Rural Poverty and Resource Distribution in Bangladesh: Green Revolution and Beyond

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Abstract: Recent studies have examined the relationships between agricultural innovations and rural poverty in LDCs, concentrating on either exchange or nonexchange income. However, neither approach is adequate if employed independently. Growing concentration of control of land and the effects of components of new agricultural technology on ancillary resources are documented for Bangladesh. Access to land and other natural resources by the rural poor is gradually diminishing. Increasing landlessness and near landlessness have resulted in greater dependence on wage employment for subsistence. However, agricultural wages, being close to the subsistence level, provide little scope for carry-over into periods of slack agricultural activity. Even though real wages may be trending upwards slightly, much of their effect on rural poverty is neutralized because of seasonality in employment and real wages. The nonexchange component of income is important in slack periods and may become critical in abnormal years when both real wages and employment fall sharply. With rapid population growth and resource depletion and greater penetration of technological and market forces, access to natural resources with a cushioning effect on the rural poor in adverse circumstances has become more limited and income security has been undermined.

Introduction

Evidence is provided in this paper of increasing landlessness in rural areas in Bangladesh and of rising concentration of control over land and other resources essential for the successful application of new technologies associated with the Green Revolution. The new technologies themselves have probably been instrumental in bringing about these changes. The question of whether rural poverty is on the increase is also explored, paying particular attention to the position of the landless or near landless. In doing so, account must be taken of income obtained from exchange such as wages (Ahluwalia, 1985; and Mellor, 1985) and to nonexchange income such as may be obtained from common property (Jodha, 1986; and Conway, 1985).

The impact of technological change in agriculture on income distribution and rural poverty has been examined either by considering variations in exchange income (e.g., Ahluwalia, 1985; and Mellor, 1985) or by focusing primarily on nonexchange income (e.g., Jodha, 1986; Conway, 1985; and Lipton, 1985). Neither of these two approaches taken separately provides a satisfactory explanation of changes that follow population growth and technological change and their impacts on rural poverty. Several studies of Bangladeshi agriculture have examined rural poverty, income distribution, and technological change (Khan, 1984, pp. 192-195; and Ahmed, 1985, p. 126) and found evidence of declining real wages due to slow agricultural productivity growth.

Land-Use Concentration, Landlessness, and Distribution of Ancillary Resources

An analysis of data from various agricultural censuses (ACO, 1962, p. 29; and BBS, 1981, p. 41, and 1986a, p. 81) clearly indicates a substantial degree of inequality in land distribution. The Gini concentration ratio for operational land in the 1960 census (ACO, 1962) was 0.502. The fall in the value of the Gini coefficient (0.419 for operational holdings) in 1977 is due probably not to a trend towards greater equalization but an underreporting of the number of small-farm households (BBS, 1986a, pp. 32-33). If one considers the pattern of land ownership distribution for 1977 and 1983-84, an interesting feature emerges. The 1977 Gini coefficient is estimated to be 0.428, which is higher than that (0.419) for operational holdings in that year. Thus, the operational holdings seem to be slightly more evenly distributed than owner holdings. The 1983-84 data, however, indicate that land distribution on an ownership basis is more evenly distributed than operational holdings (the ownership Gini coefficient is 0.493 versus 0.533 for operational holdings).

This may indicate the emergence of sharecropping of the reverse order, whereby the small farmers as a group are net lessors while the relatively large farmers are net lessees. Thus, access of the rural poor to land resources is gradually becoming more and more limited. This may be: (1) because increased profitability of self-cultivation by large farmers is leading to tenant eviction (Bardhan, 1984, p. 189); (2) because medium and large farmers taken together have attained greater control over land without any formal ownership rights (*khas* land); or (3) because the ownership of irrigation equipment gives large farmers almost absolute control over irrigation water.[2]

Cain (1983, p. 158) reported that an estimated 17 percent of rural households were landless in 1960. Employing 1961 population census data, Abdullah, Hossain, and Nations (1976, pp. 212-213) estimated that 21.9 percent of households had no land. Subsequent surveys and census reports in the 1970s indicate significant increases in landlessness. For instance, the 1977 Land Occupancy Survey reported that about 29 percent of the households owned no land other than homestead land (BBS, 1986a, p. 69; and Cain, 1983, p. 158). However, this figure is likely to be less reliable than the 1961 estimate because of the small sample, which may contain a high sampling error. The 1983-84 census reports that 28.2 percent of the households owned no land other than homestead land (BBS, 1986a, p. 69). However, the census reports a high incidence of farms (more than 70 percent) in the small-farm category (less than 0.40 hectare). As Cain (1983, p. 154) argues, the lower end of the distribution is a sensitive indicator of change. A process of polarization seems to be taking place: the near landless are dispossessed and join the ranks of the landless, while small farmers in turn become near landless.

Considering changes in the use of important components of new technology (i.e., irrigation and HYVs) may give some indication of the changing fortunes of the landless and near landless. Between the two census years, 1977 (BBS, 1981, pp. 42-43 and 45) and 1983-84 (BBS, 1986a, p. 81, and 1986b, p. 111), a significant increase occurred in the percentage of operated area that was irrigated and planted with HYVs for all classes of farmers. The intensity of irrigation (irrigated area as percentage of operated area) and of HYV cultivation (total area under HYVs of different crops of rice and wheat as a percentage of operated area) seem to be inversely related to farm size. These intensities seem to decline with increases in operated area. As of 1983-84, nearly 20 percent of area operated by small farmers was under irrigation, compared to 17 and 16 percent, respectively, for medium and large farmers. However, the overall distribution of area irrigated and area planted with HYVs in 1983-84 produces Gini ratios of 0.506 and 0.439, respectively. An intertemporal comparison suggests a trend towards greater concentration of these elements (0.355 and 0.310 for irrigated and HYV areas in 1977, respectively). Despite underreporting of small-farm households in the 1977 sample census and a likely underestimation of the Gini concentration ratios, an increasing trend towards concentration cannot be ruled out. Irrigated area is more unevenly distributed than the HYV area. The comparatively lower degree of inequality in the distribution of HYVs is because all HYVs are not irrigated. For instance, around a third of total HYV wheat area is irrigated, and the HYVs of *aus* and *aman* (*kharif*) rice are primarily rain fed even though a small percentage of the area under these rice varieties is irrigated.

Degree of access to irrigation is a key determinant of HYV adoption. According to Lipton (1985), in unirrigated and unreliably rain-fed areas, no association exists between amount of land owned and operated (between 0 and 2-4 hectares) and poverty risk. Tiny amounts of well-watered land reduce that risk. Thus, increased inequality in the distribution of irrigated land is likely to increase inequality in the distribution of incremental output. As reported in BBS (1981, pp. 41 and 45, and 1986a, p. 82), a higher percentage of large farms as compared to small and medium farms have access to irrigation. The gap in the access to irrigation has increased over time. For instance, in 1976-77, 32.7 percent of large farms had access to irrigation compared to 31.1 and 29.4 percent, respectively, of the medium and small farms. The corresponding figures for 1983-84 are 57.9, 53.4, and 38.7, respectively. While differences in these percentages are not substantial in the first period, they are in the subsequent period.

Let us now consider the distribution pattern of livestock and poultry resources. Consistent with the pattern of distribution of land and other resources, these resources are also unevenly distributed. In 1983-84 (BBS, 1986a, pp. 83-85), while most of the medium- and large-sized farms reported having bovine animals, only 55 percent of those in the small farm category did so. For sheep and goats and for poultry, the contrast seems to be less striking. Despite difficulties in making intertemporal comparisons, a significant decline in the area under fodder crops and virtual disappearance of pasture land (BBS, 1986b, p. 101) have made maintaining bovine populations more difficult for the small farms. As BPC (1985, pp. ix-45) points out, "fodder supply was adversely affected by food production, partly due to the decline in grazing land but mainly due to the shift from long-stem to short varieties of rice cultivation." The unevenness in the distribution of livestock implies that the shortage seems to affect the small farms more severely than the large ones in terms of cost of cultivation (Gill, 1981, p. 14).

The above trends seem to be supported by farm-level evidence from Ekdala and South Rampur in Bangladesh (Alauddin and Tisdell, 1987).[3]

Market and Nonmarket Income of the Rural Poor and Reasons for Concentration of Resource Control

To some extent, the rural poor, consisting of the landless and near landless, depend on natural resources such as land, which they may hire or have limited access to, to supplement their income. They are primarily wage labourers. The supplementary incomes assume greater significance during the slack months or in depressed economic conditions when only a small residue of work is available and/or wage rates are relatively low.

With the introduction of new technology in rural areas, the rural poor are likely to be relatively disadvantaged because of likely increases in the demand for natural resources. This is further reinforced by persistent population pressure (Repetto and Holmes, 1983). The price of natural resources is forced up, and, therefore, only those capable of adopting the new technology are capable of buying (hiring) the natural resources on any scale. The adoption of new technology may be limited or relatively limited to the wealthier members of the farming community. Consequently, the price of the resource rises and the poor can no longer afford to purchase it and their income falls. But the rich can purchase the resource and their income may increase in absolute terms. In any case, the differential adoption of technology may increase income inequality. The poor may be forced to try to obtain full-time work as labourers. As Bardhan (1984, p. 189) argues, "increased dependence on purchased inputs and privately controlled irrigation is driving some small farmers with limited access to resources and credit out of cultivation and into crowding the agricultural labor market."

Figure 1 illustrates a case where poor farmers are forced out of farming by their failure to adopt new technology, which, however, is adopted by others and causes a rise in the price of a vital natural resource such as irrigation water. The curve SS represents the supply of a natural resource at the village or community level and D_1D_1 demand curve for it prior to the introduction of a new technology. It sells for a price of P_1 per unit, and poor farmers, with a marginal value product curve MVP_A, make a profit indicated by the triangle in the middle panel. Suppose that, with the introduction of new technology, the community demand for the natural resource rises to D_2D_2. Its price increases to P_2 per unit. If the poor farmers do not adopt the new technology, they are unable to make any profit by purchasing the natural resource at price P_2 and are forced out of farming. Rich farmers, by adopting the new technology, may find the value of their marginal value product curve rise to MVP'_B, and their profits would also rise (right panel). Even if the price of the natural resource does not rise to such an extent as to force the small farmers out, their surplus will be reduced by a rise in the price of the natural resource if they are unable to adopt the new technology.

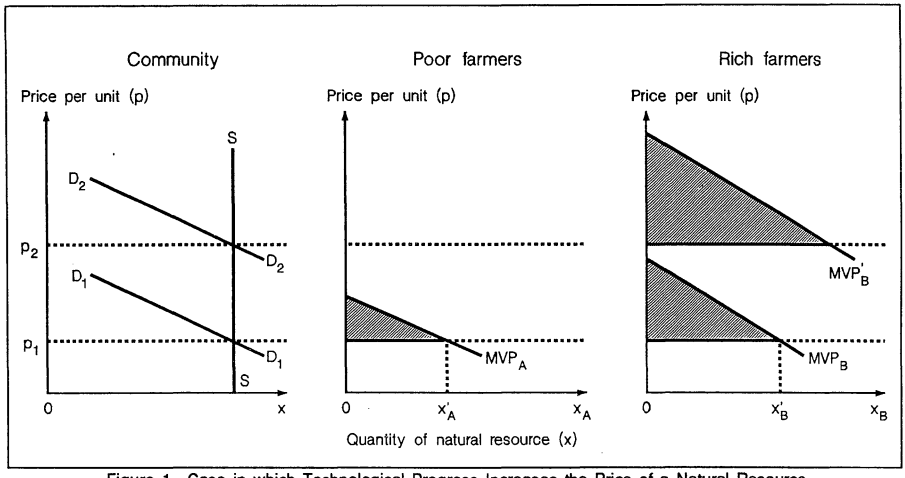

Figure 1—Case in which Technological Progress Increases the Price of a Natural Resource and Leads to Exit of a Small Farmer

One could consider the impact of technological change on common or easy access resources. With technical progress, private property rights would tend to be enforced because the value of doing so is higher (Cornes, Mason, and Sandler, 1986; and Demsetz, 1967). Property that was once common may be enclosed. Or, due to transaction costs, access to property or resources may be denied (Posner, 1980).

Due to technical progress, farmers may increase their profits by clearing land, increasing its drainage, not leaving it fallow for long, and cultivating it more intensively. This may mean the loss of wildlife and wild fruits as food for the poor. Also, adverse spillovers on the fish population, etc., may occur from greater use of pesticides and chemical fertilizers. This may have its greatest impact on the poor, who tend to be gatherers rather than farmers. Also, the poor may lose access to fuel (firewood) and thatching and other housing materials.

Although this may not strictly apply to large parts of Bangladesh, natural environments provide resources to draw on in bad times. They are like a security blanket. Lipton (1985) discusses these issues. Clarke (1971) specifically observes this in relation to New Guinea. In the absence of these cushions, the poor are likely to suffer greatly during times of economic stress.

Income Variation and Real Wages of the Rural Poor

An increase in the number of landless and near landless and the gradual loss of their access to natural resources makes their economic position more dependent on the demand for their labour. However, one needs to ask whether the increased opportunities in the labour market have been able to compensate those who have lost easy access to the natural resources that provide them with supplementary income. To what extent has demand for labour increased following the introduction of new technology? What impact has it had on the functional (family labour and hired labour) and seasonal (*rabi* season and *kharif* season) demand for labour? Does a transition from traditional to modern varieties necessarily imply an increase in the relative share of labour in total output? To what extent have real wages for agricultural labour increased in recent years?

Alauddin and Mujeri (1985), using district-level data, report that significant increases in the demand for labour per cropped hectare occurred during the *rabi* season. On the other

hand, the replacement of traditional rice varieties by rain-fed HYVs has had little impact on the overall demand for labour during the *kharif* season. Alauddin and Tisdell (1986, pp. 13-15) reported that: the relative share of labour (as opposed to absolute income) in the total output per hectare seems to be much higher from traditional varieties of rice compared to HYVs; the relative share of family labour in total output is much higher than that of hired labour; and striking differences in the returns to family labour seem to exist, depending on the mode of operation (owner or sharecropper) and technology (local or HYV). In either case, returns to family labour for owners seem to be far in excess of those for sharecroppers. As for the functional demand for labour, evidence seems to support the hypothesis that the new technology has significantly increased employment in terms of demand for family labour and to a lesser extent in terms of hired labour (Ahmed, 1981). This may reduce underemployment rather than unemployment *per se*.

In a recent study, Alauddin and Tisdell (1987) considered trends in daily agricultural wages for the 1969/70–1985/86 period using various price deflators such as cost-of-living indices for industrial workers and rice and food prices. Despite a tenfold increase in nominal wages, little trend in real wages was apparent. Real wages dropped sharply during the early 1970s and remained depressed until the early 1980s. An increasing trend is apparent in the last 2-3 years. These findings seem to be consistent with those of Khan (1984). Furthermore, sudden drops in real wages to drastically low levels occurred in adverse natural and weather conditions (e.g., the flood of 1974 and the drought of 1979).

The landless and small farmers faced problems because of resource depletion and alternative land use due to increased population pressure and following technological change. The households dependent on on-farm employment reported serious economic problems. In abnormal years, when a serious drought or flood occurs, not only do real wages fall drastically but employment becomes more limited. Opportunities for supplementary income through rearing cattle and other animals and poultry become increasingly limited. Furthermore, opportunities for growing vegetables for domestic consumption or for sale at critical times become more limited because of scarcity of water. Landless labourers and small-farm households in the Ekdala area reported having difficulties in getting water from privately owned tanks or ponds for watering vegetables and seasonal fruit plants. This was not because they were charged for it but because its use was restricted, for two reasons: water as a resource is valued more highly by the owners and transaction costs would be incurred in monitoring its sale if it were sold. Bardhan (1984, p. 189), citing Indian experience, points out another mechanism through which the rural poor might have been at a disadvantage. "Some small farmers were being driven out of cultivation as pumpsets enabled rich farmers to appropriate communal ground water, resulting in a possible drop in water tables and making the traditional lift irrigation technology even less effective than before for the poor farmers without pumpsets, hurting the poor farmers who depend on them."

Because of gradual destruction of permanent fruit trees to clear land for food production, fruit gathering in hard times is even more difficult. Also, loss of shrubs and trees results in loss of leaves used as cooking fuel as well as firewood. Thus, opportunities to draw on the reserves of natural resources, especially during difficult times, seem to be disappearing with increased population and greater penetration of market forces following the adoption of new technology. Access to grazing opportunities for livestock was also reported to be dwindling (Alauddin and Tisdell, 1987).

Most farmers surveyed in Ekdala and South Rampur believe that their economic situation is more risky or uncertain compared to the past. For Rampur, most farmers thought that this was so. A χ^2 test indicated that the null hypothesis of independence across farm size could be accepted with a high degree of confidence (χ^2 value significant at a probability level of 0.2670) against an alternative of variation of poverty risk across farms. For Ekdala, however, the alternative hypothesis could not be accepted so confidently (χ^2 value significant at a probability level of 0.0593). This suggests that small-farm households in particular feel they are at greater risk than before. The intervillage difference may be due to differences in density of population, variations in size of small and large

farms, and perhaps diversity of cropping patterns. However, farmers in both villages feel that they are at greater economic risk than ever before.

Conclusion

Recent studies have examined the relationship between agricultural innovations and rural poverty in LDCs, concentrating on either exchange or nonexchange income. However, neither approach is adequate if employed independently. Growing concentration of control of land and the effects of components of new agricultural technology on ancillary resources have gradually decreased the access of the rural poor to land and other natural resources. Increasing landlessness and near landlessness have resulted in greater dependence on wage employment for subsistence. However, agricultural wages, being close to the subsistence level, provide little scope for carry-over into periods of slack agricultural activity (Clay, 1981; and Khan, 1984). Even though real wages may show a slight upward trend, much of their effect on rural poverty is neutralized because of seasonality in employment and real wages. The nonexchange component of income is important in slack periods and may become critical in abnormal years when both real wage and employment fall sharply. With rapid population growth and resource depletion and greater penetration of technological and market forces, access to natural resources with a cushioning effect on the rural poor in adverse conditions has become more limited and income security has been undermined.

Notes

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[2]The traditional sharecroppers (small farmers) who depend on irrigation supplies from large farmers may sometimes be forced to rent out land to large farmers who, with relatively easier access to irrigation water and other complementary inputs, are able to appropriate greater relative gains than the traditional sharecroppers.

[3]Their survey of individual farmers and the landless in these villages was conducted in 1986.

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DISCUSSION OPENING—*Ibrahim Soliman* (Department of Agricultural Economics, Zagazig University)

The paper presented by Alauddin and Tisdell raises some important development issues. It is a good diagnostic study that identifies, in a descriptive way, the factors that may negatively affect the standards of living of the poor agricultural population in Bangladesh. The authors concluded that among these factors is the technological component, which will not only be effective but will also accelerate these negative impacts. Accordingly, two questions can be raised: Is it a view through a glass, darkly, and, if so, what ought to be done?; *or* is it a signal to choose the proper technology that fits each LDC's rural community? and, if so, what type of technology may fit such conditions? The study did not show explicitly the features of the traditional versus the proposed or existing package of modern technology.

In this context, Japan, for example, started agricultural development under conditions of high population density and small farm size. The Japanese used economic incentives to motivate biological technology. When Japan reached a given plateau, it moved to physical technology. Even though the present paper concluded that technical progress would diminish the demand for human labour, it did not provide any empirical evidence about such substitution elasticity of mechanization vs. human and/or animal labour in Bangladesh. On the other hand, the paper gives the impression that production under risk or uncertainty is the common performance of Bangladeshi agriculture, due to floods, fluctuations in rainfall, etc. However, the study did not consider the limitations imposed by this performance on input intensification and technological progress, which may surpass the limitations imposed by farm size and capital scarcity. Therefore, some further investigations are needed on a zonal base.

I cannot tell from the paper whether land fragmentation is a constraint or not with respect to technology expansion. Whereas the authors showed early in the paper that the intensities of irrigation and HYVs seem to decline with increases in farm size, they showed later in the paper that higher percentages of larger and medium farmers have access to irrigation than the smaller ones. Therefore, they expect that the small farmers will face difficulties in obtaining their water requirements because the water resource is going to be valued more highly by the rich (large) farmers, in addition to the transaction costs. Even if that is right, the problem is probably one of how to find an efficient cooperative system for water management.

Finally, although the paper criticized previous studies that identified rural poverty by farm size only, it did not offer an apparent alternative, except to use the terms "richer farmer" and "larger farmer."

GENERAL DISCUSSION—*Jerome C. Wells, Rapporteur* (University of Pittsburgh)

The general discussion of this paper included comparisons of contemporary technical change and worker displacement with the situations in the UK and Japan in the 18th and 19th centuries as well as consideration of the (graphical) measurement of the gains from improved technologies in the Bangladeshi case. Given the frequency of worker displacement associated with technological improvement, the need for policies to aid displaced workers was also stressed.

Participants in the discussion included E. Asante, S. Ehui, T.E. Gina, R. Herrmann, T.N. Jenkins, D. Kirschke, H. Lee, W. Mukhebi, W. Oluoch-Kosura, and N. Traoré.