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Determinants and Consequences of Land Sales Market Participation:

Panel Evidence from India

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Abstract

Although opinions on impacts of land market transfers are sharply divided, few studies explore the welfare and productivity effects of land markets on a larger scale. This paper uses a large Indian panel spanning almost 20 years, together with a climatic shock (rainfall) indicator, to assess the productivity and equity effects of market-mediated land transfers (sale and purchase) compared with non-market ones (inheritance). The analysis shows that frequent shocks increase land market activity, an effect that is mitigated by the presence of safety nets and banks. Land sales markets improved productivity and helped purchasers, many of whom were formerly landless, to accumulate non-land assets and significantly enhance their welfare.

This paper—a product of the Sustainable Rural and Urban Development Team, Development Research Group—is part of a larger effort in the group to assess the impact of land policies on poverty and economic growth. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at kdeininger@worldbank.org.

Determinants and consequences of land sales market participation: Panel evidence from India

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1. Introduction

Few interventions have been as passionately debated or subject to a larger number of policy restrictions than the operation of land sales markets. Proponents argue that the ability to sell land in a freely operating market is crucial not only to maximize productivity of land use and facilitate optimal resource allocation, but also for financial market development, by allowing use of land as collateral and thus a reduction of the cost of providing credit. The government should, it is thus argued, strive to set a framework within which land markets can operate and otherwise adopt a laissez-faire approach. Opponents retort that land is "much more than a commodity" and that, with multiple imperfections in other markets, free operation of land markets will often not enhance efficiency. They often maintain that historic inequalities in land access, together with the danger of distress sales and tendencies towards speculative acquisition and thus concentration of land will imply that, unless the government intervenes or even prohibits land sales, operation of such markets will have undesirable social and economic effects.

Although theoretical models putting land sales markets into the general context of a household's choice of an optimum asset portfolio can lead to widely divergent outcomes, empirical evidence to assess the extent to which these correspond to actual outcomes – and key underlying factors – is often scant. In fact, as land sales markets are normally very thin, large or sufficiently long samples will be required to be able to observe causes and consequences of land market participation. Existing studies are often based on comparatively small samples (Sarap 1995, Lanjouw and Stern 1998) or rely on retrospective information (Baland *et al.* 2007). The implied selectivity and lack of initial characteristics makes it in many cases difficult for analysis to go beyond simple descriptive statistics or transition matrices with little scope to help identify underlying factors and thus provide much-needed insight to enlighten the policy debate.

In this paper, we use the case of India to examine the mechanisms underlying the operation of land sales markets and their longer-term impact in comparison to non-market mechanisms to obtain land. We use a large panel data set spanning almost 20 years to provide information on initial household-level conditions, complementing this with rainfall data to construct a measure of climatic shocks. Descriptively, this allows us to compare changes in wealth, landholdings, and expenditure between groups of land market participants (purchasers, sellers, and those remaining in autarky). Availability of the same type of information for participants in non-market transactions facilitates comparison of the functioning, characteristics of participants, and longer-term impact of transfers through land sales and purchase markets with those of transfers affected through non-market channels. An ordered probit model provides a basis to assess determinants of demand and supply of land for sale or purchase simultaneously, recognizing that factors affecting participation decisions are likely to be different from those affecting the magnitude of demand or supply for those who participate. This can be used to make inferences on likely

productivity impacts of land markets and assess the extent to which imperfections in markets for credit and insurance may lead to undesirable land sales.

There are three key findings. First, the fact that the producers' propensity to participate in land sales markets was significantly increased by the number of times they experienced an unfavorable shock suggests that, in the areas concerned, credit market imperfections and subsistence constraints are still an important determinant of land sales. This is supported by our finding that ways to mitigate shocks, in particular local presence of safety nets in the form of the employment guarantee schemes and banks, if interacted with the frequency of shocks, helped counteract such negative impact. Second, although they were significantly less active than rental markets, land sales markets helped equalize factor ratios and allowed the relatively land-poor and labor abundant to improve their levels of asset ownership and welfare without making sellers worse off. Finally, once the impacts of credit market imperfections, government policies (restrictions on land sales by tribals) and life cycle events are controlled for, land sales transferred land to better cultivators, thereby contributing to net gains in productivity. Neither the factor equalization nor the contribution to improved productivity found here for land sales emerged for non-market transactions of land. More importantly, and in addition to performing much better than non-market alternatives, land sales markets were significantly more active where overall economic growth was higher, suggesting that as the economy develops and other obstacles and factor market imperfections are gradually dealt with, they are likely to performed an even more important role.

The paper is structured as follows. Section two discusses the conceptual framework and some empirical evidence on operation of land markets, motivates the paper by reviewing studies of the operation of land sales markets in India, and uses these to define the econometric model. Section three describes data sources and provides descriptive evidence on the incidence of land transfers through market- and non-market channels as well as characteristics of participants before and after accessing land. Section four presents results from estimation of an ordered probit model to assess the productivity- and equity- impact of land ownership transfers. Section five concludes by summarizing key findings, policy implications, and areas for future research.

2. Conceptual framework and empirical evidence

In this section, we summarize the conceptual framework as well as global evidence on functioning of land sales markets and review how this links to the Indian context and the results from studies conducted in this country. We use this to discuss the estimation strategy, an ordered probit model where we distinguish productivity- and life-cycle related factors affecting latent land demand from the frictions caused by various market imperfections which may either prevent those with effective demand from exercising it or push those who would otherwise not sell land into doing so because of other constraints.

2.1 Conceptual framework and empirical evidence

If households did not face subsistence or borrowing constraints, implying that they could fully insure against risk, everybody had access to the same set of information, and switching transaction partners was costless, the market for land sales would not be different from that for land rental. Demand for land would be determined by producers' ability to make best use of the land in farming and relative land endowments and market transactions will enhance social welfare by allowing small producers with higher levels of productivity to bid land away from large and less productive land owners (Zimmerman and Carter 1999). Land prices would equal the net present value of the stream of profits from the best available land use, and potential buyers would be indifferent between renting land and purchasing it.

However, policy-makers' concern about land markets leading to outcomes that may be neither socially nor economically optimal originates in three observations, namely that (i) imperfections in markets for credit and insurance will affect decisions on whether or not to participate in land markets, and that in particular subsistence constraints can become of relevance. (ii) differences in producers' access to information will lead to variation in transaction costs; and (iii) land may be acquired for speculative purposes unrelated to its use in agricultural production. The relevant considerations guiding households' decisions on land sales or purchases in the context of their choice of an optimal asset portfolio over their life time horizon have been illustrated in a large literature (Deaton 1991, Rosenzweig and Wolpin 1993, Fafchamps *et al.* 1998, Dercon and Krishnan 1998). The decision problem faced can be illustrated by considering the option of holding two assets, one, e.g. land, with high returns but that is also risky and illiquid, and another one, e.g. grain, with lower returns but less risk and higher liquidity. At every point in time, households choose a combination between these two assets to maximize utility over the entire lifetime and subject to limits for borrowing and an overall budget constraint.

While an analytical solution to this problem is impossible unless more structure is imposed, numerical simulations show that credit market imperfections and risk, households' need to satisfy basic subsistence needs can give rise to land being supplied to the market by producers who are forced to sell under duress in bad years, often to individuals with access to non-covariate income streams outside the local rural economy or large amounts of assets (Zimmerman and Carter 1999). In high-risk environments this may lead the poor to rationally prefer assets with a lower but more stable return to land even if transaction costs were modest and they had access to credit to acquire it. With imperfect credit markets, some households will be able to buy and accumulate land not because they would be more productive but due to their ability to better overcome such market imperfections (Carter and Salgado 2001, Zimmerman and Carter 2003). Similarly, others may be forced to sell use land markets to sell land in exchange for less risky assets to minimize their exposure to risk even though they would be able to make more productive

use of the land than those who acquire it (Rosenzweig and Binswanger 1993). In addition to these factors, macroeconomic instability, expectations of future land price hikes, lack of sufficiently attractive alternative assets, policies, and the valuation of land for non-productive reasons, all will affect households' participation in land sales markets independently from their innate productivity.[1] We model these two sets of factors that will affect land markets in a rather independent manner in our ordered probit estimation as discussed below.

A direct consequence of this is that the productivity and equity impacts of operation of a land sales market will depend on the extent to which other markets function and net effects of land sales markets are ambiguous *a priori* and will have to be decided empirically. If risk is negligible or credit markets work well, one would expect land markets to equalize factor endowments and transfer this factor to more able producers. In fact, this seems to be confirmed by evidence from Paraguay (Carter and Galeano 1995) and Guatemala (Barham *et al.* 1995) where sales markets in the context of an export boom transferred land to more productive producers.[2] In fact, in central Uganda, land sales were found to perform a redistributive role (Baland *et al.* 2007). Similarly, starting with a relatively egalitarian land ownership distribution, land sales markets in Vietnam helped to improve efficiency and equity by transferring land from large and less productive owners to more productive smallholders (Deininger and Jin 2007).

By contrast, in regions where covariate shocks such as floods or droughts are prevalent, one would expect the outcome of land market transactions to be more ambiguous. Comparing neighboring villages from Bangladesh and India, it is found that, while in those that had access to safety net programs, the majority of land sales were undertaken to undertake productive investments, in places where such safety nets to smooth consumption were absent, the majority of land sales were prompted by distress to obtain food and medicine. In Chile, capital market access soon led to re-concentration of land through sales markets (Echenique and Rolando 1991, Carter and Salgado 2001), something that may also underlie the phenomenon of land concentration observed in a number of African countries (Jayne 2003).

2.2 Land sales markets in India

As the country inherited a highly unequal distribution of land from its colonial rulers, it is not surprising that land reform was at the center of policy discussions for a long time. In this environment where other factor markets were highly imperfect, distress sales had historically played a major role (Kranton and Swamy 1999). Evidence suggests that households' access to insurance substitutes allowing them to buffer

[1] For example, inflation and changes in real returns on alternative uses of capital were shown to be key factors explaining changes in land prices in the United States. In Eastern Europe, the expectation of large capital inflows due to EU accession was a major reason underlying real estate booms that propelled land prices far beyond the net present value of the flow of services that could be derived from the land (Deininger *et al.* 2004, Csaki *et al.* 2004).

[2] Note that his is not universal and that the impact of export booms depended significantly on local conditions (Barham *et al.* 1995).

consumption during crisis had a significant impact on whether land sales markets helped to equalize endowments or contributed to further dis-equalization (Cain 1981). To halt these tendencies, virtually all states implemented, during the 1960s and 1970s, different types of land reform measures, mainly in the form of land ceilings and security against eviction as well as rent ceilings for tenants.[3] In addition to these, legislation in virtually all states prohibits land transfers from tribals to non-tribals. Transaction cost are further increased by stamp duty which has to be paid upon registration of a sale and which in most cases amounts to more than 10% of land value (Alm *et al.* 2004).

Literature on functioning and impact of land markets in India falls into two broad categories. A first strand uses national surveys to describe changes in the land ownership distribution. Evidence, though not always clear-cut points towards increased fragmentation due to population growth, a significant reduction in the number of large landholdings, and a slight decrease in the share of landless households especially during the 1960s that is often attributed to land reform implementation (Sharma 1994). As the policy implications from this are limited, a second line uses micro-data from small and localized samples, often following both parties to a transaction and exploring contractual details and reasons to transfer the land, to describe land market functioning. These studies highlight that land sales markets are much thinner than those for rental and, in addition, allow identification of a number of regularities.

They suggest that land and labor endowments are of great relevance in affecting land market outcomes and that markets have often transferred land from very large and very small owners towards the middle (Agarwal 1994). Better access to technology tends is found to improve farmers' ability to acquire land through sales markets (Grewal and Rangi 1981) and there is strong evidence that higher levels of non-agricultural development and the associated access to non-agricultural income improve the extent to which land sales market outcomes conform to those predicted by economic theory by improving the extent to which other factor markets function (Vijay 2002). These encouraging findings are countered by widespread evidence that, because land is not only an economic asset but also valued for a variety of non-economic reasons that include social status and power within the village (Neale 1985) and because credit markets are often highly imperfect, distress sales are quite frequent in rural India (Sarap 1998, Rawal 2001) as emergencies situations such as drought or sickness force households to liquidate their assets.

2.3 Estimation strategy

We use the above as a motivation to explore three issues, namely (i) whether land sales promote efficiency of land use by transferring it to households with higher levels of ability; (ii) the extent to which

[3] Ceilings on the amount of land that could be held by an individual or household although implementation effort varied widely and generally was much delayed until the early 1970s. Contrary to Korea, where land owners' anticipation of such ceilings led to a tremendous increase in land sales market transactions that transferred income to former tenants and increased productivity (Jeon and Kim 2000), they were largely evaded by spurious subdivisions (Kaushik 2005). Where, as in West Bengal, implementation of land reform legislation was effective, ceilings are still credited with having led to greater land sales market activity (Bardhan and Mookherjee 2006).

land sales contribute to equalization of endowments, i.e. transfer land from labor-poor and land-rich to labor-rich and land-poor households; and (iii) whether shocks and policies affect the outcomes observed in land sales markets. Further, we are interested to see how land sales compare to non-market transfers.

To answer these questions, we distinguish factors that affect households' or dynasties' latent demand for land due to their level of productivity from other factors, unrelated to productivity, that may prevent them from exercising this demand or force them to sell even if doing so runs counter to long-term maximization of productivity. To do so, we use an ordered probit model with variable upper and lower thresholds for land market participation. Latent demand is determined by their current and expected future ability to make productive use of the land. Actual participation decisions will, in addition, also be affected by factors unrelated to productivity such as transaction costs, shocks, and other factors that may affect their land market participation, either by preventing them from purchasing land or forcing them to engage in distress sales despite the fact that doing so will undermine their long-term productive capacity.

Letting latent demand for land under agricultural production be determined by a producer's level of agricultural ability α, their dynasty's initial land endowment $\overline{A}$, their initial stock of labor L, and capital K, and their stage in the life cycle N. The latter is included as it will affect future availability of labor and, to the extent that assets will be transmitted through non-market channels, capital. This implies that latent demand for land depends on long-term productivity which can be expressed as a reduced form equation

$$f(\alpha, \overline{A}, L, K, O) = \beta_0 + \beta_1 \alpha + \beta_2 \overline{A} + \beta_3 K + \beta_4 L + \beta_5 N \qquad (1)$$

Thresholds for the transition between sales and autarky and autarky and purchase are defined as follows:

$$p^S(T) = \eta_0 + \eta_1 S + \eta_2 C + \eta_3 G + \eta_4 (C \times S) + \eta_5 (G \times S) + \eta_6 \boldsymbol{Z} \qquad (2)$$

$$p^B(T) = \delta_0 + \delta_1 S + \delta_2 C + \delta_3 G + \delta_4 (C \times S) + \delta_5 (G \times S) + \delta_6 \boldsymbol{Z} \qquad (3)$$

where S denotes whether or not the household experienced a weather shock, defined as a level of rain below the average for two consecutive growing seasons, C denotes credit access, G local availability of mechanisms for risk coping, in particular the employment guarantee scheme, $\boldsymbol{Z}$ is a vector of other characteristics, and the βs, δs and ηs are parameters to be estimated.

Factors affecting the extent of participation in the main equation are the level of ability and the dynasty's endowment with land, labor, and assets, the length of the households' independent existence in 1999 and the position in the life cycle which are represented empirically by a dummy for whether a household is from a landless dynasty and the dynasty's land endowment to represent A and initial asset

endowments and levels of per capita consumption to proxy for K. To proxy for lifecycle events and concerns about inter-generational transmission, the number of unmarried sons aged between 5 and 25 years in 1981. We expect $\beta_1 > 0$ and $\beta_2 < 0$ as high levels of agricultural ability increase producers' marginal product and thus their competitiveness in land markets while standard assumptions for the production function imply a negative relationship between land endowment and marginal product. In other words, higher agricultural ability or lower land endowment will make a household more likely to transit from autarkic to land purchase and less likely to move away from autarkic to land sale. As, with imperfections in credit and labor markets, higher levels of wealth or family labor will increase a household's marginal productivity, we expect$\beta_3>0$, $\beta_4>0$, and $\beta_5>0$.

Concerning the variables in the threshold equations, note that $\boldsymbol{Z}$ includes policy constraints on tribals' land market participation, the inequality of land holdings in the village that will affect transaction costs in the land market, and the growth rate of village income to proxy for non-farm opportunities. We expect negative weather shocks to increase the supply of land to the market through (distress) sales and safety nets to reduce it as they improve poor people's ability to cope with unanticipated shocks, thus $\eta_1>0$, and $\eta_3<0$. While presence of banks also improves the ability to cope with shocks, it will also provide greater liquidity that would increase land market activity, making the sign of η_2 indeterminate. As safety nets and banks improve the ability to cope with shocks, we expect $\eta_4<0$ and $\eta_5<0$.

On the supply side, we would expect shocks (village employment schemes) to increase (decrease) land supply to the market, hence $\delta_1<0$, and $\delta_3>0$. By the same liquidity argument as above we expect that $\delta_3<0$. If access to banks and safety nets reduces the supply of land to markets through distress sales and less supply would reduce the number of those being able to buy land, we expect $\delta_4>0$ and $\delta_5>0$. Finally, the presence of constraints on market participation by tribals leads us to expect a negative (positive) sign on the coefficient for ST/SCs in the upper (lower) threshold equation. On the other hand, by increasing the scope for productivity-enhancing land transactions, economic growth at the village level is expected to increase land market activity, thus we expect the coefficient on this variable to be positive (negative) in the upper and lower threshold equations, respectively.

A critical parameter in line of argument this is α, producers' initial level of agricultural ability. To obtain an estimate of it, we use a stochastic frontier production function.[4] With a Cobb-Douglas functional form, we can specify such a function as $q_i = \phi_o + \phi x_i + u_i - v_i$ where q_i is the logarithm of crop output, x_i is a input vector including sown area, land, material inputs (i.e., fertilizer, seed, etc), fixed

[4] The main reason for estimating a frontier production function is that doing so provides us with an estimate of producers' initial level of efficiency. This comes at the cost of possible contamination as a host of other time-specific effects are included in our measure of ability. To ensure that this does not unduly affect our results, we cross-checked using a measure of ability derived from a panel production function. Results, which are available upon request, are in line with those reported here.

assets, and household characteristics that may affect crop output, and ϕs are the parameters to be estimated. Assuming that the disturbance term is composed of two additive components where v_i is pure white noise, and $u_i \sim N^+(0, \delta_u^2)$ is a term that follows a truncated normal distribution with zero mean that can be interpreted as producer's level of technical inefficiency (Coelli 1995). A measure of ability or technical efficiency $TE_i = exp(-u_i)$ can then be predicted directly.

To compare effects of market transactions to those of non-market transactions (i.e., inheritance, gift, dowry, etc), we run an identical ordered probit model to identify key determinants for non-market land transfers with some modifications of the variables to be included in the ordered probit model. For example, the entire argument of transaction costs associated with land sale and land purchase will not be relevant to inheritance and gift exchange. Correspondingly, we treat the two thresholds in the ordered probit model as constant rather than variable. As discussed in the estimation strategy section, we treated the lower and upper bounds of the ordered probit model as constant because the transaction costs are unlikely to be relevant to non-market transactions. To allow direct comparability for robustness check, we also estimate the ordered probit model with variable upper and lower bounds for the non-market land transaction (see appendix table 2), and results are similar to those reported earlier.

3. Data sources and descriptive evidence

The main source of data used in our analysis is two rounds of NCAER's ARIS/REDS survey that were conducted in 1982 and 1999, respectively. This survey, the first rounds of which were implemented in 1968-71 to evaluate the impact of an agricultural development program, covers all of India's major states. Even though the first round sample, which is stratified by farm size and wealth class, was limited to project areas, the survey was significantly expanded in 1982 to make it more representative at the national level, covering slightly less than 5,000 households (Foster and Rosenzweig 1996). The 1999 sample contains all of the households included in 1982 as well as replacements for those who were no longer present. If the original household had split, all of the households belonging to the same dynasty in the original village plus a sub-sample of successor households outside the village were interviewed, bringing the total to about 7,500 households (Foster and Rosenzweig 2004).

Data from household and community surveys are complemented by information on income and land ownership by all villagers from the survey listing. Moreover, to assess the impact of climatic shocks, we complement household data with information on rainfall for each month in the 1970-2004 period at the regional level. We use these data, together with the long-run average for each month, to defined a climatic shock as rainfall being more than 50% below or above the long-term mean for two consecutive growing seasons and will use this as one of the right hand side variables in the regressions.

3.1 Household characteristics and nature of the sample

Descriptive statistics for the whole country and its four main regions[5] in both periods treating the 1982 and 1999 rounds of the panel as repeated cross sections are reported in table 1. While there was some decrease in household size, which decreased, from 7.0 to 6.0, with about 4 persons in the 14 to 60 age category, 0.4 aged above 60, and 2.5 below the age of 14 (compared to 1.8 in 1982), we note a marked increase in educational attainment, as illustrated by the fact that years of education attained by household heads increased from slightly less than 2 in 1982 to 5 in 1999. The gap that had earlier separated northern and southern states narrowed considerably. At the same time, population growth has led to a decline in the average land endowment per person, from 1.5 ha in 1982 to 0.8 ha in 1999, and a small increase in landlessness, from 21% to 25%. The share of female headed households is, with 6.8%, almost identical in both periods, with female headship more pronounced in the South than in other regions.

Survey data point towards an annual increase of per capita income of 3.1% during the period under concern. This masks pronounced differences across regions with the South having caught up and even replaced the North as the region with the highest income in the second period. The overall improvement in living standards suggested by increased income is mirrored by a significant rise in asset values of approximately 6% per year.[6] Income shares point towards a modest level of diversification of income sources. While income from crop and livestock production dropped by about 9 percentage points, from 59% to 51% employment in own agriculture remains the most important source of income in India's rural economy. The fact that this is followed by agricultural wage employment, the share of which has actually increased over the period (from 18% to 27%) points to a continued importance of agriculture and the importance of agricultural wage employment for the landless.

The share of household income from self-employment and salary employment in rural India has been more or less constant; implying that growth of the rural non-farm sector has been just large enough to absorb population growth. This contrasts with other countries where the rural non-farm economy developed as a result of out-migration of labor or due to households taking up non-farm self employment. In fact, according to our data, the main source of income diversification was growth of non-farm wage employment, participation in which increased from 8.6% in 1982 to 20% in 1999. This fact, which is also noted elsewhere (Foster and Rosenzweig 2004), could result from the government's emphasis on creating rural employment through mechanisms ranging from direct subsidies for firms to set up in remote areas to industrial and labor market regulation such as small scale reservation acts (Besley and Burgess 2004).

[5] We group states into four regions as follows: The North includes the states of Haryana, Himachal Pradesh, Punjab, and Uttar Pradesh; the West includes Gujarat, Maharashtra, Madhya Pradesh, and Rajasthan; the East includes Assam, Bihar, Orissa, and West Bengal; and the South includes Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu.

[6] Part of this increase may be due to improvements in the survey instrument which, by asking for assets in a more disaggregated manner, is likely to have measured assets much better in the second period. As data for 1982 were available only in pre-aggregated form, we can not test this.

While overall asset endowments have increased, the broad composition of households' asset portfolio shows greater stability; the house and consumption durables make up the largest share in both periods (61% and 66%, respectively in 1982 and 1999), followed by farm assets including livestock (18% and 22%), and financial and off-farm assets (11% and 21%).

We use information on households' land ownership and income as reported in the listing exercise to compute the Gini coefficient for self-assessed income for all households in sampled villages. With a Gini coefficient of 0.32 in the first and 0.36 in the second period, inequalities in income have increased between the two periods. It is worth noting that, with a land Gini coefficient of 0.60 in 1982, inequality in assets is higher than income inequality, as also found in other parts of the world. As in the case for income, this measure of inequality increased slightly. Improved access to formal banks at the community level (75% in 1982 to 88% in 1999) will be associated with greater availability of savings instruments as well as credit, thus improving the scope to smooth consumption over time. Coverage with the EGS is available only for 1982 as the same type of program was implemented under different names in 1999.[7]

3.2 Incidence and determinants of land transfers

The share of households that, in 1982-1999, obtained or transferred land through market (i.e. sale and purchase) compared to non-market (i.e. inheritance) mechanisms, is presented in table 2. With 15% and 8% (or 0.88% and 0.47% annually) of the population and 9% and 5% of the land involved in purchasing or selling land, respectively, the level of land sales market activity in the data is in line with what has been reported by other Indian studies (Mani and Gandhi 1994, Dreze *et al.* 1997, Rawal 2001).[8] It is of interest to note significant regional differences, with land purchase markets being quite inactive in the North (6% of population and 3% of land) but relatively active in the South (25% and 18% of population and land). The fact that access to land through non-market channels is, with 10% in terms of households (or 7% in terms of land), less frequent than access through markets, with overlap between the two being minimal. Also, even in the most active areas, land sales and purchase markets are much less active than those for rental in which 15% and 9% participated in 1999 alone (Deininger *et al.* 2007). As attrition was carefully controlled for, and most household splits were actually traced, the fact that the share of those reporting to have purchased land during the period is higher than that of those who sold is most likely due to the fact that sellers sold land in small plots to more than one buyer.

Moving from aggregate to household-level information, table 3 describes initial and final characteristics for the whole sample and by households' participation in market transactions (i.e., selling,

[7] Note that, because in our econometric estimation we use only availability of such a scheme in the initial period, this will not affect estimates.
[8] Rawal (2001) reports a number of studies from India that find that in most cases the share of land transacted annually was below 0.5%. Part of the reason for this low figure may be the fact that in the studies quoted, the denominator was total village land rather than the land owned by survey respondents.

buying, and remaining in autarky, in columns 2, 3 and 4) and non-market transfers (i.e., inherited out and autarky in columns 6 and 5) during the period under concern.[9] The top panel provides information on initial conditions in 1982 while the bottom panel illustrates the status in 1999. We first discuss information for market-participants followed by that for groups according to their non-market participation. [10]

Initial conditions for market participants allow three main conclusions. First, the data point towards strong equalization of factor endowments through land sales; households who sold land had significantly smaller initial adult populations and per capita landholdings than purchasers (3.8 vs. 4.4 persons in the 14-60 age group and 2 vs. 1.3 ha per capita, respectively) and 15% of those purchasing land came from a landless dynasty.[11] At the same time, there were no significant difference in initial non-land asset endowments or the level of per capita income between those who purchased and sold land and those remaining in autarky although the two former groups had slightly higher initial consumption levels than the latter. Second, the fact that the number of unmarried sons and daughters for sellers (1.08 and 0.78) and buyers (0.88 and 0.68) is markedly above that of those in autarky (0.73 and 0.51) points towards a link between land market participation and live cycle events. Finally, with 9% and 13% in sales and purchase markets, compared to 17% overall, land market participation by scheduled caste households was uniformly low.

Shifting from initial to final conditions in the bottom panel of table 3 provides a number of insights. First, while differences in household size persisted in 1999, those who purchased land had made welfare gains that were more than 50% above those for the rest. Compared to initial levels that were not different from those by the rest or even slightly below average, purchasers' levels of final asset ownership (Rs. 86,748 vs. about 57,000 for the rest of the sample), per capita income (Rs. 4,063 vs. 2,500), and expenditure (1,908 vs. 1,579 and 1,724), were all significantly above non-participants' and sellers' in 1999.

This was accompanied by purchasers shifting from the bottom of the three groups in terms of per capita land endowment to the top, with a significantly higher end-period level of 1.12 as compared to 0.7 ha per capita, for the rest of the sample. The extent to which such performance was underpinned by higher levels of productivity will have to be explored in the econometric analysis. Although 29% of sellers in the

[9] Columns 2-4 identify changes in welfare over time between those who sold and purchased while columns 5 and 6 point towards generational differences between the old and the young generation for households who transferred land through inheritance and those who did not. In both cases, the results of t-tests for the significance of differences between the group transferring land and those remaining in autarky are indicated by stars as explained in the table.

[10] The discrepancy of number of observations between 1982 and 1999 (5932 versus 3816) is due to household splits in the 1982-99 period. Of the 3816 households of the initial sample that could be traced in the second round, 1174 split and formed a total of 3290 new households while 2642 did not experience any change, bringing the total number to 5933.

[11] In other words, more than 60% of those who had been landless at the start of the period were able to acquire land through the market. At the same time 2% of the sample who were landless in 1982 managed to acquire land but had sold it by the end of the period.

sample became landless, their asset and income levels in 1999 were not significantly different from those in the autarky group with their per capita income significantly above the latter. Even though some sales may have been undertaken out of distress, those who sold land did, on average, not become worse off and may even have done slightly better than the rest, e.g. because they took up non-farm activities.

Turning to participants in non-market transactions, we note that, in the parent generation, those inheriting out had significantly higher levels of land endowments, assets, incomes, and unmarried sons or daughters than the rest. However, different from what had been observed for market transfers, households who received land through inheritance did not manage to accumulate non-land assets or increase their consumption over time faster than those who did not benefit from such inflows. Although their per capita land endowment was, with 0.97 as compared to 0.72 ha still significantly above that for the rest, levels of assets and per capita consumption both were insignificantly different from those for autarky households. Although they have a slightly higher level of income than those who did not inherit, the difference is smaller than for those who purchased land. This suggests not only that markets are an important avenue to access land for those born into a landless dynasty but also that the latter are better able to make beneficial use of such land than those who inherited it.

4. Econometric Results

We report results from the Cobb-Douglas production frontier function and the ordered probit regression for sale's market participation as well as the probit regression results for non-market participants. The coefficients for most of the inputs in production function are as expected with the most contribution from land. Results from the ordered probit equation are also in line with expectations, indicating among others that households with better agricultural ability, more sons between 5-25 in 1981, and landless dynasty households, are more likely to purchase land. The results also point towards imperfection of credit markets having had an impact on land markets via distress sales.

4.1 Participation in land sales markets

To obtain a measure of dynasties' agricultural ability, a production function, coefficients for which are reported in appendix table 1, was estimated. The high value (0.77) of the R^2 for the OLS regression points towards a very good fit. Coefficient estimates from maximum likelihood estimation of the Cobb-Douglas stochastic production frontier are similar to those obtained by OLS. Land is estimated to be by far the most important input to crop production; doubling cultivated land area alone would lead to an almost 50% increase in total crop production. This is followed by labor with an estimated elasticity between 18.8% and 20.8.%. Compared to these two variables, returns to other factors are estimated to be more moderate with elasticities of about 5%, 4%, 2.5%, and 2.3% for fertilizer, assets, other, and pesticide expenditures.

While neither education nor the gender of the household head are significant, having all of the farm area under irrigation is estimated to increase output by between 31.5% and 34.2%.

Ordered probit results for estimation of the main equation and the cut-off points for participation are reported in table 4. Column 1 includes shocks and mitigation variables separately while column 2 interacts both to explore the risk mitigation effect of the latter more directly.[12] A first finding of interest from the main equation is the productivity-enhancing impact of land markets that is illustrated by the positive coefficient on our measure of dynasties' initial ability, suggesting that sales markets transferred land to dynasties who had been more efficient producers in 1982. Interestingly, imperfections in credit market, to the extent that they did exist, were not strong enough to overcome this tendency.[13] Compared to the least efficient dynasty in the sample, a member of the most productive would have a probability of purchasing land (over the whole period) that is higher by about 3.8 percentage points (or 25%). The main equation also supports the hypothesis of factor equalization through land sales markets as can be seen from the negative coefficient on the dynasty's land endowment, together with the positive and highly significant coefficient on whether or not a household came from a landless dynasty. According to the coefficient, members of a landless dynasty were 15 points more likely to buy land than ones with the highest land endowment in the sample. The data also support the live-cycle hypothesis, suggesting that those with unmarried sons in 1982 were significantly more likely to purchase land.[14] In addition, as we would expect, households with a longer independent existence were more likely to participate in land markets. Finally, the insignificant sign on household's total non-land assets suggests that, surprisingly, once other factors were controlled for, ownership of other assets did not make it easier to purchase or sell land.

Results from estimating the lower bound between land sales and autarky and the upper bound between autarky and purchase lead to a number of additional results of interest: The positive (negative) sign of climatic shocks in the lower (upper) bound equations suggests that being affected by lack of rainfall or floods for consecutive seasons significantly increase the odds of a household selling land and thus also increased the odds of purchasing. Mechanisms to mitigate risk, in particular the employment guarantee scheme (EGS), helps to counteract much of this effect; in fact we are not able to reject the hypothesis that, in communities where the EGS was present, climatic shocks did not affect the cut point between sale and autarky or autarky and land purchase. Finally, and in line with expectations, scheduled castes and tribes (SCs and STs) are significantly less likely to sell land. The lower propensity to sell can

[12] Recall the coding of 1 for sale, 2 for autarky, and 3 for purchase.
[13] As agricultural ability is not available for those whose dynasty did not cultivate land in 1982, estimation of the ordered probit model without farming ability increases the sample by about 1,400. Results, which are available upon request, are generally consistent with those reported here. To interpret the results, recall that the coding 1 is for sale, 2 is for autarky and 3 is for renting in, i.e. that a positive coefficient implies that the variable under concern increases the probability of land purchase and reduces that of a land sale.
[14] As presence of sons in the relevant age range is highly correlated with that of daughters (ρ= 0.4), we include only the former.

be explained as a possible result from policies restricting land sales by tribals whereas the fact that tribals' ability to interact with higher caste individuals is constrained may underlie their more limited participation in purchases.

Land sales and purchases are also found to have been more frequent in communities with bank access than in those without. As local economic growth, which could be correlated with banks' location choice, is controlled for, the better liquidity afforded by bank presence is most likely at the root of this. Interestingly, interacting bank access with the number of drought shocks leads to a significant leftward shift of the cut-point between sales and autarky, supporting the hypothesis that, by providing credit and other insurance substitutes, presence of banks reduces the propensity for distress sales. Higher growth at the village level is estimated to shift the upper bound down, i.e. to encourage land purchases, without affecting the boundary between sales and autarky. The finding that an unequal land distribution (proxied by the Gini) at the village-level shifts the boundary between sales and autarky upwards while leaving the upper bound unaffected, could suggest that the threat of ceiling legislation being implemented prompted land owners to sell off land in anticipation of such policies (Bardhan and Mookherjee 2006).

4.2 Participation in non-market transfers

Results from estimating a simple probit equation for participation in non-market transactions, are reported in table 5. Our ability measure is not significant for inheriting out regression and only marginally significant for inheriting in. While inefficient producers would be better off transferring their land to others, they do not do so through non-market channels and it would be of interest to explore to what extent rental markets are used by those who receive land through non-market transfer to bring about a more productivity-enhancing outcome. By contrast, life-cycle factors are of high relevance; larger households and those with more unmarried children are more likely to transfer out land through inheritance while longer independent existence of a household makes it more likely to have received land thorough this channel. Not surprisingly, other village- and household-level variables included in the land market regression do not have any impact on non-market transactions.[15]

In addition to not contributing to higher productivity, non-market transactions also do not help to equalize the land ownership distribution. The positive but small coefficient of the initial land endowment in the transfer-out equation highlights that those with higher endowments are more likely to transfer out land but the initial endowment does not have a significant effect on the probability of receiving land through non-market channels. Also, not too surprisingly, being from a landless dynasty makes it harder to gain access to land through inheritance or gifts. This would imply that, even if there may be undesirable

[15] We estimated equations where overall growth in the village, access to banks and employment guarantee schemes, shocks, and the land distribution were included but none of them are significant.

aspects of land markets that policy may try to mitigate, they still provide an advantageous avenue to access land. The positive and significant coefficient for initial asset value in the inherited in regression suggests that, not too surprising in an environment where land ownership and assets are unequally distributed, access to land through non-market transfers is limited to the better off and any redistribution that may be involved will be limited.

4.3 Comparing market and non-market transfers

To facilitate comparison between market and non-market mediated land transfers, we estimate a probit similar to the one in table 5 for market transactions. Results, reported in appendix table 2, support the notion that, most likely due to the more limited range of potential transaction partners, the performance of non-market transactions is inferior to that of market-mediated land transfers in most of the parameters of interest. Consistent with ordered probit results, key differences between market-mediated and non-market land transfers are confirmed with respect to productivity, equity, climatic shocks, and the village characteristics. On the supply side, we find that, contrary to non-market transactions, less efficient producers with a higher per capita land endowment (significant at 10%) who had been in existence for a longer time are more likely to sell land while SC/ST households are less likely to do so. A more unequal land distribution at the village level as well as having experienced climatic shocks and a presence of banks increases the likelihood of land sales while the interaction between banks and shocks reduces it. Most of the household level variables on the demand side are just a mirror-image of those estimated on the supply side, supporting the notion that, although they are affected by credit market imperfections, land sales markets provide much greater opportunities for the landless to acquire land and for overall improvements in productivity of land use than those afforded by non-market transactions. Furthermore, the lack of significance of coefficients on all the village characteristics for non-market transfers supports their essentially static character compared to the more dynamic evolution of market-mediated transactions in response to a changing environment.

5. Conclusion

The evidence provided here suggests that land sales markets respond to a complex set of factors, the relative importance of which evolves over time. Detailed descriptions of activity in land markets, as well as non-market transactions of land, over a horizon spanning almost 20 years provides an opportunity to get a much richer and more nuanced understanding of the operation of land sales markets than what has been available in existing studies, while at the same time highlights differences in land transfers through non-market mechanisms. From a policy perspective, this allows better understanding of the opportunities and risks of land markets.

The finding that distress sales are an issue highlights that, if other markets are incomplete, land markets can indeed lead to involuntary loss of land although, in line with the literature, we find no evidence of this leading to concentration of rural land. At the same time, the mitigating effects of public safety nets and banks found here suggest that it may be preferable to explore mechanisms which those affected can use to better cope with risks and thus avoid undesirable land sales arising from distress situations. Attempts to prevent such sales by administrative fiat will be difficult to enforce and have often backfired by worsening the terms of distress sales rather than preventing them (Deininger 2003). Our analysis contributes in this area by demonstrating the limitations of non-market channels in bringing about efficiency-enhancing land transfers and providing land access to the land-poor and landless.

The potential of distress sales notwithstanding, land sales transactions contribute to equalization of factor ratios and unambiguously improve productivity in the rural economy, as illustrated by the positive and highly significant coefficient on producers' ability and their initial land endowments. The extent to which land markets helped to further equity and productivity is particularly pronounced if compared with non-market transactions that have not had a strong impact in either dimension and are found to hardly react to the changing social and economic environment. By comparison, our results illustrate that land sales market activity increases with economic growth, in line with the notion that greater participation in the off-farm economy generates opportunities not only for efficiency-enhancing reallocation of land, but also for new investment that can be promoted by land sales. Over time, especially as economic growth helps to improve the functioning of other factor markets, the scope for efficiency-reducing distress sales is likely to be reduced or even eliminated.

Our results suggest that policies, both in the form of safety nets helping households overcome the impact of shocks, and in the form of prohibition of land transfers by SC and ST households that have visibly reduced market participation, do affect land market outcomes. Together with the limited scope of non-market transfers to either improve productivity or open up avenues for land access by the landless, this suggests that, rather than trying to prevent land sales through administrative fiat, it may be preferable to explore mechanisms that those affected can use to better cope with risks and thus avoid undesirable land sales that arise from distress situations.

Although the data available here facilitated application of a more rigorous empirical framework to the operation of land sales markets than possible in previous studies, there are a number of unresolved issues that could provide a fruitful basis for further research. One is that prices paid for land transactions were not available in our data. Information on these, relative to average land values, would be important to better assess and define 'distress sales' and better understand their potential welfare impact and ways in which they may come about. Further, as state governments throughout India obtain significant revenues

from levying comparatively high stamp duties, the precise levels of which have changed over time, on land transactions, information on prices paid or declared prices could also provide information on the impact of policies on activity in formal and informal land markets. Closely related, the problems posed by the attrition in our sample make it difficult to be certain on longer-term impacts of land transactions which would be necessary to substantiate the claim of distress sales having negative equity effects or,– equivalently, to demonstrate benefits of land sales for those who used proceeds to invest in economic pursuits. Efforts to follow those who dropped out of the sample and thus deal with attrition in a more rigorous and comprehensive manner could help gain insights to into these critical issues.

Table 1. Household characteristics by region and time

	1982					1999				
	All	**North**	**West**	**East**	**South**	**All**	**North**	**West**	**East**	**South**
Basic Characteristics										
Household size	6.97	7.49	7.27	7.33	6.03	6.01	6.71	6.04	6.38	5.16
Members < 14 years	2.47	2.70	2.74	2.57	1.94	1.85	2.16	2.01	1.93	1.34
…14 – 60 years	4.15	4.37	4.21	4.45	3.77	3.74	4.06	3.64	4.08	3.41
Head's age	50.05	51.50	49.68	48.60	49.95	49.30	49.87	48.42	48.31	50.40
Head's education (yrs).	1.92	1.64	1.45	2.10	2.62	4.99	5.43	4.24	6.00	5.01
Land owned (ha) [a]	1.47	1.56	2.10	0.78	1.00	0.77	0.65	1.02	0.53	0.70
Landless (%) [a]	20.99	19.83	18.06	23.08	24.34	25.29	26.43	23.14	27.57	25.76
Consumption & income (Rs.)										
Per capita income	1514	1874	1448	1313	1383	2707	3099	2180	2172	3310
Per capita exp.	1275	1453	1195	1080	1311	1640	1839	1536	1675	1575
Income shares (%)										
Agricultural production	59.50	63.13	69.48	49.50	49.72	51.40	58.62	54.27	36.63	49.24
Wage employment	17.90	9.93	14.35	20.13	27.59	26.76	15.53	27.35	31.29	33.41
Salary & self-employ't	19.59	22.46	15.56	27.66	18.01	18.78	24.23	15.19	30.60	12.34
Asset ownership										
Value of all assets	15906	23330	14916	9406	13899	61367	76666	65464	35426	56394
Finance & off-farm (%)	11.26	7.68	14.94	11.41	9.96	20.67	19.18	26.46	9.86	20.42
Farm & livestock (%)	22.33	24.89	26.32	18.83	17.25	18.12	15.20	17.59	16.90	22.02
House & durables (%)	66.41	67.43	58.75	69.76	72.79	61.21	65.61	55.95	73.24	57.57
Community characteristics										
Per capita income Gini.	0.32	0.35	0.24	0.34	0.36	0.37	0.39	0.38	0.37	0.33
Per capita land Gini	0.63	0.63	0.60	0.61	0.67	0.67	0.67	0.67	0.65	0.68
Emp. guarantee scheme	85.38	92.42	86.51	78.08	81.63					
Access to banks (%)	74.90	69.77	80.99	83.85	67.96	87.93	98.46	83.98	93.93	80.38
No of observations	3816	923	1268	520	1105	5932	1430	2035	856	1611

[a] Figures given in the 1982 column refer to dynasty endowments.

[b] All values are in 1982 Rs. (1 US $ = 9 Rs.). Values for 1999 have been deflated by state level deflators.

Source: Own computation from NCAER ARIS/REDS surveys

Table 2. Participation in market and non-market land transactions between 1981 and 1999

	Total	North	West	East	South
			Market transactions		
Purchased land					
Population share	15.04	6.36	11.60	19.04	24.95
Land share	9.25	3.11	7.61	19.95	17.60
Sold land	7.74	1.40	8.11	12.62	10.30
Population share	15.04	6.36	11.60	19.04	24.95
Land share	5.04	1.33	5.99	10.18	5.36
			Non-market transaction		
Inherited in land					
Population share (1982)	4.72	3.64	6.34	2.57	4.78
Population share (1999)	10.00	7.20	12.58	5.96	11.36
Land share	7.17	5.05	6.94	6.41	10.78

Source: Own computation from NCAER ARIS/REDS surveys

Table 3: Household characteristics by market participation status

	Total sample	Market transactions			Non-market transactions	
		Sale	Autarkic	Purchase	Autarkic	Inherit
			1982			
Household characteristics						
Household size	6.97	6.56**	6.95	7.32**	6.95	7.00
No. of people between 14 & 60	4.15	3.84***	4.15	4.36***	4.15	4.06
No. of unmarried sons (5-25 years)	0.80	0.88**	0.73	1.08***	0.80	1.42***
No. of unmarried daughters (5-25 years)	0.56	0.68***	0.51	0.78***	0.57	0.86***
SC/ST share	17.53	9.18***	19.25	13.41***	17.38	12.24
Assets, income and consumption						
Per capita land endowment of the dynasty (ha)	1.47	2.00***	1.45	1.30*	1.36	3.98***
Share of households from landless dynasty	20.99	2.41***	24.18	14.87***	23.31	5.43***
Value of all assets	15,906	16,408	15,866	15,820	15,196	23,979***
Per capita income (Rs.)	1,514	1,607	1,492	1,566	1,496	1,777*
Per capita consumption exp. (Rs.)	1,275	1,376	1,255	1,318*	1,262	1,370
Income Sources						
Agricultural production	59.50	63.67 **	59.48	57.31 *	57.87	74.74 ***
Salary and self-employment	19.59	18.55	19.20	21.99 *	20.37	13.49 ***
Wage income	17.90	14.39 **	18.82	15.44 **	18.72	9.00 ***
No. of observations (dynasty households)	3816	329	2885	602	3431	118
			1999			
Household characteristics						
Household size	6.01	5.57***	5.99	6.34***	6.13	5.44***
No. of people between 14 & 60	3.74	3.53***	3.69	4.08***	3.85	3.27***
Assets, income and consumption						
Per capita land endowment of household (ha)	0.77	0.74	0.71	1.12***	0.72	0.97***
Share of households landless	25.29	29.41	29.04	2.07***	27.98	1.03***
Value of all assets	61,367	57,644	56,798	86,748***	60,418	60,189
Per capita income	2,707	2,438	2,470	4,063***	2,634	3,156**
Per capita consumption exp. (Rs.)	1,640	1,724**	1,579	1,908***	1,629	1,653
Income sources:						
Agricultural production	51.40	45.73 *	49.92	61.78 ***	48.87	66.44 ***
Salary and self-employment	18.78	23.28 **	18.12	19.80	19.55	15.63 **
Wage income	26.76	26.21 *	29.18	14.73 ***	28.68	16.38 ***
No. of observations (including splits)	5932	459	4581	892	5059	593

[a] The 1982 figures for this item refers to those at the time when the current household head became head.
[b] All values are in 1982 Rs with 1999 values deflated by state level deflators.
*, **, *** significantly different from the sample mean at 10%, 5% and 1% respectively.
Source: Own computation from NCAER ARIS/REDS survey data.

Table 4: Determinants of participation in land purchase and land sale (ordered probit)

	Specification	
	(1)	**(2)**
Agricultural ability (technical efficiency)	0.164**	0.163**
	(2.30)	(2.27)
Household Size in 1982	0.008	0.008
	(1.60)	(1.60)
No. of unmarried sons below 25 in 1981	0.067***	0.067***
	(3.73)	(3.77)
Dynasty land endowment	-0.004***	-0.004***
	(3.71)	(3.71)
Landless dynasty dummy	0.122***	0.122***
	(2.84)	(2.82)
Total asset value (log)	0.030	0.032
	(1.56)	(1.62)
Years of independence in 1999	0.007**	0.007**
	(2.42)	(2.36)
Lower bound equation (sale to autarky)		
No.of climatic shocks	0.106***	0.234***
	(3.58)	(4.46)
Employment guarantee scheme (EGS) 1982	-0.147**	0.001
	(2.09)	(0.01)
EGS in 1982 × No. of climatic shocks		-0.062*
		(1.76)
Bank access 1982	0.169***	0.399***
	(2.68)	(3.56)
Bank access in 1982 × No. of climatic shocks		-0.084**
		(2.37)
Village income growth rate 1982-1999	1.127	1.219*
	(1.62)	(1.73)
Land Gini in village	0.916***	0.917***
	(4.70)	(4.67)
ST/SC dummy	-0.418***	-0.405***
	(5.40)	(5.21)
Upper bound equation (autarky to purchase)		
No.of climatic shocks	-0.129***	-0.132***
	(4.49)	(2.70)
Employment guarantee scheme (EGS) 1982	0.136**	0.199**
	(2.31)	(2.03)
EGS in 1982 × No. of climatic shocks		-0.028
		(0.84)
Bank access 1982	-0.130***	-0.235***
	(2.58)	(2.61)
Bank access in 1982 × No. of climatic shocks		0.040
		(1.33)
Village income growth rate 1982-1999	-1.867***	-1.885***
	(3.10)	(3.10)
Land Gini in village	0.147	0.149
	(1.01)	(1.02)
ST/SC dummy	0.200***	0.197***
	(3.50)	(3.44)
Observations	4583	4583

Robust z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Regional dummies included throughout but not reported.

Table 5: Determinants of participation in non-market land transaction

	Type of inheritance	
	Out	**In**
Agricultural ability	-0.011	0.045*
	(0.84)	(1.89)
Household size	0.002**	0.004***
	(2.42)	(3.20)
No. of unmarried sons below 25 in 1981	0.010***	-0.032***
	(5.09)	(6.00)
Dynasty land endowment	0.001***	-0.001
	(3.96)	(1.11)
Landless dynasty dummy	-0.022**	-0.090***
	(2.22)	(6.01)
Total asset value (log)	0.001	0.013**
	(0.49)	(2.36)
Years of independence in 1999	0.002***	-0.003***
	(3.00)	(4.05)
Dummy for ST and SC castes	0.007	0.017
	(0.96)	(1.32)
Observations	2816	4280

Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 1: Estimation of Cobb-Douglass crop production function (1982 data)

	OLS	Frontier
Total crop sown area (log)	0.488***	0.494***
	(22.95)	(31.74)
All labor in crop production (log)	0.208***	0.188***
	(11.15)	(14.15)
Seed expenditure (log)	0.093***	0.078***
	(8.49)	(10.02)
Fertilizer expenditure (log)	0.054***	0.045***
	(10.73)	(10.91)
Pesticide expenditure (log)	0.023***	0.023***
	(5.11)	(5.36)
Other expenditures (log)	0.025***	0.026***
	(4.11)	(5.26)
Value of farming assets (log)	0.040***	0.039***
	(6.25)	(8.28)
Share of crop area irrigated	0.342***	0.315***
	(5.03)	(5.51)
Head's age	0.001	0.002**
	(1.63)	(2.24)
Head attained primary or above education	0.009	0.034
	(0.33)	(1.48)
Female headed	-0.032	-0.024
	(0.67)	(0.54)
Constant	5.847***	6.595***
	(61.98)	(88.92)
Observations	3328	3328
R^2 or log-likelihood	0.77	-2721.08

Absolute value of t statistics in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%
Regional dummies included throughout but not reported.

Appendix Table 2: Determinants of land sale and land purchase (simple probit)

	Sale	Purchase
Agricultural ability (technical efficiency)	-0.028**	0.051**
	(1.96)	(2.00)
Household Size in 1982	-0.001	-0.001
	(1.17)	(0.88)
No. of unmarried sons below 25 in 1981	-0.027	0.253***
	(0.76)	(4.47)
Dynasty land endowment	0.032*	-0.179***
	(1.96)	(3.39)
Landless dynasty dummy		0.142***
		(3.94)
Value of total assets (log)	0.003	0.016**
	(0.81)	(2.30)
Years since households' independence	0.003***	0.009***
	(4.08)	(7.43)
Village income growth rate from 1982-1999	-0.182*	0.020
	(1.75)	(0.11)
Per capita land Gini in village	0.100***	0.048
	(3.77)	(1.07)
Dummy for ST and SC castes	-0.025**	-0.026
	(2.50)	(1.49)
No.of climatic shocks	0.026***	0.004
	(3.01)	(0.31)
Employment guarantee scheme (EGS) 1982	0.027	-0.018
	(1.47)	(0.55)
EGS in 1982 × No. of climatic shocks	-0.010	0.001
	(1.47)	(0.10)
Bank access 1982	0.048**	0.055**
	(2.49)	(2.14)
Bank access in 1982 × No. of climatic shocks	-0.019***	-0.003
	(2.70)	(0.30)
Observations	4583	4583

Robust z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Regional dummies included throughout but not reported.

References

Agarwal, B. 1994. *A Field of One's Own: Gender and Land Rights in South Asia* South Asian Studies. Cambridge; New York and Melbourne: Cambridge University Press.

Alm, J., P. Annez, and A. Modi. 2004. "Stamp duty in Indian states: A case for reform." World Bank Policy Research Paper 3413. Washington DC: World Bank.

Baland, J.-M., F. Gaspart, J. P. Platteau and F. Place. 2007. "The distributive impact of land markets in Uganda." *Economic Development and Cultural Change 55* (2): 283-311.

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.

Barham, B., M. R. Carter and W. Sigelko. 1995. "Agro-Export Production and Peasant Land Access: Examining the Dynamic between Adoption and Accumulation." *Journal of Development Economics 46* (1): 85-107.

Besley, T. and R. Burgess. 2004. "Can Labor Regulation Hinder Economic Performance? Evidence from India." *Quarterly Journal of Economics 119* (1): 91-134.

Cain, M. 1981. "Risk and Insurance: Perspectives on Fertility and Agrarian Change in India and Bangladesh." *Population and Development Review 7* (3): 435-74.

Carter, M. and L. Galeano. 1995. "Campesino, Tierra y Mercado." *Asunción: CEPES*.

Carter, M.and R. Salgado. 2001. "Land Market Liberalization and the Agrarian Question in Latin America." In de Janvry, A., J. P. Platteau and E. Sadoulet, eds., *Land Access, Rural Poverty and Public Action*. Cambridge: Oxford University Press.

Coelli, T. J. 1995. "Recent Developments in Frontier Modelling and Efficiency Measurement." *Australian Journal of Agricultural Economics 39* (3): 219-45.

Csaki, C., G. Feder and Z. Lerman. 2004. *Agriculture in transition: Land policies and evolving farm structures in post-Soviet countries* Rural Economies in Transition series. Lanham, MD.; Toronto and Oxford: Lexington Books.

Deaton, A. 1991. "Saving and Liquidity Constraints." *Econometrica 59* (5): 1221-48.

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. and S. Jin. 2007. "Land Sales and Rental Markets in Transition: Evidence from Rural Vietnam." *Oxford Bulletin of Economics and Statistics*, forthcoming.

Deininger, K., S. Jin, and H. K. Nagarajan. 2007. "Equity and efficiency impacts of rural land market restrictions: Evidence from India." *European Economic Review*, forthcoming.

Deininger, K., A. Sarris and S. Savastano. 2004. "Rural Land Markets in Transition: Evidence from six Eastern European Countries." *Quarterly Journal of International Agriculture 43* (4): 361-90.

Dercon, S. and P. Krishnan. 1998. "Changes in Poverty in Rural Ethiopia 1989-1995: Measurement, Robustness Tests and Decomposition." Centre for the Study of African Economies Working Paper: 98/07.

Dreze, J., P. Lanjouw, and N. Sharma. 1997. "Palanpur 1957-1993: Economic Development and Social Change." CSD Paper Series V. Mussoorie: Lal Bahadur Shastri National Academy of Administration.

Echenique, J. and N. Rolando. 1991. *Tierras de Parceleros: ¿Donde Están?* Santiago: Agraria.

Fafchamps, M., C. Udry and K. Czukas. 1998. "Drought and Saving in West Africa: Are Livestock a Buffer Stock?" *Journal of Development Economics 55* (2): 273-305.

Foster, A. D. and M. R. Rosenzweig. 1996. "Comparative advantage, information and the allocation of workers to tasks: Evidence from an agricultural labor market." University of Pennsylvania .

Foster, A. D. and M. R. Rosenzweig. 2004. "Agricultural Productivity Growth, Rural Economic Diversity, and Economic Reforms: India, 1970-2000." *Economic Development and Cultural Change 52* (3): 509-42.

Grewal, S. S. and P. S. Rangi. 1981. "An analysis of agrarian structure in the Punjab." *Indian Journal of Agricultural Economics 36* (4): 173-83.

Jayne, T. S. 2003. "Smallholder Income and Land Distribution in Africa: Implications for Poverty Reduction Strategies

24." *Food Policy 28* (3): 253-75.

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.

Kranton, R. E. and A. V. Swamy. 1999. "The Hazards of Piecemeal Reform: British Civil Courts and the Credit Market in Colonial India." *Journal of Development Economics 58* (1): 1-24.

Lanjouw, P. and N. Stern. 1998. *Economic development in Palanpur over five decades*. Oxford and New York: Oxford University Press, Clarendon Press.

Mani, G. and V. P. Gandhi. 1994. "Are land markets worsening the land distribution in progressive areas? A study of Meerut District in Western Uttar Pradesh." *Indian Journal of Agricultural Economics 49* (3): 330-8.

Neale, W. C. 1985. "Indian Community Development, Local Government, Local Planning, and Rural Policy since 1950." *Economic Development and Cultural Change 33* (4): 677-98.

Rawal, V. 2001. "Agrarian Reform and Land Markets: A Study of Land Transactions in Two Villages of West Bengal, 1977-1995." *Economic Development and Cultural Change 49* (3): 611-29.

Rosenzweig, M. R. and H. P. Binswanger. 1993. "Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments." *Economic Journal 103* (416): 56-78.

Rosenzweig, M. R. and K. I. Wolpin. 1993. "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-Income Countries: Investment in Bullocks in India." *Journal of Political Economy 101* (2): 223-44.

Sarap, K. 1995. "Land Sale Transactions in an Indian Village: Theories and Evidence." *Indian Economic Review 30* (2): 223-40.

Sarap, K. 1998. "On the Operation of the Land Market in Backward Agriculture: Evidence form a Village in Orissa, Eastern India." *Journal of Peasant Studies 25* (2): 102-30.

Sharma, H. R. 1994. "Distribution of Landholdings in rural India, 1953-54 to 1981-82." *Economic and Political Weekly 29* (12): 12-26.

Vijay, R. 2002. "Land Market Activity: A Framework." *Indian Journal of Agricultural Economics 57* (4): 714-21.

Zimmerman, F. J. and M. R. Carter. 1999. "A Dynamic Option Value for Institutional Change: Marketable Property Rights in the Sahel." *American Journal of Agricultural Economics 81* (2): 467-78.

Zimmerman, F. J. and M. R. Carter. 2003. "Asset Smoothing, Consumption Smoothing and the Reproduction of Inequality under Risk and Subsistence Constraints." *Journal of Development Economics 71* (2): 233-60.