1): 90-134.

Bourguignon, F. and T. Verdier. 2000. "Oligarchy, Democracy, Inequality and Growth." *Journal of Development Economics 62* (2): 285-313.

Boyce, J. K., P. Rosset, and E. A. Stanton. 1998. "Land reform and sustainable development." Political Economy Research Institute Working Paper Series No 98. Amherst MA: University of Massachusetts, Amherst.

Bradstock, A. 2005. "Changing livelihoods and land reform: Evidence from the Northern Cape province of South Africa." *World Development 33* (11): 1979-92.

Burgess, R. 2001. "Land and Welfare: Theory and Evidence from China." Working Paper. London: London School of Economics.

Cardenas, J. C. 2003. "Real Wealth and Experimental Cooperation: Experiments in the Field Lab." *Journal of Development Economics 70* (2): 263-89.

Carter, M. R. 1984. "Identification of the inverse relationship between farm size and productivity: an empirical analysis of peasant agricultural production." *Oxford Economic Papers 36* 131-45.

Carter, M. R. and F. J. Zimmerman. 2000. "The Dynamic Cost and Persistence of Asset Inequality in an Agrarian Economy." *Journal of Development Economics 63* (2): 265-302.

Chau, N. H. 1998. "Land Reforms in the Presence of Monitoring Costs and International Trade." *Review of International Economics 6* (4): 564-79.

Conning, J. H. and J. A. Robinson. 2007. "Property rights and the political organization of agriculture." *Journal of Development Economics 82* (2): 416-47.

de Janvry, A. 1981. "The Role of Land Reform in Economic Development: Policies and Politics." *American Journal of Agricultural Economics 63* (2): 384-92.

de Janvry, A. and E. Sadoulet. 1989. "A Study in Resistance to Institutional Change: The Lost Game of Latin American Land Reform." *World Development 17* (9): 1397-407.

Deininger, K. 2003. *Land policies for growth and poverty reduction* World Bank Policy Research Report series. Washington, D.C.: World Bank; Oxford and New York: Oxford University Press.

Deininger, K., H. Hoogeveen and B. H. Kinsey. 2004. "Economic Benefits and Costs of Land Redistribution in Zimbabwe in the Early 1980s." *World Development 32* (10): 1697-709.

Deininger, K., S. Jin and H. K. Nagarajan. 2007. "Efficiency and equity impacts of rural land market restrictions: Evidence from India." *European Economic Review*, 52(5):892-918.

Deininger, K., S. Jin, and H. K. Nagarajan. "Land Reforms, Poverty Reduction, and Economic Growth: Evidence from India." *Journal of Development Studies*, 45(4): 496-521.

Deininger, K. and P. Olinto. 2001. "Redistribution, investment, and human capital accumulation: The case of the Philippines." . Washington, DC: World Bank.

Durlauf, S. N. 1996. "A Theory of Persistent Income Inequality." *Journal of Economic Growth 1* (1): 75-93.

Eastwood, R., J. Kirsten and M. Lipton. 2006. "Premature deagriculturalisation? Land inequality and rural dependency in limpopo province, South Africa." *Journal of Development Studies 42* (8): 1325-49.

Eckstein, S. D. and G. D. Horton. 1978. "Land Reform in Latin America: Bolivia, Chile, Mexico, Peru and Venezuela." *World Bank Staff Working Paper 275*.

Eswaran, M. and A. Kotwal. 1985. "A Theory of Contractual Structure in Agriculture." *American Economic Review 75* (3): 352-67.

Feder, G. 1985. "The Relation between Farm Size and Farm Productivity: The Role of Family Labor, Supervision and Credit Constraints." *Journal of Development Economics 18* (2-3): 297-313.

Galor, O. and J. Zeira. 1993. "Income Distribution and Macroeconomics." *Review of Economic Studies 60* (1): 35-52.

Gersbach, H. and L. Siemers. 2005. "Land reforms and economic development." Discussion Paper 5184. London: Center for Economic Policy Research.

Ghatak, M., and S. Roy. "Land reform and agricultural productivity in India: a review of the evidence." *Oxford Review of Economic Policy* 23, no. 2(2007): 251-269.

Government of India. 2006a. "Ministry of Rural Development Annual Report 2006/07: Bharat Nirman through Rural Development." . New Delhi: Government Printer.

Government of India. 2006b. "Towards faster and more inclusive growth: An approach to the 11th five-year plan." . New Delhi: Planning Commission, Yojana Bhavan.

Gunning, J. W. and et al. 2000. "Revisiting Forever Gained: Income Dynamics in the Resettlement Areas of Zimbabwe, 1983-96." *Journal of Development Studies 36* (6): 131-54.

Hanstad, T., T. Haque, and R. Nielson. "Improving Land Access for India's Rural Poor." *Economic and Political Weekly*, March 8, 2008.

Jarvis, L. S. 1989. "The Unraveling of Chile's Agrarian Reform, 1973-1986." In Thiesenhusen, W., eds., *Searching for Agrarian Reform in Latin America*. Boston: Unwin Hyman.

Jeon, Y. D. and Y. Y. Kim. 2000. "Land Reform, Income Redistribution, and Agricultural Production in Korea." *Economic Development and Cultural Change 48* (2): 253-68.

Kaushik, A. 2005. "Nature of land market interventions in India." Institute for Sustainable Development Noida.

King, R. 1977. *Land Reform: a World Survey*. London: G.Bell and Sons.

Kinsey, B. H. and H. P. Binswanger. 1993. "Characteristics and Performance of Resettlement Programs: A Review." *World Development 21* (9): 1477-94.

Lipton, M. 1993. "Land-Reform As Commenced Business - the Evidence Against Stopping." *World Development 21* (4): 641-57.

Mearns, R. 1999. "Access to Land in Rural India." Policy Research Working Paper 2123. Washingon DC: World Bank.

Moog, R. S. 1997. *Whose interests are supreme? Organizational politics in the civil courts in India*. Ann Arbor, Michigan: Association for Asian Studies.

Nugent, J. B. and J. A. Robinson. 2002. "Are Endowments Fate?" CEPR Working Paper 3206. London.

Otsuka, K. 1991. "Determinants and Consequences of Land Reform Implementation in the Philippines." *Journal of Development Economics 35* (2): 339-55.

Scott, J. C. 1976. *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. New Haven, C.T.: Yale University Press.

Shaban, R.A 1987. "Testing competing models of sharecropping*" Journal of Political Economy vol 95* (5):

Thangaraj, M. 2004. *Land reforms in India. Volume 9. Tamil Nadu--An unfinished task* New Delhi; Thousand Oaks, Calif. and London: Sage Publications.

Vollrath, D. 2007. "Land distribution and international agricultural productivity." *American Journal of Agricultural Economics 89* (1): 202-16.

World Bank. 2005. "World Development Report 2006: Equity and Development." . Washington, DC: The World Bank and Oxford University Press.

Yugandhar, B. N. 1996. *Land reforms in India. Volume 3. Andhra Pradesh--People's pressure and administrative innovations* New Delhi; Thousand Oaks, Calif. and London: Sage Publications.

Table 1: Global extent and characteristics of land reforms

Country	Area		Beneficiary households		Area per household (hectares)	Implementation Period
	Total area (1000 hectares)	Share of arable Land (%)	Number (thousands)	Share of rural Households (%)		
Africa						
Egypt	390	15.4	438	10.0	0.89	1952–78
Kenya	403	1.6	34	1.6	11.85	1961–70
Zimbabwe	2,371	11.9	40	3.1	59.28	1980–87
Asia						
Japan	2,000	33.3	4,300	60.9	0.47	1946–49
Korea, Rep. of	577	27.3	1,646	45.5	0.35	1948–58
Philippines	1,092	10.8	1,511	24.2	0.72	1940–85
Taiwan, China	235	26.9	383	62.5	0.61	1949–53
Central America						
El Salvador	401	27.9	95	16.8	4.22	1932–89
Mexico	13,375	13.5	3,044	67.5	4.39	1915–76
Nicaragua	3,186	47.1	172	56.7	18.52	1978–87
South America						
Bolivia	9,792	32.3	237	47.5	41.32	1953–70
Brasil	13,100	11.3	266	5.4	49.32	1964–94
Chile	9,517	60.1	58	12.7	164.09	1973
Peru	8,599	28.1	375	30.8	22.93	1969–79

Source: Deininger (2003).

Table 2: Shares of rural households and arable land area affected by different land reforms in Indian States

	Tenancy legislation				Ceiling legislation	
State	**Area (%)**	**Pop. (%)**	**No. of laws**	**Average age**	**Area (%)**	**Pop. (%)**
Andhra Pradesh	3.48	0.75	2	17.0	8.34	3.81
Bihar	0.00	0.00	3	18.3	4.42	4.00
Gujarat	15.00	11.20	2	15.5	1.95	0.31
Haryana	0.51	0.01	0	0	1.26	0.26
Himachal Pradesh	0.16	3.19	n.a.	n.a.	0.06	0.05
Karnataka	15.38	5.29	2	14.5	1.71	0.30
Kerala	8.47	12.49	4	10.8	1.30	1.04
Madhya Pradesh	2.15	0.61	1	24.0	2.69	0.71
Maharashtra	27.01	10.68	1	23.0	7.74	1.08
Orissa	0.15	1.43	3	9.0	2.24	1.28
Punjab	1.89	0.04	1	10.0	1.50	0.25
Rajasthan	0.00	0.16	0	0	6.63	0.75
Tamil Nadu	3.65	3.23	5	13.6	2.47	1.24
Uttar Pradesh	0.00	0.00	2	14.5	5.81	3.68
West Bengal	6.41	10.80	5	8.2	14.91	19.73
Total	5.45	5.35	2.1	13.03	4.41	2.27

Source: Kaushik (2005) for columns 1 to 4; Besley and Burgess (2000) for columns (5) and (6)

Table 3: Reform Beneficiary Statistics (1978)

	Total	Barga Beneficiaries	Patta Beneficiaries	Lose land	Not affected
household characteristics in 78					
Household size	6.21	6.49	5.84	7.35	6.19
Land endowment in 78 (inc'dg patta)	2.54	1.92	1.31	6.90	2.55
landless in 78 (exc'dg patta land)	0.57	0.55	0.75	0.10	0.57
SC/ST	0.45	0.56	0.73	0.17	0.43
78 head literate	0.25	0.22	0.14	0.68	0.25
Head's occup: Ag wage	0.36	0.30	0.54	0.04	0.36
Farming	0.40	0.61	0.33	0.60	0.38
Non-farm wage	0.12	0.05	0.07	0.04	0.13
Self-employment	0.12	0.04	0.06	0.31	0.12
Non-land assets in 78					
Bad roof (thatch/plastic/mud)	0.72	0.83	0.90	0.55	0.70
Bad wall (mud/bamboo)	0.70	0.85	0.78	0.59	0.69

Table 4: Plot level production statistics (current)

	ALL	OWNER PLOTS	TENANCY PLOTS
PLOT CHARACTERISTICS			
Own land (%)	0.60	1.00	0.00
Tenancy land (%)	0.40	0.00	1.00
Plot Area (acre)	0.40	0.36	0.46
Irrigation (%)	0.79	0.83	0.74
CROP VALUE (in Rupees)			
Rabi	8562.59	9965.52	6493.54
Kharif	8846.03	8872.75	8806.64
Total	19844.49	22059.35	16578.01
YIELD - RICE (in Kilograms)			
Rabi	606.51	644.66	550.25
Kharif	1278.46	1273.02	1286.49
Total	1892.45	1925.10	1844.30
INPUTS (In Rupees)			
Seeds	1256.54	1428.47	1002.97
Fertilizer	1939.87	2195.05	1563.52
Pesticide	605.34	666.13	515.69
Bullock	119.47	126.17	109.60
Tractor	643.72	700.76	559.60
Irrigation	990.62	1106.71	819.41
Transport	247.65	260.10	229.29
Other inputs	53.93	70.32	29.74

Plots: n=9283

Table 5: Land investments by land tenure status : Plot level evidence

	ALL	OWN	BARGA
Private Irrigation Access			
Share of plots with private irrigation	0.485	0.534	0.446
Share of plots with pond irrigation	0.085	0.104	0.062
Share of plots with bore well irrigation	0.400	0.432	0.379
Construction & Maintenance of Private Irrigation Asset			
Total cash cost (Rs.)	5511	6322	4762
Number of hired labor (Days)	3.08	3.76	2.32
Number of family labor (Days)	0.48	0.64	0.27
Number of exchange labor (Days)	0.05	0.05	0.07
Total cash spent during 8 years(Rs.)	116.95	164.45	57.93
Total labor days contributed during last 8 years (days)	0.33	0.46	0.16
Land, Soil, and Water Conservation			
Share of plots with land/soil/water conservation in the past 8 years	0.293	0.401	0.135
Total amount of cash spent during last 8years (Rs.)	145.94	215.91	51.37
Share of households using any family labor during past 8 years	0.236	0.325	0.107
Total family labor used (days)	519	740	207
Number of observation	8913	5223	3300

Table 6: Tenancy and productivity
Dependent variable: Gross revenue of crop production on per unit of land (Rs./acre)

	(1)	(2)	(3)	(4)	(5)	(6)
			Kharif	**Kharif**	**Rabi**	**Rabi**
VARIABLES	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
Plot area	-0.010	-0.011	-0.008	-0.004	-0.031	-0.024
	(0.014)	(0.012)	(0.007)	(0.007)	(0.022)	(0.019)
Tenancy	-0.217***	-0.148***	-0.079***	-0.079***	-0.134***	-0.123***
	(0.026)	(0.020)	(0.009)	(0.009)	(0.025)	(0.024)
Distance		-0.067***		-0.004		-0.015
		(0.017)		(0.004)		(0.019)
Irrigation		0.650***		-0.003		0.112
		(0.040)		(0.015)		(0.134)
Constant	9.721***	9.807***	9.152***	9.167***	9.534***	9.321***
	(0.024)	(0.132)	(0.011)	(0.049)	(0.033)	(0.242)
Soil Characteristics	NO	YES	NO	YES	NO	YES
Observations	9,116	9,009	8,329	8,237	4,666	4,607
R-squared	0.051	0.231	0.026	0.028	0.025	0.040
Number of hhidgrp	1,772	1,772	1,649	1,649	1,223	1,217

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Cluster effect at village level is controlled
Soil Characteristics include soil type, color, characteristics, percolation, salinity and drainage

Table 7: Tenancy and productivity (Fixed effect model)
Dependent variable: Net value of crop production on per unit of land (Rs/acre)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Net Value**	**Net Value**	**Net Value Kharif**	**Net Value Kharif**	**Net Value Rabi**	**Net Value Rabi**
Plot area	0.057*	0.061**	0.024***	0.025***	0.012	0.027
	(0.029)	(0.028)	(0.008)	(0.008)	(0.029)	(0.026)
Tenancy	-0.249***	-0.187***	-0.088***	-0.087***	-0.137***	-0.123***
	(0.039)	(0.036)	(0.008)	(0.009)	(0.029)	(0.027)
Distance		-0.073***		0.001		-0.039
		(0.021)		(0.008)		(0.024)
Irrigation		0.469***		0.009		-0.097
		(0.071)		(0.015)		(0.179)
Constant	9.341***	9.429***	8.923***	8.915***	9.037***	9.229***
	(0.047)	(0.198)	(0.012)	(0.061)	(0.044)	(0.278)
Soil Characteristics	NO	YES	NO	YES	NO	YES
Observations	9,116	9,009	8,258	8,166	4,436	4,381
R-squared	0.014	0.044	0.024	0.028	0.012	0.026
Number of hhidgrp	1,772	1,772	1,643	1,643	1,193	1,187

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Cluster effect at village level is controlled
Soil Characteristics include soil type, color, characteristics, percolation, salinity and drainage

Table 8: Tenancy and rice yield (Fixed effect model)
Dependent variable: rice yield (kg/acre)

VARIABLES	(1) **Yield** **(Rice)**	(2) **Yield** **(Rice)**	(3) **Value** **(Rice)**	(4) **Value** **(Rice)**
Plot Area	-0.011	-0.009	-0.013*	-0.011
	(0.007)	(0.008)	(0.008)	(0.008)
Distance	-0.003	-0.002	-0.000	0.001
	(0.004)	(0.004)	(0.004)	(0.004)
Tenancy	-0.066***	-0.066***	-0.071***	-0.071***
	(0.009)	(0.009)	(0.010)	(0.010)
Rabi	0.298***	0.300***	0.309***	0.309***
	(0.049)	(0.049)	(0.050)	(0.052)
Pre Kharif	0.079*	0.081*	-0.038	-0.037
	(0.045)	(0.045)	(0.057)	(0.058)
Constant	7.231***	7.218***	9.136***	9.098***
	(0.036)	(0.044)	(0.036)	(0.048)
Soil Characteristics	NO	YES	NO	YES
Observations	11,128	11,071	11,075	11,021
R-squared	0.174	0.176	0.156	0.157
Number of hhidgrp	1,763	1,763	1,755	1,755

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Cluster effect at village level is controlled
Soil Characteristics include soil type, color, characteristics, percolation, salinity and drainage

Table 9: Tenancy and input usage (Fixed effect linear probability model)
Dependent variable: dummy for whether a certain type of input is used at all or not

VARIABLES	(1) Fertilizer & Manure	(2) Pesticide	(3) Seeds	(4) Irrigation	(5) Bullock	(6) Tractor	(7) Transport	(8) Casual Labor	(9) Permanent & Family Labor
Plot area	0.009***	0.021***	0.007**	0.014***	0.013***	0.042***	0.032***	0.172***	0.007*
	(0.003)	(0.006)	(0.003)	(0.005)	(0.005)	(0.007)	(0.007)	(0.012)	(0.004)
Tenancy	-0.001	-0.022***	0.006**	-0.075***	-0.001	0.002	-0.010	-0.013	0.008***
	(0.003)	(0.006)	(0.003)	(0.007)	(0.003)	(0.006)	(0.006)	(0.008)	(0.003)
Distance	0.005	0.003	0.015**	-0.040***	-0.003	0.013*	0.005	0.011*	0.008
	(0.004)	(0.005)	(0.006)	(0.005)	(0.003)	(0.007)	(0.008)	(0.006)	(0.006)
Irrigation	0.042***	0.174***	0.018		-0.002	0.028*	0.059***	0.015	0.024**
	(0.011)	(0.029)	(0.012)		(0.006)	(0.014)	(0.014)	(0.015)	(0.010)
Constant	0.930***	0.821***	0.887***	0.552***	0.177***	0.478***	0.335***	0.859***	0.906***
	(0.026)	(0.055)	(0.043)	(0.049)	(0.036)	(0.056)	(0.058)	(0.059)	(0.040)
Soil Characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	9,164	9,164	9,164	9,164	9,164	9,164	9,164	9,164	9,164
R-squared	0.018	0.073	0.014		0.009	0.036	0.025	0.171	0.010
Number of hhidgrp	1,777	1,777	1,777	1,777	1,777	1,777	1,777	1,777	1,777

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Cluster effect at village level is controlled
Soil Characteristics include soil type, color, characteristics, percolation, salinity and drainage

Table 10: Tenancy and input use intensity (Fixed effect model)
Dependent variable: input use intensity (Rupees per acre)

VARIABLES	(1) Fertilizer & Manure	(2) Pesticide	(3) Seeds	(4) Irrigation	(5) Bullock	(6) Tractor	(7) Transport	(8) Casual Labor	(9) Permanent & Family Labor
Plot area	-0.160***	-0.176***	-0.130***	-0.087***	-0.038**	-0.094***	-0.103***	0.361***	-0.337***
	(0.026)	(0.024)	(0.026)	(0.018)	(0.015)	(0.024)	(0.023)	(0.050)	(0.024)
Tenancy	-0.114***	-0.038*	-0.062**	-0.020	0.002	0.010	0.020*	-0.088**	-0.019
	(0.024)	(0.021)	(0.028)	(0.014)	(0.010)	(0.013)	(0.012)	(0.039)	(0.017)
Distance	-0.034**	-0.035**	-0.025*	0.006	0.008	0.004	0.021**	0.012	-0.011
	(0.017)	(0.014)	(0.015)	(0.014)	(0.005)	(0.011)	(0.010)	(0.019)	(0.014)
Irrigation	0.764***	0.529***	0.734***		0.023	0.169***	0.091***	0.356***	0.453***
	(0.046)	(0.043)	(0.061)		(0.018)	(0.026)	(0.029)	(0.058)	(0.038)
Constant	6.967***	5.880***	6.395***	7.144***	6.074***	6.350***	5.628***	11.041***	10.438***
	(0.169)	(0.146)	(0.171)	(0.100)	(0.135)	(0.124)	(0.107)	(0.223)	(0.137)
Soil Characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	9,164	9,164	9,164	9,164	9,164	9,164	9,164	9,164	9,164
R-squared	0.756	0.872	0.639	0.962	0.920	0.923	0.918	0.881	0.890
Number of hhidgrp	1,777	1,777	1,777	1,777	1,777	1,777	1,777	1,777	1,777

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Cluster effect at village level is controlled
Soil Characteristics include soil type, color, characteristics, percolation, salinity and drainage

Table 11: Tenancy and land investments (Fixed effect linear probability model)
Dependent variable: dummy variable for whether investment is made or not

	Private Irri.	Bore well	Conserva -tion	Private Irri.	Bore well	Conserva -tion
Barga Land	-0.065	-0.038	-0.289	-0.066	-0.039	-0.288
	(8.63)***	(6.13)***	(37.46)***	(8.76)***	(6.25)***	(37.30)***
Log of land area	0.03	0.017	0.045	0.03	0.019	0.045
	(5.12)***	(3.53)***	(7.52)***	(5.17)***	(3.87)***	(7.45)***
Log of distance to homestead	-0.062	-0.002	-0.004	-0.058	-0.002	-0.005
	(11.56)***	(0.38)	(0.74)	(10.89)***	(0.38)	(0.85)
Soil characteristics				Yes	Yes	Yes
Observations	8329	8270	8329	8329	8329	8329
Number of households	1624	1623	1624	1624	1624	1624
R-squared	0.03	0.01	0.18	0.04	0.02	0.18

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Cluster effect at village level is controlled
Soil Characteristics include soil type, color, characteristics, percolation, salinity and drainage