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**Growth and Entitlements:
The Analytics of the Green Revolution**

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S. R. Osmani

I. INTRODUCTION

In his celebrated analysis of modern famines, Sen (1981) has convincingly shown that what is relevant for understanding the causes of famines is not so much the availability of food in the aggregate as people's *entitlement* to food. The same point applies to the analysis of the linkage between economic growth and endemic poverty. In the specific context of the so-called Green Revolution in Third-World agriculture, this means that what matters for the poor is not so much the rate of growth of food production as the manner in which the growth process affects their entitlement to food. But this is not how the early enthusiasts of the Green Revolution conceived of the linkage. The international research on wheat and rice that has led to the emergence of the Green Revolution was motivated by the classic Malthusian concern that population growth was running alarmingly ahead of food production in the poorer countries. So when research eventually succeeded in inventing the 'miracle seeds' (henceforth called MVs, short for modern varieties), the enthusiasts came to believe that the new technology would achieve the salvation of the poor by producing more food than before. Their optimism was thus based squarely on the grounds of 'availability' rather than entitlement; Sen (1990) has aptly described this new mood as 'Malthusian optimism'.

In contrast, when the early critics of the Green Revolution tried to explain why such optimism was sadly misplaced, they were in effect looking at the problem from the perspective of 'entitlements', although not quite using that language. What they were claiming is simply that the relative abundance of food would not save the poor because, if the new technology is introduced without changing the prevailing distribution of the means of production, they will not have the means with which to establish their

entitlement to food and may very well lose whatever means they happen to have.¹

Growth, in other words, could lead to loss rather than gain of entitlements on the part of the poor. A number of channels were identified through which this loss was supposed to follow from the very same forces which would raise food production in the aggregate. It was maintained, for example, that small landowners would fail to adopt the new technology and would eventually be forced out of their land as the richer farmers, enriched even more by the new technology, tried to expand their holdings; that the poor tenants would be evicted from the leased-out land as the owners tried to take full advantage of the new technology; and that landless labourers would face a shrinking demand for their services as a result of mechanized cultivation. In all these various ways, it was feared, the classes of small farmers and landless labourers -- who constituted the bulk of the rural poor -- would lose their entitlement to food.

It is argued in this paper that while the critics of the Green Revolution were right in taking the entitlement-based approach, they were unduly pessimistic in their assessment of the consequences for the poor. However, merely to demonstrate that their pessimism has been belied by facts is not the major objective of the paper; after all, the fact that, by and large, their worst fears have failed to come true is already being well recognized.² Our aim here is to understand why they did not come true. This leads us to take an approach that is more analytical than is usual for studies on the impact of the Green Revolution. We first identify the channels, or the 'transmission mechanisms' as we call them, through which entitlements were supposed to be eroded by the forces unleashed by the new technology. We then examine the theoretical foundations of these transmission mechanisms, and find them, in most cases, to be rather shaky. Through this theoretical enquiry as well as empirical observations drawn mostly from South Asia, we arrive at the conclusion that the Green Revolution has been a friend of the poor after all,

¹ See, for example, Bardhan (1970), Byres (1972), Dasgupta (1977), Farmer (1977), Frankel (1971), Griffin (1974), ILO (1977), Ladejinsky (1969), Parthasarathy (1970), and Pearce (1980), among others.

² Even some of the early critics have begun to recognise this; see, for example, Parthasarathy (1991).

just as the inventors of the MVs expected it to be, but not for the reason they had in mind. It is not so much the increased availability of food as the enhanced entitlement of the poor that has been the critical factor.

The next three sections examine three major classes of transmission mechanisms discussed in the literature³. Section II examines the mechanisms that were supposed to immiserize the small peasantry; section III considers the forces impinging on small tenant farmers; and section IV deals with the plight of the wage labourers. We next take up for critical evaluation an important new contribution by Lipton and Longhurst (1989). They hold a position that is close to ours as regards the individual transmission mechanisms; that is, they agree that, when considered separately, the forces impinging on small peasants, tenant farmers, and wage-labourers appear to be beneficial rather than detrimental as the early critics thought. But they go on to argue that there exists an adding-up problem in that the sum total of the benefits appears to be negligible for the poor. They explain this phenomenon as an endogenous failure of the Green Revolution -- endogenous in the sense that counteracting forces generated by the growth process itself, rather than those emanating from extraneous factors, neutralize the first-round benefits accruing to the poor. This is a sophisticated line of argument whose central message is that if the Green Revolution is not exactly a foe of the poor, it is not much of a friend either. We take issue with this line of argument in section V, and present our own views on the adding-up problem in section VI. Finally, in section VII, we summarise the main conclusions and offer some brief remarks on their implications.

II. IMMISERIZATION OF THE SMALL PEASANTRY?

One of the recurring themes in the critical literature has been the idea that, given the unequal ownership of land and the inequitable social structure that it entails, the new technology will lead to increasing polarisation among the peasantry, and perhaps even to absolute

³ A fairly comprehensive listing of the transmission mechanisms can be found in Bardhan (1985 pp.77-8). The logical and statistical basis of many of them have been critically examined by Ruttan (1977), Dantwala (1985) and Lipton and Longhurst (1989), among others. Our analysis builds upon these earlier analyses.

immiserization of the poorest among them. This thesis echoes a much older concern, centred around the 'agrarian question' that engaged Marxist thinkers of the old, most notably Lenin (1974) and Kautsky (1976). Those early protagonists believed that the development of agrarian capitalism would unleash forces of differentiation among the peasantry in much the same way as industrial capitalism was seen by Marx to lead inexorably towards concentration, although it was recognized that because of the peculiarities of land as a means of production the process of differentiation would be much more protracted in agriculture than it was in industry.

These concerns were revived in modern times as Marxist scholars debated the question of whether or not the new technology would usher in capitalist relations of production in the hitherto moribund agriculture of South Asia.⁴ Those among them that saw the portents of incipient capitalism were generally inclined to see the new technology as a potentially polarising, and for the poor peasantry also an immiserizing, force. However, one did not have to be a Marxist nor did one have to believe in the imminence of capitalism to regard the new technology as a force towards polarisation. People holding a much wider spectrum of views could and did agree on its polarising effect.

One reason why many divergent views could agree on this point was that the manner in which the new technology was supposed to cause polarisation was seen to be rather different from the classical Marxist account of capitalist differentiation among the peasantry. The classical account assumed that capitalism would cause differentiation by bestowing scale economies on the emerging capitalists, thus putting the smaller farmers at a relative disadvantage and eventually uprooting them from their land as they lost out in the competitive struggle at the market place. But the crucial role played by 'scale economies' in this process could not be invoked in the case of the modern Green Revolution technology. It was generally recognised that the new technology was essentially divisible, and therefore scale-neutral. So the potential for polarisation, if there was any, had to be found in something other than technical scale economies.

⁴ For a review of the interesting, if somewhat inconclusive, debate on the mode of production in Indian agriculture, see Thorner (1982).

The critics found this potential in the increased working capital requirement of the new technology. The argument for polarisation then went as follows. The poor peasants would be unable to bear the increased burden of working capital required for the purchase of modern inputs -- viz. the MVs, water and fertilizer. As a result, they would lag behind the large farmers in the adoption of the new technology. This would not only accentuate the existing income inequalities, but would also lead to the absolute impoverishment of non-adopting small farmers as their land would be bought up by large farmers eager to spend a part of their increased wealth on the acquisition of more land.

How valid is this account of the dispossession of the poor? The answer depends on the validity of two distinct hypotheses which together constitute the logic of this account. These are: (i) the *hypothesis of differential adoption*, which says that it is mostly the big farmers that adopt the new technology while small and marginal farmers are by and large left out of the process, and (ii) the *hypothesis of land alienation*, which says that, encouraged by the newfound wealth accruing from the new technology, big farmers would begin to buy up more lands from the non-adopting small peasants, causing increasing landlessness and poverty among them.

The Hypothesis of Differential Adoption:

The logic of this hypothesis is closely connected with the well-known phenomena of market imperfections in rural economies -- especially imperfections in the markets for insurance and credit. In the absence of a well-functioning insurance market, for example, the risks of adopting an unknown technology have to be borne by the farmers themselves -- but it is the bigger farmers who are more able to bear this risk because of their greater capacity to absorb losses. At the same time, the formal credit market discriminates in favour of the rich because of their greater credit-worthiness as well as their social power; as a result, the large farmers find it much easier to meet the significantly increased working capital requirement entailed by the new technology than do the small ones.⁵ For both these

⁵ While this argument is couched in terms of production credit, Eswaran and Kotwal (1989) suggest an alternative explanation in terms of consumption credit. They focus on the risks

reasons, the large farmers surge ahead with the adoption of MVs while the smaller ones are left behind.⁶

As presented above, the argument for differential adoption rests on the technical matter of market imperfections. But when the early critics predicted differential adoption, their argument ran in terms of an unequal social structure that rested upon an unequal distribution of assets. What is the connection between the two? Initially, the connection was drawn by invoking the concept of unequal social power as the linkage between social structure and market imperfections. The argument was that by exercising their superior social power rich farmers manipulated the market to their advantage, the prime example being the formal credit market which rich farmers allegedly milched dry leaving precious little for the rest.

More recently, a new set of linkages has begun to emerge in the light of the 'new institutional economics', in which agrarian institutions are seen as a response to market failure. In this modern version, unequal access to land is still at the root of the problem, but the concept of unequal social power need not be invoked. Rational behaviour on the part of economic agents can endogenously create market conditions that discriminate against the poor. For example, it has been shown that in a setting of unequal land ownership and asymmetric information, profit-maximising banks will be driven by

associated with the new technology and argue that in the absence of an insurance market adoption will depend on the access to consumption credit. Without such access, there is a danger that a shortfall in production will translate into unacceptably large fall in consumption. This will deter adoption. On the other hand, if a farmer has access to consumption credit, then in spite of the absence of an insurance market he would be willing to take the risk confident in the knowledge that his consumption level can be maintained above a floor in the face of periodic crop failures by drawing upon future income. Therefore who takes risk depends on who has access to consumption credit, and that is how differential access to credit leads to differential adoption. This argument is based on the premiss that farmers perceive the MVs to be subject to greater year-to-year fluctuations than the traditional varieties. But, as we argue below, this perception lies more in the minds of economists than of farmers themselves. So, while Eswaran and Kotwal's argument in terms of consumption credit is theoretically plausible, it is perhaps the differential access to production credit that is empirically the more relevant constraint.

⁶ An alternative explanation, which had some currency in the early years, is that small farmers are more risk-averse than large farmers. This explanation locates the problem in the attitude towards risk or the subjective preference pattern; technically, this implies that concavity of the von Neumann-Morgenstern utility function weakens as one moves up the income scale. While this is not theoretically implausible, there are no compelling axiomatic reasons to support it either. Empirically too, experimental studies have found no evidence of marked differences in the attitude towards risk across farmers of different size-groups (Binswanger 1980).

their own interest to ration out small farmers and concentrate their business on large farmers (Binswanger and Sillers 1983; Carter 1988) .

Whatever may be the true linkage, it appears plausible to argue that an inequitable agrarian structure will constrain small farmers in the adoption of the new technology. In the early years of the Green Revolution, this argument also had plenty of empirical support. Up to about the mid-1970s, researchers almost invariably found that within South Asia, as well as outside, the adoption of MVs was confined mainly to the large and middle farmers.

However, things began to change soon thereafter. Almost all the subsequent studies have shown that the lag in adoption as between the large and small farmers has virtually disappeared.⁷ The reason for this transformation is not far to seek -- very simply, a good deal has changed in respect of both risk and credit since the early days of the Green Revolution.

On the risk front, there is reason to believe that although the insurance market continues to remain as imperfect as ever, the element of risk perceived by the farmers has progressively declined. This is true of both subjective and objective risks. The subjective risk (i.e., the fear of the unknown) that inheres in experimenting with any new technology has come down over time as small farmers have observed their big neighbours reaping a rich harvest year after year. As for the objective risk (i.e., the risk of crop failures), it is now well-established that with assured supply of water the year-to-year fluctuation in yield and output is far less severe with the new technology as compared with the old.

Until very recently, this last fact used to be contested by many observers of the Indian scene, who pointed out that the annual variance of agricultural output had increased after the introduction of the MVs. But recent research has shown that this increase in variance is explained not by any inherent tendency of the MV output to be more susceptible to weather variations, but by a number of other factors, such as: (a) increased

⁷ The international evidence on this issue is ably surveyed by Ruttan (1977), Barker *et al.* (1985) and Lipton and Longhurst (1989). Specifically on the Indian Punjab, see Bhalla and Chadha (1983); and on Bangladesh, see Asaduzzaman (1979), Hossain (1988) and Hossain *et al.* (1990).

covariation in the output of different regions whose crop-calendars have become more synchronised after the spread of the MVs, and (b) population pressure pushing land frontier into increasingly marginal lands that are more vulnerable to shocks (Hazell, 1982; Ray, 1983). In a recent re-examination of the issue, Dhawan (1988) has further suggested that the statistical procedures employed by earlier writers imparted an upward bias on the estimate of variability for the post-Green Revolution period. He has also shown from a disaggregated analysis of state-level data that, in nine out of eleven states for which reliable data were available, instability in total output actually declined after the introduction of the MVs.⁸ Outside observers may have been slow to appreciate this, but the farmers on the field must have discovered long ago that MVs in irrigated conditions were much less risky than traditional seeds in rain-fed conditions. And as the farmers' perception of risk diminished with the spread of irrigation, small farmers no longer felt deterred by the risk factor despite the lack of any significant improvement in the rural insurance market.

As regards the credit market imperfections, two things have happened that have changed things for the better: first, the degree of imperfection has declined over time as rural credit has been made more readily available through the formal channel; and secondly, the credit constraint faced by the small farmers has been softened by substitute measures, such as input subsidy. The scale of credit expansion has been particularly impressive in the Punjab, the vanguard region of the Green Revolution in India. Whereas in 1960/61 loans per hectare of cropped land advanced by primary agricultural credit societies in the Punjab was just about the same as in India as a whole, by 1977/78 the figure for the Punjab was twice as high as that of India (Bhalla and Chadha 1983, p.15). In Bangladesh, the total disbursement of agricultural credit went up by eight times in nominal terms during the period between 1976/77 and 1982/83, and by the end of the period such credit accounted for nearly 40 per cent of the cost of material inputs (Hossain 1984).

The critics often point out that the expansion of total credit has not really softened the credit constraint faced by the small farmers, since the lion's share has been appropriated by the rich and the powerful. However,

⁸ For similar evidence from Bangladesh and Sri Lanka, see Hossain (1988) and Herath (1983) respectively.

while the fact about the rich claiming the lion's share is beyond contention, the inference drawn about the credit constraint faced by the poor may not be entirely true for at least two reasons. First, one needs to distinguish between the disparity in credit-shares going to different size-groups of farmers and the disparity in credit availability per unit of land. While the former disparity is usually presented as evidence of credit bias, it is the latter that is really important. In this context, it is interesting to note that the Farm Management Studies undertaken in the Punjab in the late sixties showed hardly any difference across size-groups in the amount of loan *per acre* received from the state and cooperative institutions (Chaudhri and Dasgupta 1985, p.102).

Secondly, one often forgets that there is a close linkage between formal and informal credit markets. A recent large-scale survey of the informal credit market in Bangladesh shows that more than two-thirds of the formal channel's credit finds its way quickly to the informal channel (Alam 1989).⁹ Similar phenomena have been observed in the Punjab, although in more anecdotal forms; one hears, for example, of stories where some large farmer has taken to moneylending in the wake of the Green Revolution on discovering that borrowing from banks at low rates of interest and lending to small farmers at a premium is a more profitable business than investing in agriculture. Interestingly, these anecdotes have generally been viewed in a negative light -- as an indication of both wasteful and exploitative use of resources. It has seldom been appreciated that in a situation of imperfect credit market, where small farmers have always had difficulties in gaining access to banks and credit societies, these agriculturist-turned-moneylenders are performing a socially useful function of financial intermediation.¹⁰ Indeed, the fact that the small farmers have caught up with the big ones in the adoption of the new technology, belying the fears of the early years, has much to do with this allegedly 'exploitative' practice!

⁹ This figure refers to credit disbursed for all kinds of activities taken together, not just for agriculture. For more on the size and characteristics of informal credit market in Bangladesh, and on the articulation between formal and informal sectors, see Rahman (1992).

¹⁰ It has to be recognised, however, that unless the formal sector credit finds its way into the informal sector, the interaction between the two sectors can turn out to be harmful for the poor in the wake of increased formal sector credit. For an explanation, and a concrete example, see, Drèze *et al.* (1992).

But of course the expansion of credit is by no means the whole story. A no less important part has been played by input subsidy. Key inputs such as fertilizer and irrigation have been heavily subsidised, at least until recently, in all parts of South Asia. It is however interesting to note that this ubiquitous practice has proved to be one of those rare things in life that have the capacity to unite critics from both the left and the right of the ideological spectrum in a common chorus of derision. The critics on the left deride it because they see it as public sponsorship of private capitalism, as the lion's share of the subsidy is allegedly captured by the large farmers. The critics on the right deride it on the grounds that these subsidies allegedly distort the price regime and thus impede the attainment of allocative efficiency.

This is not the occasion to examine these views closely¹¹; suffice it to note that whatever else subsidy may or may not have done, it has certainly softened the credit constraint faced by the small farmers. In Bangladesh, fertilizer used to be subsidised by more than fifty percent in the early years of the Green Revolution, i.e. up to about the mid-1970s. Since then, the rate of subsidy on fertilizers has come down drastically, but irrigation continues to remain heavily subsidized.¹² The effect of these subsidies on the credit constraint has been discussed extensively by Osmani and Quasem (1990). They have produced evidence from field surveys to show that the small farmers have used more fertilizer per acre and brought a greater proportion of land under irrigation compared with the large farmers, in spite of the fact that they received less credit per cropped acre. Evidently, this was only possible because the availability of subsidized inputs compensated for the lack of credit. There is of course no denying that softening the credit constraint through input subsidy was only a second best strategy, but in the absence of the first best option of perfecting the credit market it has served the small farmers well.

¹¹ I have critically examined these views in Osmani (1985).

¹² In the early 1980s, the subsidy on low-lift pumps varied between 50 and 80 per cent, deep tubewells were subsidised to the extent of over 90 per cent and the water from major gravity-flow irrigation projects was virtually free -- only shallow tubewells were distributed at cost-price (Osmani and Quasem 1990).

We can now see how the initial lag in adoption by the small farmers was soon eliminated despite the persistence of market imperfections. As far as the insurance market is concerned, it is perhaps true that most of the imperfections remained unabated, but the risks dwindled - both subjective and objective risks - thus encouraging the small farmers to adopt the new technology. On the credit front, two types of positive developments took place. First, insofar as market imperfections took the form of quantity rationing, they were reduced to some extent by the greater availability of formal-sector credit and the ensuing interactions between the formal and informal sectors. Secondly, the credit constraint was further softened by the conscious public policy of pursuing the second-best strategy of subsidising critical inputs. As the impediments to adoption were thus removed or at least weakened over time, the small farmers not only overcame the initial lag, in many cases they also stole a march over the large farmers in terms of the intensity of adoption -- as measured, for instance, by the proportion of area sown with the MVs (Asaduzzaman, 1977; Dasgupta, 1977; Hossain, 1988).¹³

The Hypothesis of Land Alienation

In discussions concerning the effect of the new technology on small peasants, it is often supposed that the hypothesis of differential adoption suffices to establish the immiserizing tendency. But this is not so. On its own, this hypothesis can only say something about the *relative* gains of different classes of farmers. In order to predict *absolute* immiserization, it must be combined with something else. This point is often lost sight of, and the critical literature on the Green Revolution is replete with examples in which the evidence for 'unequalizing' tendency has been glibly interpreted

¹³ This last feature -- namely, the greater intensity of adoption among the small farmers -- can be explained by referring to the imperfections of the labour market. When the labour market is characterized by widespread involuntary unemployment, as it tends to be the case in large parts of South Asia, it is rational for family labour to be employed more intensively than hired labour (Chayanov 1966, Sen 1962). This tendency is reinforced by the moral hazard of working with hired labour -- i.e, the possibility of labour 'shirking', which entails a supervision cost for the employer. The net result is that small farmers, who use primarily family labour, will be inclined to use labour more intensively than large farmers, who employ mainly hired labour. And since the new technology is highly labour-intensive (unless accompanied by extensive mechanization), it follows that, provided credit and other constraints do not bind, small farmers are likely to adopt the technology more intensively than large farmers.

as evidence for 'immiserizing' tendency. There are however several possible candidates which, when combined with the hypothesis of differential adoption, can predict absolute immiserization of the small peasantry. Among them, we have chosen to discuss the hypothesis of land alienation because of the prominence it has received in the literature.¹⁴

It should be evident, however, that the force of this hypothesis is already weakened by the preceding discussion. If the small and marginal farmers do adopt the new technology, then whatever happens to relative income inequality among farmers, it is hardly likely that their absolute income will fall. But unless their absolute income falls, it is hard to see how the small farmers could be forced to lose their land.¹⁵ Yet the critics have all too often argued as if simply by accumulating a bigger surplus the large farmers would be able to swallow up the small ones.

It is true that by increasing the profitability of cultivation the new technology could encourage the large farmers to buy more land; and the accumulation of a bigger surplus would also enable them to do so. Accordingly, it is reasonable to expect that the demand for land would go up with the adoption of the new technology. But it does not follow that the higher demand for land will then lead to increased volume of sales. This may sound paradoxical; but there is a very sound reason for this. It lies in the special nature of the supply curve of land in poor land-scarce economies characterised by imperfect credit markets. Most sales of land in such economies are in the nature of *distress sales* -- people sell their land as a last

¹⁴ One of the other possible candidates is an argument which states that as the 'adopter' large farmers pump out larger volume of underground water to meet the increased water requirement of the MVs, the non-adopting small farmers are deprived of their traditional share of water, which leaves them worse off than before (Chambers and Farmer, 1977, p.416; see also Bhatia, 1992). This is certainly possible, but doubts remain about the quantitative significance of the phenomenon -- certainly the critics have provided nothing more than scattered anecdotal evidence. Yet another candidate is the argument that the decline in grain prices caused by increased output has harmed those small farmers who have failed to adopt or cannot adopt due to unsuitable agro-climatic conditions (Griffin, 1989, p.146; Lipton and Longhurst, 1989, p.152). This argument seems strange, however, when one notes that *poor* small farmers in South Asia are almost always *net* buyers of food, so that lower prices should help rather than harm them.

¹⁵ The present discussion is confined to small *owner* farmers. The situation of *tenants* is somewhat different -- for them, the mechanism of land alienation is eviction, not sales. Their case is taken up separately below.

resort to meet the emergency need for a given amount of cash, when neither charity nor credit can meet their needs. This feature of seeking 'a given amount of cash' is very important. It ensures that the supply curve of land will be negatively sloped, because the need for a *given* amount of cash can be met by selling a smaller amount of land at a higher price. And when such a negatively sloped supply curve is confronted with a rising demand curve, we should expect the volume of sales to go down rather than up.¹⁶

In other words, as the Green Revolution inflates the surplus of large farmers, the demand for land is indeed likely to go up leading to a higher price of land, but this higher price will enable the distressed farmers to meet their needs by parting with less rather than more of their land (subject to the constraint of divisibility). At the same time, as the small farmers gradually adopt the new technology and earn higher income, their vulnerability to periodic distress will also be reduced. As a result, the supply curve of land will shift to the left, bringing down sales even more. For these reasons, we have speculated elsewhere that, contrary to conventional wisdom, when the Green Revolution comes to an economy where demographic pressure is creating an increasing tendency towards landlessness, we should expect a retardation rather than accentuation of this tendency (Osmani and Rahman, 1986).

A striking corroboration of this speculation comes from a study of land market in the Indian Punjab (Shergill 1986). The author took 14 randomly selected villages in a medium-developed district (Sangur) in 1979/80, and looked at the history of land sales in these villages over the period from 1952/53 to 1978/79. After going through a painstaking process of cleaning the official documents through the filter of direct interviews with the parties concerned, he developed as reliable a time-series of sales and prices as it is possible to have on so sensitive an issue as land transfer. Analysis based on this cleaned time-series shows that, as expected, land prices increased at a faster rate in the Green Revolution period (i.e., the period after 1966/67), but the volume of annual land sales actually declined at the rate of 1.1 per cent

¹⁶ The 'perverse' nature of distress sales has not always been recognized by the modellers of agrarian economies. For instance, Braverman and Stiglitz (1989) develop a dynamic model of the land market where they acknowledge that sales will typically occur under distress and yet assume that a higher demand price of land will bring forth a higher supply.

after 1966/67. This was in sharp contrast with the earlier period when the annual land sales had been rising at the rate of 7.9 per cent per annum.

The fact that the trend of sales was completely reversed is rather surprising; it means that the stabilising effect of the Green Revolution was strong enough to overwhelm the process of land alienation that was being generated by demographic pressure. This reversal of the trend could however be a feature that is unique to the Punjab, in part because the Green Revolution has spread exceptionally widely in this state, and in part because the Punjab has also experienced a slow-down in population growth since the mid-sixties. In other parts of South Asia, where demographic pressure continues unabated, one should expect to see a deceleration in the rate of land transfer rather than an absolute decline in the volume of sales. However, one will have to wait for the emergence of data of the kind collected by Shergill before one can conclusively validate this hypothesis. Meanwhile, some cross-sectional evidence from Bangladesh lends indirect support to the thesis that the Green Revolution should have a stabilising effect even in areas with intense population pressure. A recent survey in Bangladesh reveals that while the land market is generally pretty thin, it is even thinner for the small and marginal farmers of the technologically advanced villages -- they sold just about 2 per cent of their land compared to 5 per cent sold by their counterparts in the backward villages (Hossain 1988, p.117).¹⁷

We have so far focussed only on the distress sale of land, and argued on the basis of both theory and facts that the Green Revolution retards the process of land alienation. But distress sale is not the only kind of sale that takes place in the land market; there is also another kind that may be called the 'portfolio adjustment' sale. People may want to move out of land (partly or wholly) either because they want to move into some other asset, or because they want to take up a different occupation -- and they do so not under the compulsion of distress, but because they find it a more profitable option. This kind of 'portfolio adjustment' sale is not the predominant mode of land

¹⁷ Note that the land-man ratio was almost exactly the same in the two sets of villages, and land ownership distribution was also very similar, especially at the lower end of the scale (Hossain 1988, Table 2). As a result, the difference in land sales cannot be attributed to differential population pressure on land.

transfer in rural Asia yet, but it does occur. So the question arises: what is the impact of the Green Revolution on land transfer of this kind?

Clearly, it is possible for the Green Revolution to increase the volume of sales on this account. Consider a farm family which has inherited a small piece of land that is too small to keep the entire family labour occupied throughout the year; furthermore, since the labour market does not clear, there is no assurance of getting full employment by doing wage labour on the side. In the circumstances, the family might consider taking up self-employment in some non-farm activity that promises to ensure a higher rate of return on family labour; but owing to imperfections of the capital market, they cannot raise the initial capital to start the business. So they think of selling their piece of land to procure the necessary capital but the price of land is too low to fetch the minimum amount required to set up the business (which is assumed to be subject to a certain degree of indivisibility). As a result, much to its dismay, the family remains tied to the land. Then comes the Green Revolution, inflates the surplus of big farmers, and pushes up the price of land. At this higher price, it may now be possible for that family to raise the necessary fund by selling land. So we should expect to find a larger volume of sales on account of portfolio (-cum-occupational) adjustment in the wake of the Green Revolution.

But note that this kind of land sales cannot be seen as causing impoverishment of marginal farmers. Since portfolio adjustment is guided by the principle of seeking out the highest rates of return, land sales on this account will typically improve the economic conditions of those moving out of land.¹⁸

Thus whether we think of land transfer as distress sale or as portfolio adjustment, such transactions cannot be seen as a mechanism through which the Green Revolution can have an immiserizing effect on poor peasants.

¹⁸ We are not suggesting that a farmer will necessarily move out of land just because the economic rate of return on labour is higher in some non-farm activity (even assuming he can raise the initial capital to make the move). People may have emotional attachment to land, or they may value the farming way of life, so much so that even the prospects of higher income in some other occupation may not be enough to lure them away. In other words, higher economic rate of return is not a sufficient condition for voluntarily moving out of land; but it will typically be a necessary condition, and that is what is important for our argument.

When this observation is combined with the one made earlier that the small and marginal farmers have now adopted the new technology with no less vigour than that displayed by the big farmers, one can only conclude, contrary to conventional wisdom, that the growth process engendered by the Green Revolution has enhanced rather than eroded the entitlements of the small peasantry, despite the constraints imposed by the existing socio-economic structures.¹⁹

III EVICTION AND PAUPERIZATION OF TENANT FARMERS?

The 'eviction of tenant' argument can be seen as a part of the broader argument about immiserization of the small peasant, because until recently tenants typically belonged to the rank of small farmers almost everywhere in South Asia. We are treating it separately here only because the suggested mechanism of immiserization is different here from the one we have discussed above in the context of owner-farmers. In fact, the stakes are supposed to be even more heavily loaded against tenants than against owner-farmers of comparable size. Recall that despite the inhibiting influence of market imperfections small farmers have caught up in the adoption of the new technology. This is true for both owner-farmers and tenant farmers.²⁰ But while the catching up process rescues the owner-farmer from the trap of immiserization, the same is not necessarily true for the tenant, for he may be evicted at will at any time by his landlord. It is indeed one of the major contentions of the critics of the Green Revolution that evictions are likely to

¹⁹ Note that we have not dealt here with the related but distinct question of whether the Green Revolution has accentuated the *relative* inequality among farmers of different size-groups, because our immediate concern here is with *absolute* poverty. The evidence on inequality happens to be rather mixed, with the balance of weight tilting slightly towards deterioration; see, for example, Bhalla and Chadha (1983), Hossain (1988), Hossain *et al.* (1990), Osmani and Rahman (1986), Lipton and Longhurst (1989), and Prahladachar (1983), among others.

²⁰ One of the common perceptions in the early phase of the Green Revolution was that the tenant farmer adopts less than the owner farmer. But like most perceptions of the early phase, this too has now been revised. For the empirical basis of the revisionist view, see Dasgupta (1977) on India, Hossain (1988) and Hossain *et al.* (1990) on Bangladesh, and Herath (1983) on Sri Lanka.

increase following the introduction of MVs as landlords turn to own-account cultivation lured by the increased profitability of agriculture.²¹ If true, this would constitute an important mechanism through which the Green Revolution could erode the entitlements of a significant section of the rural poor.

Theoretical Considerations

We shall presently consider the empirical evidence in this regard, but first it is worth pointing out that the theoretical basis of the contention is not particularly sound. It is not at all clear why increased profitability of farming should by itself induce a landlord to take up own-account cultivation. He can, after all, also enjoy the fruits of higher profitability by allowing the tenant to continue to farm his land, provided the tenant can be induced to adopt the new technology and the landlord's share of the output does not decline. What matters, therefore, is the *relative* profitability of the two modes of cultivation -- namely, tenant-cultivation on the one hand and own-account cultivation on the other. For eviction to be rational, there must occur a *reversal of relative profitability*; that is to say, own-account cultivation - which in practice means farming with hired labour -- must become the more profitable option under the new technology, while tenant-farming happened to be the preferred mode under traditional technology. But what is there in the new technology that would cause such a reversal? This question has never been satisfactorily addressed by the critics, impressed as they were simply by the absolute increase in profitability under own-account cultivation. But higher absolute profitability under own-account cultivation can be accompanied by either a rise or a fall in relative profitability. Indeed we shall argue below that there are good reasons to suspect that relative profitability might very well change in favour of tenant farming under the new technology.

To see how this might happen, it is first necessary to understand the rationale behind the choice among alternative modes of cultivation: what,

²¹ Thus, for example, argues Ladejinsky (1969, p. A-147), "...the sharecroppers are, if anything, worse off now than before, because as the ownership of improved land is prized very much, there is mounting determination among owners not to permit the tenants to share in the rights of the land they cultivate. Their preference is to be rid of them."

for example, are the considerations that determine the choice between cultivation by tenants and cultivation by hired labour? Some insight into this question can be gained from the huge and growing literature on the theory of share tenancy.²² The dominant view that emerges from this literature is that the institution of tenancy is but a rational device for providing incentive to labour in the presence of moral hazard. The problem of moral hazard consists in the fact that once a wage-contract has been agreed the labourer has every incentive to minimise his work effort, because in the first place his reward does not depend on the level of output, and, furthermore, he expects to get away with impunity by shirking labour since monitoring the work effort is always costly and often impossible. When the landlord perceives the degree of moral hazard to be too severe, he prefers to lease out his land to a tenant, who would not have the incentive to shirk labour since his reward would depend directly on his effort.

Of course, the desire to provide incentive is not sufficient to explain the specific institution of 'share' tenancy, as distinct from other forms of tenancy, because incentive is often best provided by offering a fixed-rent contract. For share-tenancy to dominate over other contractual forms, some other conditions have to exist, such as uncertainty, or wealth constraint, or the possibility of repeated contracts, etc. But these additional complications need not worry us here, because our immediate concern is with the general choice between tenancy as a whole and hired labour, and not with the specific issue of why share-tenancy tends to dominate over other contractual forms. In this general context, there is little doubt that the central issue is the moral hazard of using hired labour. So in order to see how the choice between alternative modes of cultivation would be affected by the Green Revolution, we ought to ask the question: how does the new technology affect the scope for moral hazard?

The answer depends crucially on the degree of mechanization that accompanies the adoption of the new technology. Consider first the case of negligible mechanization, as happens to be the case in Bangladesh, in most states of India other than the Punjab and Haryana, and in the densely populated wet zone of Sri Lanka. In such environments, the new technology

²² For highly illuminating reviews of this literature, see Otsuka and Hayami (1988) and Singh, N. (1989).

is highly demanding in terms of labour use. Not only that it requires more labour hours per unit of land, it also demands more careful application of labour -- for example, in preparing the land, in line-transplanting of seedlings in place of traditional broadcasting of seeds, in weeding, and in timely application of fertilizer and water. All this means that the scope of moral hazard increases with the introduction of MVs. In consequence, one should expect to find an increase in the incidence of tenancy rather than eviction of tenants!

There is however one potential deterrent to increased tenancy that must be noted -- it is the problem of credit constraint. Since the new technology increases the working capital requirement, and since the tenants (in the environments described above) are typically small farmers faced with a severe credit constraint, it may be difficult for them to lease in land even if the landlords wanted to give it to them. But this problem can be overcome by the landlords either by offering a production loan to the poor tenant (i.e., by interlinking credit and land market transactions), or by agreeing to a cost-sharing arrangement. This would alleviate the credit constraint while at the same time minimising the problem of moral hazard. So the scenario that can be expected to emerge in the wake of the Green Revolution is one of higher incidence of tenancy accompanied by more widespread practice of cost-sharing and/or interlinked transactions.²³

There is actually a good deal of evidence that the practice of cost-sharing and interlinked transactions tends to increase with the adoption of MVs. For example, it has been observed in a large-scale study recently conducted in Bangladesh that the proportion of contracts with arrangements for sharing the cost of both fertilizer and irrigation went up substantially with the adoption of MVs (Hossain *et al.* 1990, p.135). Similarly, a study in the Indian state of West Bengal in the late 1970s found that in order to encourage tenants to adopt the new technology, the landlords not only offered production loans, often without interest, but also shared the cost in nearly

²³ The prediction of higher incidence of tenancy is supported by Bardhan's (1979) analytical model. However, in his model, the driving force is the increase in the wage rate owing to greater demand for labour, while our argument rests on the premise of increased moral hazard. In a sense, our prediction is stronger than his because it suggests that even if the wage rate does not rise -- because, say, labour supply increases at the same time -- the incidence of tenancy will still go up.

two-thirds of the cases (Bardhan and Rudra 1978). In our interpretation, these new developments are to be seen as a device for overcoming the credit constraint that tenants are likely to face in adopting the new technology. As such they are to be viewed as supportive institutional innovations as the new technology gives an impetus to tenant cultivation.

Interestingly, however, some observers have interpreted the very same phenomena as supportive of the orthodox thesis that the new technology would contribute to the demise of tenancy. For example, it has been argued that the input-providing, cost-sharing landlord would be tempted to evict his tenant, because after "... having made the investment, taken an active role in decision making, and significantly reduced the uncertainty of cultivation, he would probably be most reluctant to share half (or more) of the produce with someone else." (Dasgupta 1984, p.A-93.) This argument presumes that the landlord has a better option open to him, but as we have argued above this presumption cannot be valid in an environment where the MVs are grown with little mechanization (which happens to be the case in West Bengal of which Dasgupta was speaking).

The adoption of MVs in such an environment increases the moral hazard of labour, which is why cultivation by wage labour becomes less rather than more attractive than before. The investment that the landlord makes by way of input sharing does nothing to reduce this moral hazard; so there is no reason why after 'having made the investment' the landlord would be 'most reluctant' to share the crop with the tenant.²⁴ These investments are made by him so as to make the best of the situation when he decides to have his land cultivated by tenants. Accordingly, the evidence on cost-sharing practices, production loans from landlords, their active participation in

²⁴ Some of the investments made by the landlords may, however, have the effect of altering the terms of contract. For example, as their investment in irrigation reduces the risk of cultivation, fixed-rental contract may become more attractive than the traditional share contract. With a fixed-rental contract, the tenant bears all the risk but he also gets the best incentive to work. Therefore, as risk is reduced and labour becomes more demanding with the adoption of the new technology, the fixed-rental contract is likely to emerge as the superior contractual form for both parties. However, since social institutions change only very slowly, fixed-rental contracts will not sweep the rural scene overnight. But one should expect to find a move in that direction. This is indeed confirmed by the findings of Bardhan and Rudra (1978) for West Bengal and Hossain *et al.* (1990, p.135) for Bangladesh. The moral of all this is that after having 'significantly reduced the uncertainty of cultivation, Dasgupta's landlord may quite reasonably ask for a change in the terms of tenurial contract, but he would have no good reason for taking the land back for cultivation by wage labour.

decision-making, and similar other institutional changes should be seen as supportive of the underlying tendency of tenancy to prosper rather than wither away under the impact of the new technology.

Empirical Evidence

But what about the actual evidence on the prevalence of tenancy - is it growing or declining? The data on tenancy in South Asia is notoriously unreliable. However, most observers agree that tenancy has declined over time in most parts of South Asia, especially in India and Sri Lanka. This has been taken by some as evidence for the view that the new technology has contributed to the decline of tenancy (e.g., Dasgupta, 1984; Gill, 1989). Yet it is well-known that there are other reasons behind the eviction of tenants, most notably the enactment of tenurial reforms which purported to offer more favourable rights to tenants and thus frightened the landlords into taking back their land before the hand of the law could reach them.²⁵ Unless the effects of these other factors are separated out, the evidence of declining tenancy cannot by itself indicate anything about the effect of the new technology.

An alternative procedure is to compare cross-sectionally the evidence from technologically advanced and backward areas. Unfortunately, there are not a great many studies of this kind; but one fairly large-scale study in Bangladesh has found that the incidence of tenancy is much higher among farmers growing MVs. This is especially true in the main MV-growing season (*Boro*) when the proportion of farmers renting in land was found to be 35 per cent among MV-growers as opposed to only 16 per cent among traditional farmers, and the amount of land rented as a proportion of sown area was 17 per cent for MVs compared with only 8 per cent for traditional seeds (Hossain 1988, p.75). Similar findings were reported in yet another study, covering an even larger geographical area (Hossain *et al.* 1990, p.59).

Thus both theory and evidence (scant as it is) support the non-orthodox view that the adoption of MVs should strengthen rather than

²⁵ The impact of these reforms on the prevalence of tenancy has been discussed in Osmani (1991b).

weaken the institution of tenancy, especially in areas with little mechanization. However, the picture can be quite different when widespread mechanization, especially the use of tractors and power tillers, accompanies the adoption of MVs. As we shall see in the next section, there is considerable controversy over whether mechanization of this kind reduces or increases the overall use of labour. But two things are fairly certain: first, tractorization reduces labour input *per hectare* in any given cropping season, and secondly it simplifies and deskills the labour process by routinising and standardising the application of labour. Both these facts imply a reduction in the scope for moral hazard in the use of wage-labour and also a reduction in the cost of supervision per hectare of cropped acreage. If these effects are strong enough to tilt the balance in favour of cultivation by wage-labour eviction of tenants is likely to follow.²⁶

Notice however that mechanization does not necessarily lead to tenant eviction; it all depends on the *degree* to which the moral hazard of wage labour happens to come down. It is not surprising therefore that at least in one micro-study (in Bangladesh) the author has found that the incidence of tenancy was substantially higher in the village which had mechanized its tillage operations while adopting the MVs, compared with a neighbouring village which had also adopted the MVs but had not mechanized (Asaduzzaman 1988).

However, the general experience of South Asia is that areas characterized by extensive tractorization are also areas that have seen large-scale eviction of tenants. This is especially true of the states of Punjab and Haryana (and the western part of Uttar Pradesh) in India and the dry zone of Sri Lanka. But even this evidence needs to be interpreted with caution. The Sri Lankan experience shows, for example, that the eviction of tenants has occurred no less in the wet zone, where mechanization has not made much progress, than in the dry zone where it has; it is perhaps relevant that the

²⁶ A vivid historical corroboration of this hypothesis is provided by Day (1967) who notes that large-scale mechanization substituting for hand-picking of corn and cotton contributed to a rapid decline in sharecropping in the Mississippi Delta.

common factor in both these areas was the enactment of tenurial reforms that promised greater security for tenants.²⁷

The situation in the Punjab and Haryana is a little more complicated. The tenurial structure has evolved in these states in two distinct phases - the pre-MV and post-MV periods. Eviction of tenants has taken place in both phases, but it was more pronounced in the first. The distinguishing feature of the second phase is the emergence of 'reverse tenancy' -- the phenomenon of large and middle farmers renting in land from small and marginal farmers. One observer has succinctly described the changing behaviour of big landowners as follows:

"In the first phase, after post-Independence land reforms and development of irrigation, they started resuming their land for owner cultivation. In the second phase, as a result of recent technological changes and introduction of tractors and other machines (in addition to the continuation of first phase transformation) some of the middle and big owners started leasing-in land in order to optimise the use of capital resources." (Singh, I. 1989, p.A-88).

Thus the structural change that can be unambiguously attributed to mechanization is not so much the eviction of tenants as the emergence of reverse tenancy. The bulk of the evictions had occurred well before the new technology came to the scene.

The overall conclusion, therefore, is that in areas characterized by extensive tractorization there is a possibility that the new technology might lead to the eviction of tenants, but there is no firm evidence yet that this has happened in any significant scale in South Asia. And in areas where the spread of tractorization is much less pronounced, which is the current situation in the major part of South Asia, theoretical considerations suggest that the new technology should in fact encourage tenant cultivation; and whatever evidence there is tends to confirm this.

²⁷ "There is little evidence in Sri Lanka of eviction by large owners to resume own cultivation by mechanising the operations." (Gooneratne, 1979, p.16.)

IV THE IMPACT ON WAGE LABOURERS

In most parts of South Asia, agricultural wage labourers constitute the bulk of the rural poor. So the overall impact of the Green Revolution on the entitlements of the poor would depend to a large extent on how it affects the employment and wages of agricultural labourers. It is by now well-documented that the biological properties of the MVs and the associated agronomic practices are such that their adoption generally calls for greater use of labour per unit of cultivated land. This should normally mean that the introduction of MVs will increase the demand for labour and thereby improve their earnings.

But the critics have argued that in reality things have not quite worked like this, because widespread mechanization of farming operations have actually reduced the demand for labour.²⁸ There is a huge empirical literature on the subject of labour absorption under the new technology; we shall only summarize the major findings that are relevant for our purpose, urging the reader to consult the original sources for details.²⁹

Labour Absorption under Non-Mechanized Conditions

There are three main ways in which MVs tend to raise the demand for labour. First, the agronomic practices associated with MVs are usually much more labour-intensive than is the case with traditional varieties of foodgrains. Preparation of seed-bed, more intensive ploughing and weeding, application of inputs such as pesticides, fertilizer, water, and finally harvesting of a bigger crop - all these require much more labour than

²⁸ An alternative view holds that, even in the absence of mechanization, the initial favourable impact on wage labour will soon evaporate through general equilibrium repercussions and other systemic failures (Lipton and Longhurst 1989). We shall examine this view in some details in the next section.

²⁹ The Indian experience has been comprehensively reviewed by K. Bardhan (1977, 1983) and Basant (1987); the Bangladesh experience by Muqtada (1986) and Hossain (1988); and the Sri Lankan experience by Wickramasekara (1980). For a more broad-based review of the Asian experience, see Ishikawa (1981), Barker *et al.* (1985), and Wickramasekara (1987).

before.³⁰ Secondly, since the growing period of MV cereals is usually of shorter duration, the way is opened for multiple cropping, which vastly increases the demand for labour. Thirdly, the possibility of multiple cropping is increased by yet another feature of the new technology -- the irrigation component; by assuring supply of water in the dry season, irrigation makes it possible to grow an extra crop at a time when land would otherwise remain fallow.

The combined effect of all these factors amounts to a significant increase in labour absorption. For example, it has been estimated in Bangladesh that labour absorption per acre can increase by as much as 40-50 per cent when traditional seeds are replaced by MVs (Hossain 1988). But even more remarkable is the increase in the absorption of hired labour. It is a common experience of Asian agriculture that the introduction of MVs has increased the absorption of hired labour proportionately more than family labour (Barker *et al.* 1985, p.128; Basant 1987, p.1349).³¹ Recent field surveys in Bangladesh confirm this pattern: they show that if total labour absorption goes up by 35 to 40 per cent, the absorption of hired labour can go up by as much as 50 to 80 per cent (Hossain 1988, p. 45; Muqtada and Alam 1986, Table 2.32).

It is thus clear that MVs have a considerable potential of improving the earnings of agricultural wage labourers in conditions of non-mechanized farming. So the relevant question now is: to what extent does mechanization prevent this potential from being realized in full? The answer depends very

³⁰ One notable exception is the case where the MV cereal replaces jute in Bangladesh, for jute is one of the most labour-intensive crops grown in the region -- even more so than most varieties of MV rice. But the saving grace is that when MV is grown in the jute season, it is not done mainly at the expense of jute, but usually at the expense of traditional rice and non-cereal crops which are much less labour-intensive, and also quite often by cultivating hitherto fallow land.

³¹ That this should be so is easy to understand when the MVs are adopted exclusively by large farmers. But the same phenomenon is observed even when MVs are widely adopted by all categories of farmers -- large and small. The main explanation lies in the acutely seasonal nature of the extra demand for labour generated by MVs. Since the extra demand is largely concentrated in peak periods of labour use, when family labour is already overstretched, the extra demand has to be met mainly by the use of hired labour. A secondary reason perhaps lies in the fact that leisure is a normal good for most people -- as income rises with the adoption of MVs farmers may decide to consume more leisure, making room for greater use of hired labour.

much on which of the operations happen to be mechanized. Irrigation, ploughing, and threshing are the three operations in which mechanization has proceeded the most in South Asia. Of these, mechanization of irrigation is widely recognized to have actually increased rather than decreased labour absorption -- firstly, by making it possible to provide water in adequate amounts and at the right times without which it would not have been possible to adopt the labour-absorbing MVs in the first place, and secondly, by allowing extension of cultivation into the dry season. It is the other two mechanizations - described under the generic name of tractorization - that have been perceived to be labour-displacing.³² So in what follows, the discussion on mechanization will deal essentially with the consequences of tractorization.

Labour Absorption under Mechanized Conditions

Studies on India and Sri Lanka have come to a near consensus that the *pure* effect of mechanization on labour absorption in a single crop season is negative (Basant 1987; Wickramasekara 1980). The pure effect is defined as the difference made by mechanization, holding other inputs of the new technology constant. It has however been argued in some quarters that the effect over the crop-year as a whole may turn out to be positive because mechanization can increase the intensity of cropping. The argument is that, by economizing on the time required for certain crucial operations, mechanization may enable farmers to overcome the time constraint which often prevents them from raising an extra crop. The experience of East and South-East Asia shows that this argument has some validity in that region; but in South Asian conditions, mechanization (meaning tractorization as opposed to irrigation) has usually contributed very little to higher cropping intensity (Binswanger 1978; Barker *et al.* 1985; Basant 1987). So even for the

³² This distinction between irrigation and tractorization is neatly captured by Sen's (1958) terminology of 'landesque' and 'labouresque' capital. 'Landesque' capital, such as irrigation and fertilizer, is land-saving and is therefore labour-absorbing, while 'labouresque' capital, such as tractors, is labour-displacing. Raj (1973) has rightly pointed out that it is not always possible to make a clear-cut distinction between these two types of capital because what is 'landesque' under certain conditions may turn out to be 'labouresque' under others, and vice versa. Nevertheless, in the present conditions of South Asian agriculture it is probably true to say that irrigation is unambiguously 'landesque', while tractorization is 'labouresque' in most conditions -- on the latter, more below.

crop-year as a whole, the pure effect of mechanization can be taken to be negative. This conclusion however needs to be qualified by a couple of remarks before any implications can be drawn about the impact of the Green Revolution on wage labourers.

First, what is relevant for our purpose is not so much the *pure* effect of mechanization as the labour-absorptive capacity of the *complete technology package* comprising MVs, fertilizer, irrigation, and tractorization. On this, unlike in the case of the pure effect, the evidence is rather mixed. In parts of India where mechanization has been adopted intensively, some micro-level studies have found negative employment effect of the complete package, while others have found the opposite (Basant, 1987); the general picture can only be described as indeterminate.

However, the macro-level evidence shows that although labour use *per hectare* has fallen in the Punjab, Haryana and Uttar Pradesh -- the three pioneering states of the Green Revolution, and also the three most mechanized ones -- total labour absorption in agriculture has gone up even there because of the increase in gross cropped area that has been made possible by irrigation; so the overall package has been labour-absorbing even in these states (Bhalla 1989).³³

Secondly, even the overall labour absorption of the complete package is not adequate for our purpose, because we want to assess the impact of this package on the living standards of *wage labourers*. So the relevant question for us is: how has the package affected the demand for hired labour? The general finding of the micro-level studies carried out in various parts of India is that the effect of the overall package is to *increase* the demand for hired labour, even when it reduces total labour absorption.³⁴ Together with the

³³ But the same is probably not true of Sri Lanka where no such increase in cropping intensity has accompanied the spread of mechanization (Wickramasekara, 1980; ARTEP, 1986).

³⁴ See, for example, the case studies by Chawla *et al.* (1972), Singh (1976), Roy and Blase (1978), Agarwal (1981), and Oberai and Ahmed (1981) for the Punjab; Bhalla (1981) for Haryana; Raju (1976) and George and Raju (1981) for Andhra Pradesh; Garg *et al.* (1972) and Pandey (1972) for Uttar Pradesh; and Dasgupta (1977), Bardhan (1978) and NCAER (1980) for studies covering several states. For concise reviews, see Vyas and Shivmaggi (1975) Binswanger (1978) and Basant (1987).

macro-evidence mentioned earlier that total labour absorption has not fallen even in the most mechanized states, this finding leaves hardly any basis for the contention that the new technology has actually immiserized the wage-labourers of India through the labour-displacement effect of mechanization.

This conclusion is also consistent with the macro-level evidence on real wages of agricultural labourers in India. It has been observed that between the early seventies and the mid-eighties the real wage of agricultural labourers rose in several parts of India and did not fall anywhere despite the pressure of expanding labour force (Jose, 1988; Acharya, 1989). Such behaviour of real wages would be difficult to explain if agricultural growth actually reduced the demand for hired labour.

Is Mechanization a Necessary Part of the New Technology?

It has to be accepted, however, that even if mechanization (in conjunction with other components of the new technology package) has not actually reduced the demand for hired labour in most places, it has at least prevented the labour-demand potential of the new technology from being realized in full. There is indeed some disturbing evidence that in the most advanced mechanized areas such as the Punjab and Haryana, the elasticity of employment with respect to output has already declined to an alarmingly low level (Bhalla, 1989). A more extreme case is Sri Lanka, where mechanization may have actually reduced the demand for hired labour (Wickramasekara, 1980). If these are any indication of what the future holds for the rest of the Green Revolution belt, are not the critics right after all in arguing that without significant land reforms the landless labourers cannot hope to gain from the introduction of the new technology?

The answer depends on an issue that has been the subject of much debate: is mechanization a necessary part of the growth process that is set in motion by the new technology? There is a powerful school of thought which argues that it is; if this school is right, then the prospects of wage-labourers in South Asia must be deemed to be bleak indeed. But is it right?

In debating this question, it is first necessary to guard against a possible source of error. Taking a sufficiently long-term view, one can

always argue that mechanization of agriculture is a necessary part of the growth process. It is a well-known empirical regularity of Modern Economic Growth (a la Kuznets) that, at a certain stage of development, the absolute size of agricultural labour force begins to decline, as the demand for labour from non-agricultural sectors begins to outstrip the natural increment of labour force. Labour shortage then becomes the binding constraint not only on agricultural output, but also on the growth of the overall economy, as agriculture becomes unable to supply either the extra wage-goods or the extra labour required to sustain growth in the rest of the economy. At this critical juncture, mechanization helps the growth process by releasing the binding labour constraint.

In this sense, mechanization of agriculture is certainly a necessary part of long-term growth; it has happened everywhere in the western industrialized world, in Japan, and is now happening in the currently fast developing countries such as Taiwan and Korea. But note that mechanization of this kind cannot be said to cause labour displacement; rather it is the displacement of labour that causes mechanization. Furthermore, the whole economy, including the labourers, benefits from such mechanization; the labourers benefit because agriculture is now able to release labour for more productive employment elsewhere without reducing the supply of wage-goods. Obviously, this is not the kind of mechanization that one worries about when one ponders the consequences of the Green Revolution. Rather, one worries about the situation in which mechanization comes long before the critical juncture of declining absolute labour force has arrived in agriculture -- i.e., when the scarcity of labour has not yet become the binding constraint on output expansion. So the question one needs to ask in the present context is whether such 'premature' mechanization is a necessary consequence of the growth process that is unleashed when the new technology is inserted into the prevailing social structure.

The view that it is a necessary consequence has been expounded most forcefully and consistently by Byres (1972, 1980).³⁵ His argument is based on

³⁵ It should be noted, however, that Byres is concerned with an issue that does not logically require mechanization to be a necessary part of the growth process. His concern is to examine how the new technology is shaping the course of class formation and class action in rural India. Mechanization is an integral part of the story he tells, because, through its effects on capital accumulation and the labour process, it can significantly mould the

an assumed complementarity between biochemical and mechanical innovations.³⁶ Biochemical innovations accentuate the seasonality of labour demand, calling for greater use of labour during time-bound operations (such as seed-bed preparation). Scarcity of labour during these peak periods may hamper the timeliness of operations; this, according to Byres, will induce the rich farmers to go for mechanization.

Now, it is certainly true that machines can speed up work; but if this is what is believed to be the main inducement behind mechanization, then one must explain what precisely do the farmers hope to gain from speeding. Technically, two types of gain are possible. First, it may improve the yield (for example, by making it possible to complete time-bound operations in time, or by allowing some extra rounds of ploughing, etc.). Secondly, it may increase cropping intensity (for example, when the time gap between the harvesting of one crop and the sowing of another is too narrow to be bridged by human or animal labour at a reasonable cost).

Note that while both these gains are technically possible, they have rather different implications for our analysis. If the yield-effect is what induces mechanization, then the resulting growth will be unambiguously labour-displacing. However, if cropping intensity happens to be the underlying inducement, then over the crop year as a whole labour demand may actually increase; in that event, mechanization cannot be said to be unhelpful for the poor. So even if the complementarity argument is sufficient to establish the necessity of mechanization, it is not sufficient to draw the further link between mechanization and the impoverishment of wage-labour. That link can only be sustained if somehow the cropping intensity effect can be played down.

formation of classes. However, in order to deduce the course of class formation, he does not need to assume the necessity of mechanization -- he can proceed from the indisputable premise that mechanization has actually been a part of the growth process, whether necessary or not. At times, he seems to be clearly aware of this point. For example, in response to Griffin's (1974) view that tractorization is induced by 'political prices' and not by underlying economic forces, he retorts by saying, "These are the prices that matter, after all. It is the actual situation that concerns us..." (Byres 1980, p.416). Yet he is not satisfied simply with noting that mechanization is actually happening; he takes great pains to prove that it is happening as a 'necessary' part of the growth process.

³⁶ In mechanical innovations, Byres includes both irrigation and tractorization. This is perfectly legitimate for his own purpose, but for our present purpose we focus on tractorization alone since, as mentioned before, irrigation is unambiguously labour-absorbing in South Asian conditions.

Byres is evidently aware of this problem; so he tries to play down the intensity-effect with the following argument. He makes a distinction between short run and long run effects, and argues that any short run increase in labour absorption owing to increased cropping intensity will be reversed in the long run when mechanization spreads to almost every operation. But invoking the long-run in this way will not do, because as we have argued before the mechanization that will 'necessarily' happen *in the long-run* cannot be viewed in the same light as *premature* mechanization. The argument must stay within the context of the short-run; and in that context, the only valid way to sustain Byres's position is to argue that empirically the complementarity between mechanization and biochemical inputs arises more from the yield-effect than from the intensity-effect.

But what is the empirical evidence on complementarity? Here Byres is on palpably shaky grounds. He does not discuss the yield-effect at all; and when he looks for evidence on the intensity-effect, he finds mostly contrary evidence which he then tries rather unconvincingly to brush aside. The fact is that a large number of studies carried out in different parts of Asia have by now produced the near consensus that the initial tractorization has had no significantly positive effect on yield almost anywhere and no appreciable effect on intensity in South Asia (Binswanger 1978, 1986; Barker *et al.* 1985; Basant 1987). Thus as far as the South Asian experience is concerned, mechanization cannot be said to have been complementary to biochemical inputs on technical grounds.

Byres, however, tries to resist this conclusion. He does so on the basis of the indisputable fact that if the farmers have actually resorted to mechanization it must be because they have found it profitable to do so. He thus seems to believe that the existence of complementarity is revealed by the higher profitability of mechanized cultivation as compared with the non-mechanized cultivation of MVs.³⁷ Quite apart from the fact that the presumed revelation is contradicted by scores of technical studies on complementarity, there is also an analytical problem with this line of

³⁷ "When all is said and done, however, the decision about whether to mechanise ... will hinge upon the farmer's view of profitability of mechanised operations in comparison with non-mechanised alternatives." (Byres 1980, p.415)

argument. What Byres is trying to do is to deduce technical properties of the production function solely from data on economic profitability, and that can be quite a hazardous thing to do. Since the relationship between the production function and profit is mediated by the price regime, one has to reckon with the possibility that the higher profitability of mechanized farming may simply be a reflection of a price regime that is favourable to mechanization. It is after all a well-known fact that in many countries of the Green Revolution belt, the government has consciously tried to promote the use of tractors by cheapening them through various means, such as tariff reduction, direct subsidy, and cheap credit.³⁸ It is therefore plausible to argue that the profitability of mechanization derives not so much from complementarity with biochemical technology as from artificially structured prices -- or the 'political' prices, as Griffin (1974) calls them.

In view of all this, if one still wishes to establish the 'necessity' of premature mechanization, the argument will have to shift from the technical to the political domain. Instead of invoking the complementarity argument, one will have to claim that, given the prevailing structure of unequal landownership and its associated structure of unequal power, the growth process will necessarily entail the favourable 'political' prices because large landowners will exert their superior political power to make sure that these prices come into being.

Such arguments have indeed been made (e.g. Griffin 1974). They also have an apparent plausibility. But it has never been convincingly shown why the unequal power structure will 'necessarily' entail the political prices. In fact, such arguments as there are seem implicitly to rely on the crude functionalist logic that since these prices are advantageous to the holders of superior power, they must emerge as a necessary consequence of the existing power structure!

In the South Asian context, the most obvious counter-example to such arguments is the experience of Bangladesh, where the political forces have not yet produced any drive towards tractorization. The Sri Lankan

³⁸ It is instructive that in one Sri Lankan study even farmers who did not adopt the MVs were found to have taken to mechanized threshing, alongside the adopters, simply because the low cost of machinery induced them to do so (Hameed *et al.* 1977, p.190).

experience is equally instructive, although in a different sort of way. There, political forces have indeed exerted an overwhelming influence in favour of tractorization, but the pressure has not come mainly from the big landowners eager to squeeze the most out of the new technology. The original impulse came long before the new technology arrived, in the 1950s; and ironically a crucial catalytic role was played by a Marxist Minister for Agriculture, Philip Gunawardena, who believed in the Stalinist model of collective agriculture based on large consolidated holdings and mechanized cultivation. He knew that the goal of collective agriculture could only be reached step by step over a long time, but he felt that mechanization need not wait that long; every incentive was then given to promote the use of tractors. Subsequently, further impetus came from yet another force that is unique to Sri Lanka -- the existence of a large number of educated unemployed youth in the rural areas. Policy makers believed that the tractor will "attract peasant youth who were reluctant to don the loin cloth and go behind a buffalo." (Wickramasekara, 1983). The drive towards tractorization that resulted from these pressures led to a situation where already by 1961/62, at least one decade before the arrival of the new MVs, 36 per cent of the paddy land was ploughed by tractors in the main *Maha* season, as compared with 50 per cent by 1977/78 (Wickramasekara 1980, Table A-5).³⁹

Thus the Sri Lankan experience shows that the wielding of superior power by large landowners is not a necessary condition for the emergence of political prices in favour of mechanization, while the Bangladesh experience shows that it is not sufficient either. In India, the so-called 'kulak' lobby may have played a part in influencing political decisions, but there is no reason to think that they have forced the decision on policy makers. Policy makers do have a sphere of autonomy, and they are perfectly capable of making mistakes on their own.⁴⁰

³⁹ In fact, even the increase from 1961/62 to 1977/78 is likely to have occurred before 1970 (i.e., prior to the arrival of new MVs), because several field surveys across the country show that the use of tractors may have declined in the 1970s (Wickramasekara, 1980).

⁴⁰ It is significant that well before the 'kulak' lobby became a powerful entity, the earliest official blueprint of the 'new strategy' in agriculture envisaged the biochemical and mechanical innovations as equally necessary elements of the strategy (GOI, 1966).

We can now sum up our major contentions regarding the impact of the Green Revolution on agricultural wage labourers. The new technology has substantially increased the demand for wage-labour in areas not yet swamped by tractors. In areas where tractors have made a big headway, the effect on total labour absorption is uncertain but the demand for hired labour has generally gone up even there, although not quite as much as in non-tractored areas. Furthermore, to the extent that tractors have prevented wage labourers from reaping the full benefits of the new technology, the blame lies more in the policy makers' mistaken view that modernization means mechanization than in any inner compulsion generated by the technology itself or by its interaction with the prevailing social structure. Therefore, there is no basis for the view that *by its very nature* agricultural growth in South Asia has either impoverished or by-passed the poor wage-labourers.

V. THE ADDING UP PROBLEM: SYSTEMIC FAILURES AND GENERAL EQUILIBRIUM REPERCUSSIONS

The So-Called 'MV-Poverty Mystery'

We have claimed above that the impact of the Green Revolution on three of the most vulnerable groups in rural South Asia -- viz., small peasants, tenant farmers, and agricultural labourers -- would appear to be favourable according to both theory and evidence. But, as we shall presently see, analyses of the kind presented above are not sufficient to satisfy at least one group of sceptics. Before we deal with their scepticism, however, it is necessary to make a few remarks about the impact on two other categories of poor people who have not figured in our discussion so far. They are the poor non-farm population living in the MV areas, and all those poor who live in the non-MV areas, including urban areas.

It is obvious that the second of these two groups would benefit from the MVs insofar as the productivity-raising effect of the MVs brings down the

price of food..⁴¹ As for the non-farm poor of the MV areas, several studies have found that, in addition to benefiting from lower food prices, they also benefit in terms of higher incomes as the increased prosperity of the farm population reflects on the non-farm sector through a number of linkage effects. Examples of such linkage effects are: the 'consumption linkage' of higher demand for non-farm products generated by higher farm incomes; the 'input-output linkage' of higher demand for non-farm labour in related activities such as grain milling or maintenance-and-repair of irrigation equipment and other machines; and the 'commercial linkage' of increased scope for employment in marketing activities - both of goods such as crops and agricultural inputs for which MVs lead directly to an increase in the volume of transactions, and of goods such as urban consumer goods for which MVs increase the volume of transactions indirectly by raising the farmers' income.⁴²

As opposed to these 'benign' linkage effects, the critics have sometimes drawn attention to one 'malign' effect -- loss of livelihood for rural artisans as higher farm income leads to the substitution of urban products for 'inferior' rural goods. However, empirical evidence from Bangladesh shows that rural industrial products are typically not 'inferior' goods in the sense of having a negative income elasticity of demand, at least not within the range of incomes currently obtaining in the advanced villages (Osmani and Dev, 1986). Even in the Punjab, where rich farmers have gained more than anywhere else, it has been found that the "consumption behaviour of the rich peasants is not qualitatively different from that of the poor in rural Punjab. They merely consume greater amounts of much the same bundle of goods." (Bhalla and Chadha 1983, p.162) So it is not clear how significant is the malign effect on rural artisans. In any case, taking the rural non-farm poor as a whole, there is no doubt that the effect has been benign, as shown

⁴¹ Lipton and Longhurst (1989) have argued that insofar as the poor of the non-MV areas happen to earn their livelihood through wage labour, they do not really benefit from lower prices because money wage goes down in response to lower price of food. But as we show later in this section, this argument is untenable.

⁴² The importance of these linkages, especially consumption linkages, has been emphasized most vigorously by Mellor (1976, 1989). In the South Asian context, the empirical evidence has been explored by Bhalla and Chadha (1983) for the Punjab, Hazell and Ramaswamy (forthcoming) for south India, and Hossain (1987, 1988)) for Bangladesh.

by the studies of Mahendra Dev (1988) for India, and Hossain *et al.* (1990) for Bangladesh.

The overall picture, therefore, is that the new technology has a potentially beneficial effect on all sections of the poor -- viz., marginal owner-farmers, small tenant farmers, agricultural wage labourers, the poor non-farm population of the technologically advanced areas, and also the poor of the backward areas and urban areas.

Yet, until the beginning of the 1980s, there was no sign of any diminution in the massive poverty of the South Asian people, despite more than a decade of the Green Revolution. If anything, there were some indications of increased poverty, at least in some parts of the region. In an important recent work, Lipton and Longhurst (1989) have called it the 'MV-poverty mystery' and made a serious attempt to resolve it.

They believe, as we do, that when one decomposes the effect of the MVs on different groups of poor people and looks separately at different channels through which MVs affect their entitlements, there is unmistakable evidence that the impact on the poor is potentially beneficial, and often quite substantially so. Yet somehow these separate effects do not seem to add up - - the aggregate picture remains pretty dismal. One possible explanation could be that there are some extraneous forces undoing the good work of the Green Revolution, but Lipton and Longhurst specifically reject this as a major explanation. Their preferred explanation is in terms of 'endogenous failure': the potential benefits of growth spurred by the MVs do not materialize because of counteracting forces created endogenously by the growth process itself. Since the emphasis here is on endogenous or systemic failure, the Lipton-Longhurst thesis adds a new weapon in the armoury of those who take a sceptical view of the Green Revolution.

We are going to argue, however, that there are some serious problems with the theoretical foundation of their thesis. We agree with them that there is an adding-up problem that needs to be accounted for, but we do not believe that the answer lies in endogenously generated counteracting forces. We shall present our own explanation in the next section, but first we shall examine the arguments put forward by Lipton and Longhurst.

The focus of their thesis is on the market for wage labour. The aim is to show why and how the entitlements of agricultural wage-labourers fail to improve, despite the indisputable increase in labour demand following the adoption of MVs. They suggest that the answer lies in certain systemic impediments which prevent the increased labour demand from being translated into increased entitlements of wage-labourers. These impediments are supposed to originate from two features of the labour market: viz., downward stickiness of the wage rate, and the wage-price nexus, which refers to the propensity of money wage and food price to move together.⁴³ Corresponding to these two features, Lipton and Longhurst develop two separate lines of argument in support of their thesis.

The Sticky Wage Argument

The argument starts from the premise that the real wage typically stays above the market-clearing level in rural labour markets and displays strong downward rigidity. Various reasons have been offered in the literature to explain this phenomenon -- for example, the existence of a subsistence floor, efficiency wage considerations, norm-based behaviour, and so on. Whatever may be the precise reason in particular circumstances, the consequence of non-market-clearing, according to Lipton and Longhurst, is harmful for the labourers -- it allegedly prevents both wages and employment from rising in the wake of the MVs. There are actually two parts of the argument -- one purporting to explain why employment does not expand, and the other to explain why the wage rate does not rise.

The first part of the argument contends that employment does not expand in the wake of the MVs because the 'downward sticky' real wage cannot be depressed in order to accommodate higher employment. But why

⁴³ According to Lipton and Longhurst, these labour market considerations constitute an application of what they call the 'wider Keynesian equilibrium' to developing rural economies. They also explore several alternative general equilibrium frameworks -- e.g. Walrasian, Leontief, and multiplier Keynesian. But in each of these latter cases the focus is more on the distribution of gains among different social classes than on the impact on absolute poverty, which is our concern here. That is why, we deal exclusively with the labour market features, which Lipton and Longhurst themselves also believe to lie at the heart of the MV-poverty mystery (p.8). However, we leave aside the question of whether the suggestion that these features capture the essence of Keynesian equilibrium does justice to what Keynes himself wanted to convey.

does the real wage have to be depressed in order to generate more employment? After all, if the MVs raise the demand for labour, as they are expected to do, i.e. if the demand curve for labour shifts to the right, then employment can expand at constant real wages -- there is no need for the wage rate to come down. It turns out that Lipton and Longhurst are actually contemplating a situation in which the demand for labour shrinks, i.e. the demand curve shifts to the left as a result of the arrival of such labour-displacing devices as weedicides and threshing machines in the wake of the MVs (pp.247-8). In this context, wage rigidity does serve to constrict employment, since employment will fall more when wages are sticky than when they are flexible. This is how Lipton and Longhurst use the notion of wage rigidity to explain why one fails to observe "expanded employment at restricted wage-rates ... to meet extra farming requirements per acre of MVs." (p. 248).

But this does not really explain the failure to observe 'expanded employment'; in fact, even to talk of 'expanded employment' in this context is seriously misleading. If labour-displacing innovations become newly available, no amount of wage restriction can *expand* employment, other things remaining the same. The best it can do is to *moderate* the labour-displacing effect. Therefore, what Lipton and Longhurst are in effect saying is that 'sticky wages' prevent this moderation from taking place. Obviously, this is not an explanation of why employment *fails to expand* in the wake of the MVs; it is an explanation of why employment *contracts more than it should* following the introduction of labour-saving innovations.

On its own, their point is valid enough, but it has no bearing on the 'MV-poverty mystery'. The 'mystery' refers to the phenomenon that agricultural labourers remain poor, *despite* an upward shift in the demand curve for labour caused by *increased* labour requirements of the MVs. If there were no upward shift in the demand curve, there would be no mystery left to explain: one could simply say that the labourers remained poor because the demand for their services did not increase. So if there is a mystery, and if one is to explain it in terms of employment failure, as Lipton and Longhurst set out to do, then one is required to show that employment will fail to expand following an *upward shift* of the labour demand curve. By showing instead that sticky wages magnify the decline in employment following a

downward shift of the demand curve, they are quite simply barking up the wrong tree.

The second part of the argument -- purporting to explain the failure of wages to rise -- is also difficult to accept. The argument is best stated in their own words,

"... in many places the pre-MV wage-rate ... has been kept well above the equilibrium that would appear indicated by market supply and demand for labour ... therefore, even if MVs induce a considerable increase in demand for labour (and some reduction in supply) this need not pull up the equilibrium wage above the actual pre-MV rate. So past, pre-MV 'stickiness downwards' helps explain why MVs, despite tightening labour markets, do little to raise wage-rates" (Lipton and Longhurst, 1989, p. 284.)

It is implicitly assumed here that as long as the equilibrium (meaning, market-clearing) wage rate remains below the actual rate, variations in supply and demand will have no effect on the actual wage rate. This assumption would of course be trivially true if the wage rate happened to be rigidly fixed, say, on the basis of subsistence or some other norm. But the notion of a rigidly fixed wage-rate has been conclusively disposed of by empirical studies of the labour market in rural South Asia (e.g., Bardhan 1977; Binswanger and Rosenzweig 1984). These studies have shown that rural wages vary a good deal both over time and across regions, and that these variations are systematically related to changes in demand and supply of labour. Furthermore, recent theoretical studies have shown that this sensitivity to supply and demand is perfectly consistent with the existence of a non-market clearing wage rate. That is to say, the actual wage-rate can stay above the market-clearing level and still be sensitive to the forces of supply and demand -- rising when demand rises, falling when demand falls (Bardhan 1984; Osmani 1990). Therefore, the non-market-clearing nature of the pre-MV wage-rate does not necessarily imply that it will not rise further in response to higher demand for labour generated by the MVs.

Thus, on a little reflection, both parts of the 'sticky wage' argument appear to come unstuck. It establishes neither the failure of employment nor the failure of wage-rate to rise following increased labour demand in the wake of the MVs. As a result, it does precious little to resolve the so-called 'MV-poverty' mystery.

The Wage-Price Nexus

The other systemic effect that Lipton and Longhurst invoke to explain the 'MV-poverty mystery' is the so-called 'wage-price nexus', which refers to the well-known phenomenon that food price and money wage tend to move in the same direction, albeit with a lag. Their contention is that the wage-price nexus serves to dissipate any gains labourers may initially derive from the MVs either as wage-earners or as consumers.

The argument is in two parts, dealing separately with the effects of MVs on labourers *qua* wage-earners and *qua* consumers. Although the wage-price nexus is common in both parts, the direction of causality between wage and price is opposite in the two cases. As regards the effects on labourers *qua* wage-earners, the relevant causality is from money wage to food price: as the money wage rises due to increased labour demand in the wake of the MVs, the food price soon follows suit, thus eroding the real gains from higher wages. On the other hand, the relevant causality for labourers *qua* consumers is from food price to money wage: as the price of food falls due to increased supply following the adoption of MVs, labourers do not gain as consumers since money wage also falls in response to lower price of food, keeping their entitlement to food constant.

For reasons to be explained below, we shall call the first part the 'Keynesian effective demand argument'; the second part has already been given a name by Lipton and Longhurst: it is called the 'responsive money-wage deceleration hypothesis'. The two parts together form the core of the Lipton-Longhurst thesis that any initial gains labourers may derive from the MVs soon disappear as a result of general equilibrium repercussions: the gains in the labour market are eroded by repercussions in the food market, and the gains in the food market are dissipated by repercussions in the labour market. If these arguments are accepted, they can go a long way towards resolving the 'MV-Poverty mystery', but, as we shall see, there are serious logical problems with both parts of the argument.

(i) The Keynesian effective demand argument

Consider first the plight of labourers *qua* wage-earners. Lipton and Longhurst try to establish that higher money wages do not typically translate into higher real wages in the wake of the MVs. In making their case, they invoke the Keynesian idea that when money wage is changed the effect on real wage will depend on how the change in money wage affects the level of effective demand. In particular, they seem to adopt the following line of Keynesian reasoning: real wages cannot be reduced simply by cutting money wages since a general cut in money wages would depress the level of effective demand, which in turn would bring down the general price level, thereby frustrating the attempt to reduce real wages⁴⁴. Lipton and Longhurst employ an analogous reasoning in the reverse, so as to explore the effect of higher money wages, the only difference being that instead of using the general price level they use the price of food as the mediating variable. The argument goes as follows.

The increased labour requirements of the MVs may result in higher money wages, and for a time this may also ensure higher real wages, but not for long. Since a large part of food demand emanates from wage income, any increase in money wages will raise the effective demand for food. This will eventually push up the price of food, thus preventing any lasting improvement in real wages. Thus it is that general equilibrium repercussions, à la Keynes, are supposed to erode the first round gains accruing to labourers *qua* wage-earners.

To us, however, this line of argument seems to involve a misapplication of Keynesian ideas. What we are considering here is the likely effect of a technological change on the real wage rate. And Keynes never meant to suggest that his effective demand mechanism will prevent alterations in the real wage following a technological change. In fact, his analysis abstracted completely from all changes on the supply side, including technological change. The problem he was considering was the

⁴⁴ It must be noted, though, that Keynes' own analysis of how changes in the money wage might affect the real wage was much richer than this; he pointed out a large number of channels through which effective demand might be affected, some of which were mutually counteracting in nature, so that the net effect on effective demand and hence on real wages was ambiguous., in his own view. See, Chapter 19 of his *General Theory*.

following: when an economy is stuck at less than full employment, can real wages be reduced so as to stimulate employment *simply* by reducing money wages, when *nothing else had changed in the economy*? But in the present case something *has* changed: a major technological change has occurred, which has on the one hand shifted the supply curve of food to the right by making land more productive than before, and on the other shifted the demand curve for labour upwards by making cultivation more labour-intensive than before. These two deviations from the Keynesian *ceteris paribus* make it inappropriate to apply the effective demand argument without major qualifications.

In the first place, one can no longer deduce the movement of prices on the basis of effective demand alone. It was alright for Keynes to focus exclusively on effective demand since he was abstracting from any changes on the supply side. But in the present case, effective demand is only one of the factors affecting price. The same force -- viz. technological change -- which raises the effective demand for food through higher money wages, also shifts the supply curve down by improving the productivity of food production. As a result, one cannot deduce that higher money wages will necessarily lead to a higher price of food.

In fact, even if the price of food goes up in absolute terms, it cannot, in equilibrium, rise so high as to leave the real wage unchanged. This is ensured by the second deviation from the Keynesian *ceteris paribus* -- namely, the upward shift in the demand curve for labour. At the existing real wages, there will emerge an excess demand for labour, so that competition among employers will ensure that the real wage is bid up. If the induced changes in the food market keeps frustrating the attempt to secure higher real wages, the result will be a spiralling disequilibrium in both labour and food markets -- with ever increasing money wage and food price chasing each other. A general equilibrium can occur only when food price rises less than proportionately, thus accommodating the labour market requirement for higher real wages.⁴⁵ It does not, therefore, seem plausible

⁴⁵ In the unlikely event that equilibrium is achieved at the old real wage -- perhaps because the labour market is too tired with its unending battle with the food market to insist on higher wages - there will still be a gain for the workers, because employment must in any case increase following an upward shift of the labour demand curve; and this increase will the greater if the real wage fails to improve.

to argue that the effective demand mechanism will prevent labourers from benefiting from the MVs *qua* wage-earners.

(ii) The responsive money-wage deceleration hypothesis

Let us now turn to the case of labourers *qua* consumers. Here the contention is that lower food prices, brought about by the MVs, do not help the labourers because employers bring down their money wage in line with food prices, leaving their entitlements much the same as before. Lipton and Longhurst provide both an explanation of how this happens, and a piece of evidence that purports to show that it does happen. But neither the explanation nor the evidence seems convincing enough.

The explanation is best stated in their own words:

"A deceleration of food prices (e.g. due to extra supply of food from MVs), by raising the value of labour income enables or induces many more poor and unskilled workers to come forward and compete for employment. Hence real wage-rates are not automatically improved by restraint of food prices; employers can correspondingly restrain the money value of the wage they pay (whether cash or kind), and find as many workers willing to work, at about the same real wage-rate as before. We call this effect responsive money-wage deceleration." (p. 214).

So the secret seems to lie in the existence of a highly elastic supply curve of labour: lower food prices cannot improve real earnings because the supply curve is nearly horizontal at a given real wage. But if the supply curve is really so elastic, one wonders why Lipton and Longhurst took the trouble of invoking the Keynesian effective demand mechanism to explain the failure of MVs to raise real wages -- a horizontal supply curve would have done the job well enough!

In any case, the justification they provide for the supposedly high elasticity of labour supply does not seem particularly convincing. It is clear from the above quotation that the argument presupposes the existence of a large pool of *voluntarily* unemployed workers who are induced to 'come

forward and compete for employment' by the lure of higher real wages.⁴⁶ Not only does this go against the accumulated evidence that most of rural unemployment is involuntary in nature (because poor people cannot afford to remain unemployed), it is also inconsistent with other parts of Lipton and Longhurst's arguments where, as we have seen, they invoke the notion of 'non-market-clearing' wages to explain the MV-poverty mystery.⁴⁷

As for empirical support for their hypothesis, Lipton and Longhurst cite a study by Papanek (1988) on the relationship between food price and money wage in rural India. In this study, Papanek has found that, as the price of food changes, money wage responds with a lag but catches up completely within a period of just two years. Lipton and Longhurst take this as supporting their hypothesis that if food becomes cheaper, money wage will decline proportionately in response.

But this inference seems to be based on a misunderstanding of Papanek's finding, which cannot really be used in support of the Lipton-Longhurst thesis. What is relevant for Lipton and Longhurst is the effect a change in the *relative* price of food following increased production in the wake of the MVs. In contrast, Papanek has estimated the effect of a pure inflationary change in the *absolute* price of food. Normally, the price coefficient of a wage-price regression should reflect the combined effects of both relative and absolute price changes. But Papanek followed a procedure which served to eliminate the effect of relative price changes, at least those originating from the supply side. He used the average product in agriculture as an additional regressor in the equation linking money wage with price. As a result, the coefficient of his price variable leaves out any effect of relative

⁴⁶ If instead they are *involuntarily* unemployed, then they have already come forward and competed for employment, so that the pre-MV wage rate already reflects any pressure that may arise from their competition. No additional pressure can therefore be created in the wake of MVs, other than through 'exogenous' changes in labour supply.

⁴⁷ An alternative explanation of elastic labour supply could perhaps be framed, à la classical economics, in terms of induced population changes. It is interesting to note in this context that in his more recent work, Lipton has found evidence from Indian data that higher income does induce higher fertility, even if for a temporary period until the fertility-reducing effects of higher income begin to take over (Vosti and Lipton 1991). But even this temporary effect on fertility cannot be invoked to support Lipton and Longhurst's view on elasticity (nor do they invoke it themselves), because the time required for income to first affect fertility and then for fertility to be reflected in labour supply is too long for the short-period analysis of real wages that is involved here.

price changes originating from variation in production, and retains only the effect of pure inflationary changes in the absolute price level. One would naturally expect the effect of a once-for-all change in the absolute price level to have only a transitory effect on real wages, and this is what is shown by Papanek's estimates. But one cannot conclude from this that a decline in the relative price of food, caused by expanded supply, will also have a similar transitory effect.⁴⁸

In summary, Lipton and Longhurst set out to find an explanation for the 'mystery' that the real incomes of labourers do not improve despite an increase in the demand for labour in the wake of the MVs. They conclude that this is a 'systemic' failure of the Green Revolution -- one that is inherent in the system rather than being caused by exogenous factors. They offer two lines of explanation for this systemic failure -- the sticky wage argument and the wage-price nexus. The sticky wage argument contends that MVs fail to improve either the wage rate or the volume of employment because of the non-market-clearing nature of rural real wages and their downward rigidity respectively. We have argued on the contrary that the non-market-clearing property does not necessarily stand in the way of raising the wage rate in response to higher labour demand, and that the downward rigidity cannot prevent employment expansion when the demand curve for labour shifts up.

We have also contested the wage-price nexus argument, which comes in two parts. The first part employs the Keynesian effective demand argument to establish the point that even if money wages rise initially in response to higher labour demand, the real gains will soon be eroded as higher effective demand pushes up the price of food. We have shown however that this argument involves a misapplication of Keynesian ideas as it ignores the supply-side effects of technological change. The second part -- the so-called 'responsive money wage deceleration' hypothesis -- contends that if MVs reduce the price of food by improving the productivity of food production, the agricultural wage-labourers will fail to benefit from it since

⁴⁸ It is possible that Papanek himself interprets his finding in the same way that Lipton and Longhurst do, for he too infers from his finding that cheapening of food in the wake of MVs will have a beneficial effect only in the short run -- the only difference being that while Papanek emphasizes the short-run benefit, Lipton and Longhurst stress the long-run transitoriness. But this interpretation cannot be sustained, even if Papanek himself happens to share it.

money wages will come down too in response to lower food price, leaving their entitlement to food constant. But we have noted, firstly, that the underlying assumption of the existence of a vast pool of voluntarily unemployed workers is empirically untenable, and, secondly, that the observed wage-price relationship from which the argument seeks its empirical support shows only the effect of a change in absolute price whereas the relevant issue here is the effect of a change in relative price. For all these reasons, we find that Lipton and Longhurst's attempt to explain the so-called 'MV-poverty mystery' in terms of systemic failure falls short of being convincing.

VI. THE ADDING-UP PROBLEM AND THE POPULATION QUESTION

Our own view is that there is in fact no mystery about the relationship between MVs and poverty. It is true that MVs have a great potential for reducing poverty by strengthening the entitlements of all the poor classes; and it is also true that despite substantial progress made in the adoption of MVs the poor of South Asia remain desperately poor. Put together, these two statements may appear to pose a mystery; but the mystery soon begins to clear up as one recognizes that the two statements have very different logical status. The first statement is in the nature of a comparative static prediction under *ceteris paribus* condition; it says that the introduction of MVs would reduce poverty substantially, assuming that exogenous factors remain unchanged. In contrast, the second statement makes an observation about trends in the real world where exogenous factors are also changing and making their effects felt on the incidence of poverty. It is no surprise therefore that trying to understand the second statement solely in terms of the first would pose a mystery.

The Exogenous Factors

A proper understanding of the second statement requires the application of a full-fledged general equilibrium analysis -- one that involves not only the feedback effects induced by the initial impact of MVs

but also any possible interaction between MVs and other exogenous factors. Lipton and Longhurst's general equilibrium analysis was confined solely to the feedback effects, without allowing for any changes in exogenous factors. Not surprisingly, it failed to explain the phenomenon of persistent poverty in real time, because in real time exogenous factors have in fact been changing. As soon as the effects of these exogenous factors are added on to the effects of MVs, it becomes quite easy to explain why poverty has persisted despite the progress of MVs.

A couple of exogenous factors are of particular importance in the context of South Asia. One of them is the closing of the land frontier, especially in India and Bangladesh. Until about the mid-1960s, expansion of net cultivated area was a major source of agricultural growth in the Indian subcontinent. In the final half century of colonial rule (1891-1946), this was in fact the only source of growth of foodgrain production as the growth of yield was negative during this period. In the immediate post-colonial period, the growth of cultivated area accelerated in India, rising from 0.3 per cent to 1.0 per cent per annum. But the potential for further expansion was soon exhausted, and in the post-MV period the rate of growth has come down to a mere 0.4 per cent (Rao and Deshpande 1987, pp.164-6). Something similar has happened in Bangladesh as well; from the late 1940s to the late 1960s the net sown area rose moderately from 19.7 million acres to 21.7 million acres (implying an annual growth rate of just 0.5 per cent), but since then it has remained practically stagnant (Boyce 1987, p.102).

The cessation of land expansion in both India and Bangladesh has had a profound impact on the entitlements of the poor, not only indirectly by inhibiting the rate of agricultural growth but also directly by restricting the scope of employment. The expansion of cultivated area directly augments the employment and income of poor farmers if they happen to share in the expansion, and raises the employment of hired labour if the expansion is carried out by large farmers. This traditional source of entitlement-expansion was almost completely lost by the time MVs arrived at the scene. Whatever contribution MVs then made to the entitlement of the poor, a part of it was neutralized by this exogenous loss of entitlement. As a result, in a real time comparison between pre-MV and post-MV poverty, the latter will fail to reflect the full effect of MVs.

The second exogenous factor of great significance is population growth. The idea that excessive growth of population has undone the good work of MVs is of course a fairly common one. But there is much misunderstanding about how exactly population growth affects the picture. There are many bad arguments for blaming poverty on population growth. By picking on them, it is easy to discredit the idea that population is an important factor -- something that the critics of the Green Revolution have often done. Lipton and Longhurst (1989) do the same by refusing to explain the 'MV-poverty mystery' in terms of population growth. They recognize that population growth may have had some offsetting effect, but they refuse to see it as being terribly important. In support of their view, they cite the case of the Indian Punjab where the "MV-induced real income growth far exceeded the growth of workforce or population" (p. 259), and yet, allegedly, there was no visible sign of poverty alleviation for nearly two decades after the introduction of MVs. We shall first argue that there are some very good arguments for seeing population as an exceedingly important factor; and then demonstrate that the Punjab cannot be put up as a test case against the importance of population growth.

Population, MVs, and Poverty: the Entitlement Approach

The most simplistic argument blaming population for the MVs' inability to reduce poverty goes by the name of the 'denominator effect'. It says that the good work done by the MVs is not reflected in poverty because population growth prevents higher aggregate output from being reflected in higher *per capita* consumption. A slightly more sophisticated line of argument brings in the idea of a 'negative numerator effect'. It says that high population growth reduces per capita consumption not only by increasing the denominator, but also by slowing down the rate of output growth by various means (for example, by forcing the growing population to extend cultivation to increasingly inferior lands). Such arguments can be described as the neo-Malthusian view of the linkage between population and poverty.

The critics of this view have pointed out, rightly, that high population growth does not necessarily mean low per capita consumption since the 'numerator effect' can in fact be positive rather than negative. They have noted, for example, that there are various ways in which population growth

may actually accelerate the rate of output growth, thereby offsetting, and even outweighing, the negative denominator effect in the long run.⁴⁹

More importantly for the present context, whatever may be the exact nature of the 'numerator effect', it is quite clear that the neo-Malthusian view cannot explain the 'MV-poverty mystery' in South Asia. For there is, after all, no evidence that population growth has accelerated in the post-MV period; if anything, there has been a slight deceleration. So if the MVs did really do a good job in raising aggregate production, population growth by itself should not have prevented per capita consumption from rising.

There is also a more fundamental conceptual problem with the neo-Malthusian view. Its primary focus is on *per capita* consumption; but this aggregative statistic, whether it is rising or falling, can say very little about what is actually happening to the consumption of the poor. In order to trace the effect on the poor, one needs to know what has been happening to the entitlements of the vulnerable groups, such as, the marginal farmers, the wage labourers, and the poor self-employed people engaged in non-farm activities. Indeed, once the linkage between population and entitlement is clearly understood, the so-called MV-poverty mystery also begins to unravel rather quickly.

The essential point is that the combination of intense demographic pressure and private property relations in rural South Asia is constantly eroding the entitlements of vulnerable groups, and thereby generating an 'immiserizing' force. Economic growth, whether through MVs or otherwise, must first overcome this force before its poverty-reducing effect can begin to manifest itself. So, if the entitlement-enhancing effects of MVs do not seem to add up in terms of actual reduction in poverty, it is because these effects are not strong enough to outweigh the 'immiserizing' force unleashed by population growth.⁵⁰

⁴⁹ Boyce (1987) provides a succinct review of this controversy. He also makes a strong case that the hypothesis of negative numerator effect does not apply to Bengal (comprising Bangladesh and the Indian state of West Bengal).

⁵⁰ For an earlier analysis along these lines, see Osmani (1991a).

The way the 'immiserizing' force works can be seen most clearly by assuming a 'no growth' scenario as the benchmark. It is also convenient to begin the story with the case of small and marginal farmers. Given the institution of private property ownership, a high rate of population growth tends progressively to reduce the average size of farm-ownership over the years. With reduced holdings, the small and marginal farmers can only maintain their entitlements if corresponding gains can be made in land productivity. But in the absence of such productivity growth, their holdings become non-viable. In this way, demographic pressure leads inevitably to a continual increase in the number of economically non-viable holdings. The resulting marginalization of the peasantry is the beginning of the process of overall impoverishment.

Under relentless economic pressure, the marginalized peasantry eventually becomes alienated from land (through distress sales) and swells the rank of landless labourers, whose own stock has also been growing at a rapid pace due to the same demographic pressure. While the supply of wage labour is thus being doubly augmented, the demand for labour cannot keep pace in the absence of productivity growth. Note that we are allowing here for the possibility that the demand for labour may rise to some extent under population pressure. One possible mechanism is the very process through which labour supply is augmented -- namely, the growing landlessness of the marginalized peasantry. To the extent that the land lost by the newly landless peasants is acquired by labour-hiring large farmers, the process of land alienation raises labour demand at the same time that it increases labour supply. However, it is unlikely that the increased demand will match the increased supply. This is in part because some of the land may be acquired by family farms keen on using their own family labour more intensively instead of employing additional hired labour. In part, the mismatch will also arise from the well-known Chayanovian reason that labour tends to be used less intensively on the land cultivated by hired labour than on the land cultivated by family labour. For both these reasons, the amount of labour released by land transfer will be greater than the amount of labour absorbed. When this imbalance is viewed in conjunction of the fact that labour supply is further expanded by the natural increase of the stock of wage-labourers, it seems reasonable to suppose that the population-induced increase in labour

demand falls short of population-induced increase in labour supply.⁵¹ The consequent decline in the real wage and (per capita) employment then leads to a contraction in the entitlements of wage-labourers.

In the hope of avoiding persistent contractions in entitlement, many among the agricultural labourers then pour into the non-farm sector in search of alternative employment. But this only adds to the misery of the non-farm population whose real incomes cannot rise (because the demand for their products do not rise) in the absence of agricultural growth. In this way a chain reaction of immiserization engulfs all sections of the rural poor -- the small farmers, the agricultural labourers, and the poor non-farm population. This is the mechanism through which population growth aggravates poverty -- operating through entitlements, not simply by reducing the size of per capita consumption.⁵²

When the MVs are introduced at a time of rapid population growth, their poverty-reducing effects begin to counteract the population-induced immiserizing force. Depending on the relative strength of these two opposing forces, the observed poverty may or may not decline over time. Thus if poverty seems not to have declined substantially during the post-MV period, this is not because MVs are inherently immiserizing within the existing socio-economic structures as many critics of the Green Revolution

⁵¹ Boyce (1989) has suggested that the population-induced increase in labour demand may also arise through various other mechanisms and that in the long run the resulting increase in demand may also outweigh the induced increase in labour supply. However, these other mechanisms operate, if at all, only in very the long run, and Boyce himself seems willing to grant that in the recent decades the supply effect has far outweighed the demand effect in Bangladesh. Therefore, given our present focus on the relatively short time-span of the Green Revolution period, it is perhaps reasonable to assume that the supply effect is the stronger one.

⁵² Griffin (1981) argues in a similar vein that "...rapid population growth certainly makes matters worse rather than better. It does this, however, not by reducing the aggregate rate of growth of output or of output per head ... The primary effect of rapid demographic expansion is to lower the share of labour in national product and thereby to increase inequality in the distribution of income." (p.310) There are however a number of differences between Griffin's views and ours. First, in our view the effect of population growth is not merely on inequality of income but also on absolute poverty. Second, it is not just labourers but also marginal farmers and non-farm self-employed people who are victims of the population-induced immiserizing force. Third, while we consider this immiserizing force to be the principal explanation of the MV-poverty mystery, Griffin attaches to it only a subsidiary importance; instead he declares labour-displacing mechanization to be the principal immiserizing force (p.307) -- a view we have contested earlier in this paper.

have argued, nor because the first round benefits have been eroded by negative feedback effects as Lipton and Longhurst have recently suggested, but because the pace of MV-expansion has not been rapid enough for the *net* gain in poverty alleviation to be substantial after wiping out the immiserizing effects of population growth. In short, we believe the problem lies in inadequate output growth relative to population pressure.

This may sound like a roundabout way of re-establishing the neo-Malthusian view, but it is not. What matters in the neo-Malthusian view is whether population growth exceeds or falls short of output growth. But this simple arithmetic no longer works once the entitlement approach is adopted. Output growth may comfortably exceed population growth, and still may not be strong enough from the perspective of entitlements to counter the immiserizing force of population growth.

This can be seen most clearly by considering the entitlement of agricultural wage labourers. The net effect of the tussle between output growth and population growth will depend on how they affect the demand and supply of labour. If population grows at the rate of p and output at the rate of f , then the rate of growth of labour supply is given by $s = e_s \cdot p$, and the rate of growth of labour demand is given by $d = e_d \cdot f$, where e_s is the elasticity of labour supply with respect to population, and e_d is the elasticity of labour demand with respect to output.⁵³ The entitlements of labourers can be expected to improve when $d > s$, but this will be so if and only if the following inequality holds: $f/p > e_s/e_d$.

Now, typically, e_s will be greater than unity because labour supply is augmented not only by the natural increase in the existing stock of workers but also by new additions from the ranks of small farmers who are increasingly being marginalized by demographic pressure. And the general finding on e_d is that its value is considerably less than unity even when the labour-absorbing power of MVs is not dissipated by mechanization.⁵⁴ This means that the rate of growth of production (f) will have to be considerably in

⁵³ We are ignoring here any possible effect of population growth on labour demand. See the discussion in footnote 50.

⁵⁴ See, for example, the evidence cited in Bhalla (1989).

excess of population growth (p), before poverty among wage-labourers can begin to decline. To look at it differently, a constant or even a rising per capita output would not necessarily indicate that MVs have won the battle against population growth.⁵⁵

It follows then that one cannot play down the importance of population growth by merely pointing out that poverty has been resilient even when output has grown faster than population. Yet this is precisely how Lipton and Longhurst, like many others, use the case of the Punjab to brush aside the population argument. This may be a clever way of paying back the neo-Malthusians in their own coin. But a bad coin is a bad coin, whether it is used for paying, or for paying back.

Nonetheless, there is something special about the Punjab case that demands further thinking. As Lipton and Longhurst rightly point out, output growth not just exceeded but *far* exceeded population growth in the Indian Punjab. So if the poor in the Punjab did really find it hard to establish clear gains, one is bound to feel the nagging suspicion that something is missing -- that perhaps population cannot be the primary explanation after all. It is therefore necessary to look into the facts of the Punjab a little more carefully; did the poor there really find it so hard to gain from MVs?

The Punjab As a Test Case?

Lipton and Longhurst are of course not alone in drawing attention to the alleged resilience of poverty in the fast-growing Punjab. The critics and sceptics of the Green Revolution everywhere have treated Punjab as a test

⁵⁵ This point can be illustrated by some rough calculations we have made elsewhere for rural Bangladesh (Osmani 1991c, p.180). During the period from the late 1960s to the mid-1980s, MVs have generated nearly 15 per cent additional demand for hired labour, whereas population pressure has brought about a 60 per cent increase in the number of wage-labour households. The explanation of this imbalance lies partly in the fact that the supply of labour has been augmented by forced entry into labour market on the part of small farmers marginalized by demographic pressure, and partly in the fact that the demand for labour has been restrained by the slow diffusion of MVs, which by the mid-1980s came to cover only about one-third of the foodgrain acreage. In short, output growth has not been strong enough to neutralize the immiserizing effect of population growth. But this has happened in a period when the growth in food production has more than kept pace with population growth.

case of their scepticism. But the supporting evidence they provide do not stand up to close scrutiny. Typical among their evidence are the three offered by Lipton and Longhurst. One of them is an early study by Rajaraman (1975) on poverty in rural Punjab, a second one is a celebrated study by Sheila Bhalla (1979) on the trend of real wages, and the third one is a study by Bardhan (1984) on the wage income of labour households.

Rajaraman compared the level of poverty in rural Punjab between the years 1960/61 (a pre-MV year) and 1970/71 (a post-MV year), and found that poverty had increased over the decade. This finding was taken as a damning indictment of the Green Revolution at the time, because the first phase of the Revolution (in wheat crop) was almost completed in the Punjab by the year 1970/71, and yet there were no apparently gains in sight for the poor. But subsequent studies have shown that it was misleading to draw any firm conclusions from Rajaraman's two-point comparison. Ahluwalia (1978) looked at the poverty estimates for a number of years from the late 1950s to the early 1970s, and found no trend in either direction. More recently, Mundle (1983) has found a distinctly declining trend over the decade from 1963/64 to 1973/74, by using several alternative estimates of the poverty line.⁵⁶

There is however one reason why these latter findings may not be enough to convince the sceptic. It is well-known that unlike in many other parts of the subcontinent, small and marginal farmers far outnumber the labouring households in rural Punjab. Considering only those below the poverty line, the two groups are seen to be almost equal in size (Mundle 1983, p.87). It is conceivable that the observed improvement in aggregate poverty reflects the fact that most of the gains has accrued to the 'farmer' half of the poor population, leaving the 'labourer' half (which is perhaps the poorer half) no better off, or even worse off, than before. It is in this context that the studies by Bhalla (1979) and Bardhan (1984) assume special significance, for their findings relate specifically to the labouring class.

⁵⁶ It should be pointed out that the latter two studies are not strictly comparable to the first, because Rajaraman considers only the 'new' Punjab state created by partitioning the old state in 1966, while the other two consider the 'old' Punjab comprising the present states of Punjab and Haryana. Yet perhaps the problem of comparability is not a serious one since the two new states share many common structural features and have traversed a similar trajectory in adopting the new technology.

Bhalla constructed a time series of real wages for rural Punjab stretching from 1961/62 to 1976/77, which showed that compared to the first half of this period real wages had risen by about 20 per cent in the second half.⁵⁷ This has been seen by the critics as being too modest an improvement to justify one's faith in the poverty-reducing potential of the Green Revolution. But a few things need to be said in order to put this 'modest' improvement into perspective. First, real wages increased in the Punjab at a time when there was decline or virtual stagnation in real wages in most other states, especially the ones that had not yet embraced the new technology (Jose 1974, 1988). This means that the measure of MVs' success in the Punjab is not simply the extent to which the real wages actually increased over time, but the sum total of this increase and the potential decline that was thwarted. Secondly, it has been widely noted (including, by Bhalla herself) that increased labour demand in the Punjab drew migrants from neighbouring poorer states - especially (eastern) Uttar Pradesh and Bihar. This influx of labour naturally kept the wage rate down; but this also means that the benefit of the Green Revolution in the Punjab spread to people outside its own borders, something that is not captured by the rise in real wages. Thirdly, one other thing that is not captured by real wages is the possible rise in employment.

Bardhan's (1984) evidence however bears on both wages and employment, and is therefore apparently even more damning than Bhalla's. Using National Sample Survey (NSS) data, he compared the conditions of agricultural wage-labourers in the Punjab between two points in time - 1964/65 (pre-MV) and 1974/75 (post-MV). He observed that the real wage, employment, and the wage income per labour household were all lower in 1974/75 compared to 1964/65. There are however a couple of problems with his findings.

First, the evidence of lower real wage in the mid-seventies is inconsistent with Bhalla's finding that the real wage was on the whole higher in the 70s compared with the 60s. As it happens, the year 1974/75, which

⁵⁷ This estimate is based on the adjusted Bhalla series -- adjusted by Mundle (1983, p.99) for some inconsistency in the deflators used in the original series.

Bardhan uses as the terminal year, was completely atypical of the 1970s. A severe drought and inflation had conspired together in that year to depress the wage rates to exceptionally low levels, not only in the Punjab but all over India (Jose 1988, Acharya 1989). Bhalla's real wage series for the Punjab (as adjusted by Mundle) reveals this clearly; from an average of Rs 2.67 per day in the period 1961/62-1968/69 the real wage had climbed to Rs 3.39 in the period 1969/70-1973/74, but then slumped abruptly to Rs 2.54 in 1974/75, from which it took a couple of years to recover. To use the wage data for this exceptional year in order to seek insights about the effect of the Green revolution must be seriously misleading.

Secondly, even though the wage level was unusually low, poverty was perhaps no higher in 1974/75. Bardhan used the NSS data to show that the 'wage income' of the labour households -- combining estimates for wage rate and average employment -- was lower in that year compared to 1964/65. But wage income is only one component of total household income, even for wage-labour households. The overall picture has been put together by Mundle, using the same NSS data as used by Bardhan, but reaching the completely opposite conclusion:

"On the eve of the so-called green revolution, in 1964-65, per capita real incomes of agricultural labour in Punjab were 14 per cent lower than in 1956-57. But a decade later, in 1974-75, per capita real incomes were about 50 per cent higher than in 1964-65 (or 28 per cent higher than in 1956-57) for this class."
(Mundle, 1983, p.105)

The Punjab thus fails as a test case of the sceptics' view. Rather, it lends support to the contrary view that the Green Revolution has on the whole helped reduce poverty, even within the existing structural constraints. Of course, a part of the impact has been offset by the immiserizing force generated by demographic pressure; and the fact that the net effect has come out visibly in favour of the poor is only because the rate of output growth has *far* exceeded the rate of population growth. In much of South Asia, the day is yet to come when output growth would *far* exceed population growth in a similar manner; that is why, poverty there remains so resilient.

VII. SUMMARY AND CONCLUSIONS

In the preceding pages we have attempted a detailed rebuttal of the view that, given the prevailing structural constraints imposed by the unequal distribution of land and other assets, growth through Green Revolution must impoverish, or at best by-pass, the majority of rural poor. The approach has been essentially analytical rather than empirical, although empirical evidence has been drawn upon, mainly from South Asia, to validate the analytical conclusions.

First, from the critical literature, a number of 'transmission mechanisms' were identified through which the new technology was supposed to either impoverish the poor or prevent them from gaining any benefits. Next, each of these mechanisms was subjected to a detailed analytical scrutiny in the light of both economic theory and empirical facts. This enquiry has led to the conclusion that the arguments typically advanced to support the thesis that the Green Revolution is no friend of the poor are fraught with severe problems. A more satisfactory analysis of the very same transmission mechanisms shows that the poor should actually benefit from the spread of the new technology, even without a radical redistribution of assets.

This conclusion however had to confront the fact that in South Asia as a whole there has been very little actual reduction of poverty despite growing adoption of the new technology. This raised the question: if the transmission mechanisms reveal the Green Revolution to be beneficial for the poor, why don't these benefits add up to a substantial reduction in poverty? In this context, we critically examined an important new contribution made by Lipton and Longhurst (1989) who have suggested that the benefits do not add up because the potential benefits cannot materialize either due to certain systemic impediments (such as, non-market clearing wages in the labour market), or, because the initial gains generate negative feedback effects (mainly, between the labour market and the food market). Impressive as it appears at the first sight, this line of reasoning was found, on closer scrutiny, to be built on shaky analytical foundations. Our own explanation of the adding-up problem suggests that the observed resilience of poverty does not represent a systemic failure of the Green Revolution itself. The problem lies rather in the fact that the spread of the new technology has not been strong

enough to outweigh an underlying 'immiserizing' force that is being continually generated by the combination of strong population growth and the system of private property ownership.

The detailed arguments supporting our conclusions have already been summarised at the end of each section; there is no need repeat them here. We shall instead make a few general remarks about the nature of our arguments and some of their implications for policy.

The first remark concerns the contrast between the 'food-availability' focussed approach and the entitlement-based approach towards understanding the problem of poverty. The early enthusiasts of the Green Revolution almost invariably adopted the availability-focussed approach by pinning their hopes on beating the population spectre with a new technology that would make food more plentiful than before. It is to the great credit of the early critics that they broke out of this Malthusian mould of focussing on the availability of food. They realised that increased production of food per capita would not necessarily help the poor. In making their case, they adopted what has later come to be known as the entitlement-based approach.

While we have been critical of the views held by these critics, we have no doubt at all that their methodological approach was fundamentally correct. In fact, our criticism of their views is based on the very same approach. In examining the individual transmission mechanisms, and also in explaining the adding-up problem in terms of population growth, our concern was always to trace the impacts on the poor's entitlement to food. If we have reached different conclusions by following the same approach, it is partly because we have questioned some of their assumptions and premises, and partly because we claim to have avoided some logical errors committed by them.

The second general remark is about the role of public policy in shaping the links between growth and entitlements. The critics of the Green Revolution recognized quite early in the day that public policy must play an important mediating role if the poor were to benefit from the new technology. The underlying idea was that the existing economic and social structure made it difficult for the poor to gain from the growth process unless their disadvantages were offset or at least mitigated by supportive public

policy. That is why, the critics insisted on land reforms as a means of ensuring a level playing field, so to speak. They were certainly right in so insisting; but in retrospect where many of them went wrong was in taking the extreme view that without land reforms nothing else would help the poor. History has not dealt kindly with this extreme view, as the poor can now be seen to have gained in South Asia despite the lamentable absence of any significant land reforms.

However, the underlying perception that supportive public policy would be necessary for the benefit of growth to reach the poor has stood the test of time. While precious little has been done in implementing land reforms, a good deal has been achieved in respect of other supportive policies. Development of irrigation facilities and making the water available at subsidized prices was the crucial first step. Then fertilizer was made affordable through a policy of heavy subsidy, and the availability of credit was expanded manifold. The state also supported adaptive research for developing new seed varieties suitable for wide adoption within specific agro-climatic regions. Without these policies, it is very likely that small farmers would not have overcome the initial lag in adoption, and the critics' worst fears would have come true. By the same token, wrong policies have at times prevented the rural poor from receiving the full benefit of the new technology; the prime example of this being premature tractorization in Sri Lanka.

The lesson is thus clear: there is no inexorable relationship between growth and poverty. This is true even with unchanged distribution of land and other assets. There are policies, other than land and asset redistribution, that can make a difference, and we believe they have made a difference in South Asia, in enabling the poor to share in the benefits of the Green Revolution. But this is not to suggest that the policies have been especially 'pro-poor' in the sense of being more favourable to the poor as compared with the rich.⁵⁸ Furthermore, it needs to be stressed that since policies are reversible the conflict between growth and poverty may very well emerge in future.

⁵⁸ The non-targeted nature of input supply and pricing policies, the impetus given to mechanization by artificial cheapening of capital, and of course the almost total neglect of land reforms, are some of the features which obviously disqualify the policy regime from being characterized as pro-poor.

The final remark is about the strength of the growth process itself. We have suggested that the reason why the potential benefits to the poor do not add up to a substantial reduction in poverty is that output growth has not been strong enough to counter the immiserizing pressure of population growth. This raises the question: why has output failed to grow strongly enough? What, if any, has been the failure of public policy in this regard? In what way, if at all, has the constraints of the existing socio-economic structure held back the pace of growth? These are some of the questions that are crying out for an answer. The Green Revolution literature of the past two decades has been almost entirely obsessed with the question of whether or not growth has led to greater inequality and poverty. Perhaps the time has come to spend more effort in exploring the other question of why has growth been too slow in the first place.

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