Land Reforms, Change in Property Rights and Efficiency: A Special Reference to India

Basab Dasgupta*

September 23, 2004

Abstract

This paper empirically investigates the effects of change in land rights on the improvement of agricultural efficiency in West Bengal – one of the eastern states in India . Data Envelopment Analysis (DEA) is used to estimate district wise efficiency. The findings suggest that district wise efficiency in agricultural production has increased in the post land reform period. Moreover, the intertemporal dynamics suggest that some of the districts achieved higher efficiency at a faster rate than others. The ranking of the districts with respect to efficiency assures co-movement with investment in High Yielding Variety (HYV) crops and improvement in land reforms. A censored regression analysis for the panel data also corroborates this fact. It shows that while switching towards HYV coupled with successful land reforms influenced significantly the efficiency scores, investment in irrigation has contributed very little to such improvement.

JEL Classification: **Q15**

Key words: Efficiency, Land Reforms, Property Rights

*Department of Economics, U-63, 341 Mansfield Road, University of Connecticut, Storrs, CT-06269.

Email : basab.dasgupta@uconn.edu

Land Reforms, Change in Property Rights and Efficiency: A Special Reference to India

1 Introduction

The purpose of this study is to find out the role of changes in land rights on the efficiency gain in the agricultural production in West Bengal. West Bengal is one of the eastern states in India where land reforms is considered to be most successful. Even until 1970s it was one of the agriculturally most backward states with more than 70 percent of the total rural population living below the poverty line. During early 1980s the situation started improving. By 1990s it became one of the fastest growing states with a growth rate of 4.2 percent as compared to the average of 2.5 percent for all India. Percentage of rural people below poverty line plummeted to 40.8 percent (Economic Survey, 2002). The share of agriculture in the State Domestic Product (SDP) at constant prices increased from Rs. 2477.64 crore in 1980-81 to Rs. 3948.8 crore in 1991-92 with an annual growth rate in production 6.1 per cent. During this period the rate of growth of food grain production in West Bengal was 6.5 per cent per annum which is considered to be the highest among 17 major states of the Indian Union (Saha and Swaminathan, 1994).

However, there is a mixed reaction for this upheaval change. Some of the economists (Banerjee et. al.(2002)) view this change as an achievement of the land reforms policy of the Left Front government that assumed power in mid 70s. The policy environment created by this government is mainly directed towards the development of the poorer farmers. According to them this was the period when land ceilings were enforced, land was redistributed to the

landless and the rights of the sharecroppers were secured through Operation Barga.

According to the summary case studies on India presented in the Shanghai Poverty Conference held in May 25-27, 2004, this yield raising effect appears to be a combination of land reforms and technological factors. It also emphasizes the role of the *panchayats* for spreading the use of inputs through extensive construction of $unsurfaced$ rural roads as well as through their dispute settlement and intermediary roles.

While, on the other hand, the critics hold the view that "the state government has been caught in the complacency of relatively impressive growth figures in agricultural output in West Bengal in recent years. Different states under different governments have witnessed such temporary spurts of growth due to different reasons and this present high output growth in West Bengal would prove to be unsustainable sooner rather than latter" (Bhaumik (1994)).

In a nutshell, there is no disagreement between these two schools of thought in the productivity growth. The point of divergence is the 'sustainability' issue. To probe deeper into this issue our study concentrates on the effects of land reforms or Operation Barga on the efficiency and change in investment pattern in West Bengal agriculture. Based on the notion that 'any efficient production unit is sustainable' we consider output oriented technical efficiency as the measure of sustainability in our study. To make a comparison between the pre and the post land reforms, we divided our analysis in to two periods - 1970-71 to 1980-81 and 1981-82 to 1994-95. Given this backdrop our study addresses the following questions:

- Is this productivity growth backed up by improvement in efficiency?
- Does the change in property rights on land act as an incentive to improve the efficiency score in West Bengal?

This study has been divided into four sections other than the introduction. Section 2 is devoted to the historical background and literature survey on the land tenure system before and after the land reform has been undertaken by the ruling party.

In Section 3 we used Data Envelopment Analysis (DEA) to estimate the district wise output oriented technical efficiency in agriculture for each year separately for the time span 1970-71 to 1994-95. Then based on these annual efficiency we calculated the averages for the two periods – 1970-71 to 1980-81 and 19881-82 to 1994-95. This has been done in order to show the improvements of the districts wise efficiency after land reforms. We constructed an index to find out the rankings of the districts with respect to their efficiency as well as investment (Table-4). To find out this ranking we used the index proposed by Sengupta (Sengupta, 1995)[1].

Section 4 is devoted to analyze the role of infrastructure and land reforms, on the efficiency of different districts of West Bengal. A censored regression analysis has been done using Tobit Model. In such situations when the dependent variable is censored due to lack of proper information ordinary least squares generate biased and inconsistent parameter estimates. Maximum Likelihood Estimation (MLE) is adopted to find out these parameter estimates. Last section concludes.

2 Historical Background and Literature Survey

To understand the influence of early institutional set up on the land tenure system even after the independence we need to look back to the period under British rule. During the British

[1]The estimation procedure has been given in the Appendix

rule three broad types of land revenue systems were introduced in India in order to collect revenue. Introduction of a representative intermediary class into the system was the prime objectives of the British rule to reduce the transaction cost in collecting revenue. This had been done without disturbing the existing basic elements of preceding agrarian structure. The system that prevailed in the eastern part of India was landlord based system known as the *zamindary* system. The *raiyatwari* system or cultivator based system was established in southern India and the village based system or the *mahalwari* system was established in the north western India. *Mahalwari* system was mainly the village based system and the property rights of land had been given to the owner of the village. The owner was responsible to collect the revenue. This system was predominant in the north western states like Punjab. Since there was a single owner of the village the land holdings were consolidated.

Under *Raiyatwari* system the revenue collection used to be done directly from the farmers. Madras in South India, Bombay presidencies were mainly under this land tenure system. The cultivator had their legal rights over lands.

However, British administration introduced *zamindary* system to transfer the property rights of land to the landlords in order to reduce their transaction cost in collecting revenue. Based on the previous land tenure system, *zamindary* system was established in the eastern states, particularly, in West Bengal, Bihar, Orissa and some parts of Madhyapradesh. In 1793 the British government made the revenue of the *zamindars*fixed by declaring permanent settlement. Through this transfer of property rights British government in India handed over the intermediary class the right to expropriate as much rent as they could from the tenants. Under this *zamindary* system it was permitted for the tenants to lease in land from different landlords (the *zamindars*).

The main motivation of the British rule in choosing different systems in different areas of India was to ensure a large and steady source of revenue for the government while also maintaining a certain political equilibrium (Banerjee et al, 1995).

This differential revenue system had different consequences afterwards with respect to investment. In *mahalwari* system revenue rates were determined mainly on the basis of soil quality, caste of the tenants, capabilities of irrigation and command over manure (Allahabad Settlement Report, 1878). In the *raiyatwari* system revenue was a certain percentage of the estimated output. But in the case of *zamindary* system the revenue was fixed irrespective of either production or capabilities of irrigation or command over manure. As a result, while the land tenure system in *mahalwari* or *raiyatwari* system acted as an incentive to invest in productive capital in order to increase production, it acted as an incentive for the *zamindars* in the eastern India to expropriate exorbitantly high amount of revenue from the tenants to maximize their profit. Investment did not take place from the *zamindar's* side in their land. Tenants also did not have the incentive to invest in their leased in land because of such fixed rate revenue system. Due to this dual effects of disincentive to investment, land quality deteriorated, fragmented plots of land never consolidated in order to make it fit for adoption of lumpy inputs and improvement in irrigation facility turned out to be a far cry.

To come out of the clutches of such plights, most of the states in India enacted land reforms as per the constitutional right in the post independence period. Several legislations like tenancy reforms, ceiling on land holdings and land consolidation measures have been passed during early 1950s. Major focus of this reform was to transfer the property rights of land to the tillers or the sharecroppers by eradicating intermediaries between the government and the cultivators.

However, the degree of success in implementing land reforms have varied significantly from state to state even sometimes with a major portion of the agenda unfinished in most states. This difference in success can be attributed to the varied nature of land reform legislation, the level of political will and institutional support for land reforms. Some states, particularly the states where *mahalwari* land tenure system was prevailing, land reform were unsuccessful despite the broad policy guidelines. The major reason was that the average land holding being higher as compared to the other states in India the intermediary class had a strong political clout against the Land Ceiling Act (Table-1).

Between 1950s and mid 1970s the pattern of implementation of the Land Ceiling Act in West Bengal was more or less similar without any radical change (Table-2). Therefore, consideration of the period from 1970-71 to 1980-81 as the representative of pre reform period instead of the entire span from 1950 to 1976 would not lead to any loss of generality for the state of West Bengal. In the following section we have estimated the output oriented technical efficiency using Data Envelopment Analysis (DEA).

3 Measuring Technical Efficiency in West Bengal Agriculture: DEA Approach

DEA is a non-parametric approach used for extracting information from a sample of observed input-output data set. Unlike regression analysis, where single regression plane is fit in order to estimate optimum value, DEA optimizes on each individual observations with an objective of calculating a discrete piece wise frontier determined by the set of Pareto efficient decision making units (henceforth DMUs). DEA does not require any assumption about the

functional form for the production frontier (Charnes et al., 1994).

Instead of simple regression, we used DEA in our study to calculate the optimum level of output in the absence of clearly defined production function. In DEA generally a bench mark technology is defined from the 'observed' input-output set and then the comparison is made between the benchmark and the observed input output bundles (Ray (2004)). The basic underlying assumptions in this regard are:

(i) All observed input bundles are feasible.

(ii) Production Possibility Set is convex.

(iii) Inputs are freely disposable.

(iv) Outputs are freely disposable.

Output oriented technical efficiency is measured as the ratio of actually observed output produced (y) to the maximum producible output ($y*$) from the same set of inputs. It is a technique that compares all the DMUs with each other assuming that the maximum lies in the observed data set. If $T = [(x, y) : x \quad \text{can produce} \quad y]$ and the maximum that x can produce is $y* = \phi y$, where $\phi \geq 1$, and ϕy also lie in the technology set then in that case output oriented technical efficiency

$$E = \frac{y}{y*} = \frac{y}{\phi y} = \frac{1}{\phi} \tag{1}$$

All the DMUs located on the frontier are considered to be most efficient and produce maximum possible output from the observed data. Degree of inefficiency is measured from the relative distance of the inefficient DMU from any efficient one on the frontier or from the convex combination of two efficient points.

This study considers each district as a separate decision making unit (DMU). It also considers district wise total food grain production as the output for every year during 1970-71 to 1994-95. Total number of labors employed in agriculture, area under food grains, total fertilizer used and extent of irrigation are considered to be the four inputs in our model. In this study, area under irrigation is considered to be the proxy for capital used. We consider irrigation as the measure of capital because most of the investment in agriculture takes place to install shallow tube well, pump set, submerged pump set and to build channels for flow irrigation.

The following maximization problem for each DMU has been solved using Linear Programming.

$$\begin{aligned} &\max_{x_{it}} \phi \\ \text{subject to} \quad &\textstyle\sum_{j=1}^{n} \lambda_j y_j \quad \geq \phi y_t \\ &\textstyle\sum_{j=1}^{n} \lambda_j x_{ij} \quad \leq x_{it} \\ &\textstyle\sum_{j=1}^{n} \lambda_j \quad = 1 \end{aligned} \tag{2}$$

Where x_i represents the amount of ith inputs required to produce output. Subscript j represents the jth DMU. In our case we considered land, fertilizer, irrigation and labor. λ is the fraction of input or output.

The findings of our DEA analysis (Table 3) suggest that except for the five districts like Darjeeling, Hooghly, Jalpaiguri, Murshidabad and Purulia, the average efficiency has improved for other 10 states from the pre to the post reform period. For some districts, particularly, Bankura, Cooch Behar, Nadia and Maldah there is a significant upward jump

in efficiency from pre to post reform period.

The lower efficiency scores for the districts of West Bengal during 1970s can be justified on the following grounds. During this period of time when most of the north-western states experienced an upsurge in food grain production due to 'Green Revolution', West Bengal could not reap the immediate benefits of this new innovations in technology. In the common parlance of the literature, following infrastructural and institutional inadequacies are considered to be responsible for such failure to cope up with the higher growth in food grain production.

First, the resource market imperfections is considered to have a bias in favor of the large farms. Due to this bias the efficiency gain by small farms from intensive cultivation is always outweighed and the inverse relationship between farm size and productivity gets negated (Carter and Kalfayan (1989)).

Second, infrastructural facilities in west Bengal were generally week and inadequate even though the infrastructural sector in Indian planning process was considered to be priority sector. But little has been done to improve it. The relative importance of infrastructure varied during different plan periods. In the initial plan periods, particularly, the third and the fifth plan, the share of infrastructure accounted for 56 per cent of the total plan outlay of India. Afterwards, it decreased to 49-50 per cent (Bhatia, 1999).

Third, operational landholding below a critical level creates a non-viable situation for the adoption of lumpy inputs. Farm machineries like tractor, thresher and combine harvester are compatible only with large areas in order to reduce the operating cost to their lowest point. The rapid progress of agricultural mechanization made many people to believe that the economies of scale associated with it would make family farm obsolete (Zyl et. al, 1995).

Finally, the effect of zamindary system still persisted in the land tenure system in the eastern part of India even after the independence. This, 'institutional overhang' (Banerjee et. al, 2001) led to a structural stagnation in the land tenure system and halted agrarian growth mainly in the eastern part of India. .

Under *zamindary* system during the British rule, the landlords used to lease out lands with lopsided contracts. Most of such share cropping contracts changed hands generation wise without any proper modification. This arrangement prevailed even after the abolition of the British rule in India . Such sub optimal contracts left sharecroppers with no incentive to invest in their leased in scattered operational holdings. As a result, modern technological breakthrough could not penetrate the traditional mode of production leading to a stagnation in production.

Efficiency is a relative concept. For better understanding of the change in efficiency we need to look at of the relative development of the investment and institutions among the districts. For that, based on Sengupta (1996), we constructed three indices for irrigation intensity, area under high yielding variety and percentage area under small and marginal farms separately using the following formula:

$$I = \frac{I_i - I_{min}}{I_{max} - I_{min}}$$

where, I_i is the investment for i^{th} DMU. I_{min} and I_{max} are the maximum and the minimum investment among the DMUs. This indices have been generated to rank (see Table-4) the districts within a period. With the help of these rankings we tried to capture the change in relative positions of each districts from pre to post reform period due to the differences in

the nature of investment and implementation of land reforms.

In this context, we consider irrigation intensity and area under HYV as the two indicators of investment. The reason we made two different indices for these investment indicators is to find out more specifically the inclination of each districts towards these two types of investments. Our results suggest while almost all the districts prefer to switch towards more high yielding variety crops the investment in irrigation is not so significant.

Percentage area under small and marginal farms ($PSMAREA$) is used as the proxy for success of land reforms. The reason behind considering $PSMAREA$ as the proxy is that in West Bengal the ceiling on land has been decided on the basis of the status of the land according to the Land Ceiling Act. The excess land has been distributed among the tillers on an egalitarian ground. This pattern of distribution increased the marginal holdings from the pre to post reform periods.

Table 4 shows the relationship among relative rankings of each districts in pre and post reform period with respect to efficiency, land reforms and two other investment indicators e.g., irrigation intensity and area under high yielding variety (HYV). This table shows that even if some of the districts experienced an increase in efficiency as shown in Table-3, a decline in their relative rankings assures their slower rate of improvement. For most of the districts the increase [2] or decrease [3] in efficiency from pre to post reform can be explained by the co-movement in investment and land reforms from this table. However, some specific and exceptional cases are discussed as follows:

- Burdwan's efficiency gain is clearly from its high investment in HYV and irrigation

[2] 24 Parganas, Bankura, Midnapore and Nadia

[3] Birbhum, Darjeeling, Purulia, Cooch Behar, West Dinajpur and Jalpaiguri

but this high investment is not associated with the improvements in land reforms.

- For Purulia the low efficiency is a result of low investment even though land reform is moderately successful.

- The drastic fall of efficiency of Darjeeling is due to the stagnation in both investment and land reforms at a lower level. The major reason behind such stagnation can be viewed as the outcome of temporary detachment of this mountain district from the main land, both economically and politically, due to major political unrest. In other words, political unrest halted the development of land reforms and investment at a lower level and this unfavorable political environment coupled with stagnated development in land reforms and investment dragged the efficiency to a much lower level.

- For Hooghly, investment in HYV or irrigation has fallen over the decade due to a relative decline in land reforms program. But this decline in investment affected its efficiency more than proportionally.

- In Howrah lower investment relative to other districts can be viewed as the cause of low efficiency along with a sharp decline in land reforms.

Based on the arguments cited above and the information obtained from Table-3 and Table-4, our next section tries to find out the importance of those infrastructural variables along with investment and land reforms indicators in explaining the difference in efficiency between pre and post land reform.

4 Impact of Land Reforms, Infrastructure and Investments on Efficiency

In this section we show how changes in land rights has acted as an incentive to improve investment behavior and, ultimately, improve efficiency.

We also examine the role of infrastructure on efficiency as suggested by many studies (e.g. Bhatia (1999), Shanghai Poverty Conference (2004)). These studies have established a strong relationship between rural infrastructural development and level of per hectare yield of food grains during this period. Most of the papers have pointed out a significant scope for increasing the yield of food grains by improving the rural infrastructure. But hardly any research has been done in the context of efficiency gain due to institutional change or changes in investment.

In this Section we used Censored Analysis or Tobit model in order to capture the variations in efficiency with respect to land reforms along with the infrastructural variables and investment indicators.

The reason behind using Tobit model is that the dependent variable - Efficiency ($= \frac{1}{\phi}$), lies between 0 and 1 and there are some values of efficiency which are equal to 1 for different values of the regressors. Since 1 is the upper bound there will always be some information missing. Therefore, instead of using the maximum likelihood estimation if we use simple least squares estimation then the parameter values will not only be biased but also will be inconsistent.

The censoring of the dependent variable has been done in the following way:

$$E = E_i \qquad \text{for } E_i < 1$$

$$E = 0 \qquad \text{for } E_i = 1$$

Where, E_i is the technical efficiency of i^{th} district in a particular year. [4]

In this model we used length of road ($LROAD$) and number of principle market per '000 square hectare ($PTMRKT$) as the infrastructural variables. Irrigation intensity ($IRRINT$)[5] and area under high yielding variety (HYV) are incorporated in the model as the investment indicators. The variable constructed to represent the change in property rights of land is ($PSMAREA$). This variable represents area under small and marginal farms as a percentage of gross cropped area. We consider $PSMAREA$ as the proxy of land ownership distribution because the percentage area under small and marginal farm has a highly positive correlation with the distribution of land to the tillers through Land Ceiling Act.[6]

For our analysis we used panel data for these 15 districts for the years 1970-71 to 1994-95. The whole analysis has been divided into two parts to capture the effects of land reforms before and after its implementation. The censored model used here is as follows :

$$(E_i, Censor) = \alpha_1 + \alpha_2 irrint + \alpha_3 llroad + \alpha_4 ptmrkt + \alpha_5 lhyv + \alpha_6 psmarea + e_i \qquad (3)$$

[4]The distribution is considered to be Standard Normal and the c.d.f. and p.d.f have been evaluated at $z_i = x_i'/\sigma$.

[5]Irrigation intensity is defined as the ratio of net irrigated area to net sown area.

[6]Most of the basic data like the infrastructural variables, area and production of food grain, data on input use have been collected from the Statistical Abstract of West Bengal and the district wise handbooks. Data on irrigation has been collected from Agricultural Situation in India for the state of West Bengal. Literacy and area under small and marginal farms have been collected from the Census of India.

We assume that if $E_i = 1$ then censor = 0, else censor = E_i. Logarithm of Length of road ($LLROAD$) and that of area under HYV ($LHYV$) are introduced in the model.

The results for the period 1970-80 (Table-5) show that only length of road is significant among all variables. Both the investment variables, $IRRINT$ and $LHYV$, and, the land reform variable, $PSMAREA$ are not significant. Moreover, the negative sign associated with $IRRINT$ and $LHYV$, and, also with the land $PSMAREA$, does not comply with the expected direction.

However, results for the post reform period (Table-5) show that among the two investment variables, $LHYV$ is significant along with the land reform variable, $PSMAREA$. The infrastructural variables, $LLROAD$ and $PTMRKT$ are not significant in this case. From the above results it can be said that performance of West Bengal agriculture in post reform period (1980-94) is largely influenced by successful land reform measures. High significance level of $PSMAREA$ in our model for post reform period corroborates this fact.

High significance of HYV for this period represents switching from traditional mode of production to high yielding variety. The other investment variable, $IRRINT$ that represents irrigation intensity, is not significant[7] during this post reform period. Moreover, its negative sign is bit disturbing. The only way it may be explained are following:

- Either, the area under operation may be too small and even though government provides deep or small tube wells to the farmers they can not optimally utilize the capacity of those facilities. Or,

- it may be the case that even if irrigation increases the access to water for the small and

[7]To maintain international journal standard we do not consider any variable as significant beyond 5 percent level

marginal farms might not have increased resulting in irrigational distribution a skewed one.

But validity of any of these reasons indicates the lack of proper distribution or management of irrigation facility.

5 Conclusion

This paper empirically investigates the effects of change in land rights on the improvement in efficiency to answer the question regarding sustainablity in West Bengal agriculture. Based on the argument, that, any efficient production process is sustainable, we consider efficiency in our study as the indicator of sustainability. We used Data Envelopment Analysis (DEA) to estimate efficiency for the major 15 districts over a span of 25 years (1970-71 to 1994-95).

We consider percentage area under small and marginal farms as the proxy for changes in land rights achieved through land reforms. To capture its effect on efficiency we divided the entire time period in two periods-1970-71 to 80-81 as pre reform period and 1981-82 to 1994-95 as post reform period. Though the radical change in land reform started taking place in West Bengal after the present ruling party assumed power in 1976, we observe the structural change occurred during 1980-81 due to a gestation lag of some years after the implementation of such land reforms has been started.

The main contribution of our paper is to relate the district wise technical efficiency in agricultural production with land reform and investment in the pre and post land reform periods. Another important contribution of this paper is to capture the inter temporal dynamics of each districts with respect to efficiency, investment and land reforms. As we

find from our results that not only most of the districts experienced an improvement in efficiency in the post reform period but also some of them achieved it at a faster rate than the others.

To trace the major reason behind this relative pace of change we found that this improvement in ranking with respect to efficiency is an outcome of improvement in investment, particularly, investment in high yielding variety crops. Though investment in irrigation does not show any specific pattern with efficiency gain we found co-movement of investment in HYV with improvement in land reforms. Intuitively such co-movement between investment in HYV, land reform and efficiency can be justified in the following way.

The change in land ownership pattern from intermediary class to the tillers has acted as an incentive to invest efficiently in order to achieve higher efficiency. This higher efficiency in the post reform period strengthen our argument that the achieved productivity growth is sustainable and this achievement became possible because of the shift of land rights. Previously, under *zamindary* system during the British rule or even after the independence, when hang over of such system was still persisted the fixed revenue system acted as a disincentive to invest. Suboptimal investment coupled with inefficient land contracts deteriorated the agrarian situation in West Bengal. As a result, modern technological breakthrough could not penetrate the traditional mode of production leading to a stagnation in production.

Finally, our findings from the censored regression analysis for the panel data also corroborates this fact. It suggests that while switching towards HYV coupled with successful land reforms influenced significantly the efficiency scores, lack of proper management investment in irrigation is not optimally used. Moreover, the role of infrastructural variables like length of road or availability of agricultural markets are also not significant in explaining

this improvement in efficiency over the period.

These above findings have several policy implications. The land reform program should not be considered only as the distribution of excess land to the tiller but also proper infrastructural development along with irrigation has to be taken up by the government. Because, the decision to invest in HYV is entirely the farmers decision but investment in irrigation includes significant portion of investment by the government too. Land reforms is a package and that should consist of development of infrastructure, irrigation along with the land distribution. Therefore, whatever efficiency gain has been achieved can be treated as partial and is a result of the change in property rights and efficient allocation of resources from the farmers' side. To supplement the investment in HYV, an overall improvement in infrastructure including the investment in irrigation is also equally important.

References:

1. Allahabad Settlement Report, 1978.

2. Banerjee, A. and M. Ghatak (1995), Empowerment and Efficiency: The Economics of A Tenancy Reforms, Journal of Political Economy.

3. Banerjee A, P. Bardhan, K. Basu, M. Datta Chaudhuri, M. Ghatak, A. S. Guha, M. Majumdar, D. Mookherjee, D. Ray (2002), Strategy for Economic Reform in West Bengal, Economic and Political Weekly, October 12.

4. Banerjee , A. and Iyer, L (2001), The Imperial Legacy: Colonial Land Tenure Systems and Independent India, Working Paper, Department of Economics, MIT, September.

5. Bhatia M.S. (1999), Rural Agriculture and Growth in Agriculture, Economic and Political Weekly, March 27-April 2.

6. Bhaumik, S. K. (1994), Tenancy Relations and Agrarian DevelopmentA study of West Bengal.

7. Carter, M.R, and Kalfayan, J. (1989),A General Equilibrium Exploration of the Agrarian Question, Unpublished Research Paper, Department of Economics, University of Wisconsin, Madison.

8. Charnes, A., W. Cooper, A. Lewin and L. Seiford (1994), Data Envelopment Analysis: Theory, Methodology, and Application, Kluwer Academic Publishers.

9. Economic survey,(2001-02) Ministry of Finance, Government of India.

10. Hanstad, T., and J. Brown (2003), Amending the West Bengal Land Reforms Act: Benefiting the Poor and the Marginalized, RDI Reports on Foreign Aid and Development No. 118, May.

11. Ray, S. C., (2004), Data Envelopment Analysis: Theory and Techniques for Economics and Operation Research, Cambridge University Press.

12. Rogaly B., Harris-White B. and Bose S. (1995), Sonar Bangla? Agricultural Growth and Agrarian Change in West Bengal And Bangladesh, Economic and Political Weekly, July 22.

13. Saleth R. M. (1999), Irrigation Privatization in India : Options, Issues and Experience, Economic and Political Weekly, June 26-July 2.

14. Saha A. and Swaminathan M. (1994), Agricultural Growth in West Bengal in the 1980s: A Desegregation by Districts and Crops, Economic And Political Weekly, March 26.

15. Shanghai Poverty conference (2004), Reducing Poverty, Sustaining Growth: Scaling Up Poverty Reduction - A Global Learning Process and Conference in Shanghai, May 25-27, pp. 236-37.

16. Sengupta, I., (1996), Social Dimensions of Economic Development: A Comparative Study of the Indian and International Experience, M.Phil Dissertation, Jawaharlal Nehru University, August.

17. Zyl, J. V, H. Binswanger and C. Thirtle (1995), The Relationship Between Farm Size and Efficiency in South African Agriculture, Policy Research Working Paper, No. 1548, The World Bank, November.

18. West Bengal, Economic Review, 1977-78, Statistical Abstract; Ministry of Rural Development, Annual Report, 1991-92, Govt. of India.

19. $http://www.indiaagronet.com/indiaagronet/AGRI-LAW/CONTENTS/Ceiling.htm$

20. $http://www.worldbank.org/wbi/reducingpoverty/docs/newpdfs/case-summ-India-Lessons.pdf$ for summary reports on India in the Shanghai Poverty Conference, May 25-27, 2004, pp. 236-237.

Table 1: Ceiling Limits on Land Holdings Across States (in Ha.)

States	Irr. with two crops	Irr. with one crop	Dry Land
National Guidelines	4.05 – 7.28	10.93	21.85
Andhra Pradesh	4.05 – 7.28	6.07 – 10.93	14.16 – 21.85
Assam	6.74	6.74	6.74
Bihar	6.07 – 7.28	10.12	12.14 – 18.21
Gujarat	4.05 – 7.29	6.07 – 10.93	8.09 – 21.85
Haryana	7.25	10.9	21.8
Himachal Pradesh	4.05	6.07	12.14 – 28.33
Jammu+Kashmir	3.6 – 5.06	3.6 – 5.06	5.95 – 9.20
Karnataka	4.05 – 8.1	10.12 – 12.14	21.85
Kerala	4.86 – 6.07	4.86 – 6.07	4.86 – 6.07
Madhya Pradesh	7.28	10.93	21.85
Maharashtra	7.28	10.93	21.85
Orissa	4.05	6.07	12.14 – 18.21
Punjab	7	11	20.5
Rajasthan	7.28	10.93	21.85 – 70.82
Tamil Nadu	4.86	12.14	24.28
Tripura	4	4	12
Uttar Pradesh	7.3	10.95	18.25
West Bengal	5	5	7

Source: *http : //www.indiaagronet.com/indiaagronet/AGRI − LAW/CONTENTS/Ceiling.htm*

Table 2: Implementation of the Land Ceiling Law in West Bengal

	$Upto1977$	$Between1977-83$	$Between1983-1991$
No. of beneficiaries (Households)	984,032	472,443	537,141
Cropped Area redistributed (Acres)	626,284	140,417	146,688
Land distributed /beneficiary (Acre)	0.64	0.30	0.27

Source : West Bengal, Economic Review, 1977-78, Statistical Abstract; Ministry of Rural Dev., Annual Report, 1991-92, Govt. of India

Table 3: Periodic Average of Efficiency of Different Districts in West Bengal

Name of the District	('70-71 to '80-81)	('81-82 to '94-95)
24 Parganas	.91	.95
Bankura	.73	.86
Birbhum	.84	.87
Burdwan	.94	.97
Cooch Behar	.85	.93
Darjeeling	.97	.82
Hooghly	.83	.82
Howrah	.73	.79
Jalpaiguri	.80	.69
Murshidabad	.92	.89
Maldah	.72	.88
Midnapore	.95	.98
Nadia	.66	.92
Purulia	.69	.63
West Dinajpur	.79	.84

Table 4: Relative Ranking of the Districts Based on Efficiency, HYV and Irrigation Intensity Index

	Ranking in 1970-80				Ranking in 1980-94			
District	Efficiency	Land Reform	HYV	Irrigation	Efficiency	Land Reform	HYV	Irrigation
24 Parganas	5	5	6	9	3	4	3	10
Bankura	11	8	8	1	9	6	8	1
Birbhum	7	11	5	5	8	12	6	5
Burdwan	3	10	1	3	2	10	1	3
Cooch Behar	6	6	12	15	4	8	11	15
Darjeeling	1	15	15	3	11	15	15	14
Hooghly	8	3	3	4	12	5	5	4
Howrah	12	1	11	7	13	2	12	7
Jalpaiguri	9	14	13	14	14	14	13	13
Murshidabad	4	7	7	6	6	1	7	6
Maldah	13	13	10	11	7	13	9	12
Midnapore	2	2	2	12	1	3	2	8
Nadia	15	4	4	8	5	7	4	9
Purulia	14	9	14	2	15	9	14	2
West Dinajpur	10	12	9	10	10	11	10	11

Table 5: Results from Censored Regression for the Pre and Post Reform

Dependent variable : Efficiency:

Variables	Period 1970 to 1980	Period 1981 to 1995
PSMAREA	−0.0011(.1054)	0.0012* (.0438)
IRRINT	−0.0008(.2531)	−0.0009(.0735)
LHYV	−0.006(.3228)	0.0271**(.0001)
LLROAD	0.90** (.0001)	.0035 (.8504)
PTMRKT	.0009 (.1194)	−0.0003(.4472)
Log likelihood	83.9815	120.4720
Number of obs.	165	210
Non censored values	128	166

Note: Figures in the parenthesis indicate level of significance.