Is Growth Alone Sufficient to Reduce Poverty? In Search of the Trickle Down Effect in Rural India

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Abstract

A theoretical analysis and econometric tests have been undertaken to examine whether the trickle down effect took place in rural India in the light of the Lewis's contribution on the existence of surplus labour. We found little evidence to suggest that the trickle down effect did occur. The emergence of capital-labour substitution was primarily responsible for preventing growth from reducing poverty. The decline in poverty and higher growth rate that took place during the late 1970s and 1980s were largely a result of government anti-poverty measures and the more equitable distribution of credit and inputs to smaller and marginal farmers.

JEL: O1

Key Words: Trickle down effect, Rural poverty, Economic growth, Capital formation

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1. Introduction

One of the essential arguments of Lewis's model (1954) is that the process of economic growth can absorb the surplus labour from the rural sector. His model exclusively concentrates on the growth of the modern urban industrial sector as a vehicle to absorb surplus labour from the rural sector. His concept of surplus labour is derived from the assumption that the marginal productivity of labour is zero. Thus withdrawing labourers from the agricultural sector is not likely to cause a loss in the output of this sector instead it will increase the availability of agricultural output per unit of rural households, thereby offering an opportunity to improve the living conditions of the rural poor. Without going into the details of his argument, the model therefore, perhaps for the first time put forward an argument that economic growth alone may be sufficient to address the issue of poverty. With this in mind, we examine whether economic growth alone is sufficient to reduce poverty with reference to the agricultural sector.

One of the main objectives of development economics is to improve the well-being of those people who otherwise would continue to live in poverty. Finding an effective means to alleviate poverty is one of the main driving forces of any policy programme in a developing economy. Broadly speaking, there are two different strands of thought on the 'means' to alleviate poverty. There are those who believe that growth will take care of poverty, and those who believe that selective intervention will also be required. One of the important sources of poverty is the existence of unemployment and seasonal unemployment in the rural areas of developing countries.[1] The argument that growth alone will take care of poverty appears to rest on the assumption that owing to the existence of a very large surplus of labour, the initial rise in

[1] Since poverty measures have responded more to rural economic growth than to urban economic growth (Ravallion and Datt, 2002), in this paper we focus on how rural poverty has been influenced by agricultural economic growth. However, as growth and poverty both depend upon the pattern of investment in agriculture,

the growth of employment is unlikely to be accompanied by a rise in the wage rate. This assumption eliminates the possibility of the emergence of capital-labour substitution in the foreseeable future. Hence the argument can be made that growth will take care of poverty. Whether this really takes place is not only an empirical issue; it also depends upon the policy that is pursued by the respective governments. The results of the empirical findings are contradictory. For example, in the case of Latin America, it was observed that the growth rates were not accompanied by a reduction in poverty (Fishlow, 1995). According to Fishlow, this is largely attributable to extreme and persistent initial economic inequalities.[2] In most other countries, according to the World Bank (1995), it was observed that the high growth rates in the economy were accompanied by a reduction in the number of people living below the absolute poverty line. The World Bank's findings are questionable; Deaton (2001), for example, argues that no consistent evidence can be found on the basis of which one can draw a definitive conclusion that growth has reduced poverty.[3]

This issue has resurfaced in India in recent years. For example, Besley and Burgess (2001) found that following the implementation of tenancy legislation in West Bengal, the incidence of poverty declined.[4] Similarly Tendulkar (1998) and Rao (1994) found that the implementation of the government's anti-poverty measures since the late 1970s helped to reduce the number of people living below the poverty line. Contrary to the above, Datt and Ravallion (1998), Ravallion and Datt (2002), Mellor (1999), Palmer-Jones and Sen (2003) and Fan *et al.* (2000) found that when a longer time period is considered there is a declining trend in the

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we use investment as the conditional variable to measure its impact upon poverty and growth.

[2] Alesina and Rodrik (1994) and Persson and Tabellini (1994) introduce another dimension into the debate; they argue that inequality in income and wealth are inversely related to subsequent growth. Thus they reverse the question as to how redistribution affects growth.

[3] In the case of international comparisons, a problem arises from the incompatibility of commodity bundles between nations. In addition, the use of purchasing power parity as a means to compare poverty between nations is not adequate. Consequently, there remains a great deal of doubt in relation to the accuracy of the World Bank's claim. See Deaton (2001) and Srinivasan (2001) for further details on this issue.

[4] Similarly, Deininger and Square (1998) argue that the initial distribution of assets such as land plays an influential role in future growth of income.

incidence of poverty with the rise in the growth rate.[5] This led them to conclude that the trickle down effect works once we take into consideration the longer time period, for example, Datt and Ravallion's data spans 30 years. Thus the debate is wide open, that is, does growth endogenously take care of poverty or is external intervention required? This is the subject matter of this paper.

The above findings of Datt and Ravallion raise an important question: if the number of people living below the poverty line has fallen consistently over the last 30 years with the rise in the growth rate, why did the Indian government introduce major policy changes at least three times during the same period? Furthermore, if poverty was declining at a 2 percent rate with a rising growth rate, why was India unable to alleviate poverty altogether? These are some disturbing questions that need to be investigated before one can agree or disagree with those who claim that the trickle down effect worked in India. For the moment, if we ignore the trend and just concentrate on poverty from two points in time, for example, the measurement starting point and its end point, the percentage of people living below the poverty line only changes by a modest margin. As the government intervened during the period in question, there is a need to examine whether a rise in the trend above the average annual figures was followed by government intervention, or whether government intervention emerged owing to other factors. If the rise in the trend above the average ultimately caused the government to intervene, an element of doubt will always remain as to whether the so-called trickle down effect really occurred in India.

The plan of the paper is as follows. Section 2 examines the origin and nature of the debate on poverty, and includes a discussion of our preliminary findings. Section 3 examines whether there was a trickle down effect, by investigating whether there exists any empirical relationship between the changes in the poverty rate with either changes in the output or with

[5] For a cross-country analysis, see Dollar and Kraay (2002) for a similar argument.

capital formation in Indian agriculture. Section 4 provides a theoretical explanation as to why the benefits of growth did not trickle down to the poor in India. This is followed by the conclusion.

2. The relationship between capital formation, growth and poverty

Following liberalisation in India in 1991, rural poverty rose sharply from 25 percent to almost 36 percent within a year (i.e. between 1990-91 and 1992), and only normalised, i.e. returned to its pre-reform level, by 1993-94, after government intervention (Tendulkar and Jain, 1995 and Tendulkar, 1998). This rise was not anticipated, because much of the reform was centred on urban areas, i.e. the reform was comprised of two elements, short-term macroeconomic stability and structural adjustment. Hence it was anticipated that any adverse impact of the reform would mainly be confined to the urban poor, and the rural poor would largely remain unaffected. In fact, while in urban areas the number of people living below the poverty line rose marginally, the bulk of the adverse shock was felt by the rural poor. These findings sparked a renewal of a debate that originally took place in the 1970s following Bardhan's (1970) findings.

Liberalisation promised similar results to those that were also made in the mid-1960s when India adopted the high yielding variety programme (HYVP), popularly referred to as the green revolution. The green revolution offered to solve India's two most critical problems: food shortages and poverty. The higher yield of HYV seeds compared to that of the local variety and its shorter maturity opened up the possibility of multiple cropping, thereby offering to solve India's food problem. In addition, this multiple cropping also opened up scope for further employment, thereby offering an opportunity to eliminate seasonal unemployment, which was an important source of poverty in the rural area. Thus, it was anticipated that cultivation with HYV seeds would generate a greater number of days of employment and thereby would directly

reduce poverty. Instead, observation revealed that the number of people living below the poverty line continued to increase at an accelerating rate. For example, the study by Bardhan (1970) showed that while the number of people living below the poverty line increased from 18 percent to 31.8 percent between 1960-61 and 1964-65, this figure rose to 63.1 percent by 1967-68. The HYVP was officially introduced in 1964-65, and the above figure shows that the incidence of poverty rose at a much faster rate during the green revolution period as compared to the pre-green revolution period. Punjab appeared to be on top of the list, which is one of the heartlands of the green revolution.[6] Bardhan's findings not only raised some serious issues relating to the policy chosen by the Indian government, but also raised doubts in relation to the authenticity of the prediction of the trickle down effect. However, Bardhan's work was based on a few observations; therefore it was difficult to detect the underlying trend in the incidence of poverty from his work.

Ahluwalia (1978) provided a systematic time series analysis of trends in the incidence of rural poverty by taking into consideration 14 years of data spanning from 1956-57 to 1973-74, and argued that there is a mild tendency for the trickle down effect to work. It is interesting to note that in his period of investigation, Ahluwalia does not make a distinction between the pre-green revolution and green revolution periods, thereby avoiding the adverse impact of the green revolution on the incidence of poverty, that can be observed from Bardhan's work. However, he did not consider the general rise in the price of goods and services, and once this inflation factor was considered it showed that poverty was indeed rising (Griffin and Ghose, 1979; and Saith, 1981). The question that arises from Bardhan's work is, why, when the green revolution was supposed to reduce poverty, poverty started to escalate during this period? Similarly Tendulkar's work raised the same issue, i.e. why, when liberalisation promised a higher growth rate and a better distribution of income and wealth, did the incidence of rural poverty suddenly

[6] See Ladjensky (1969a) on this issue.

increase following liberalisation, specially when it was anticipated that rural poverty would largely remain unaffected? The importance of this issue particularly arises when prior to liberalisation poverty seemed to be declining in the rural area. What caused its course to change? The government intervened to normalize the situation, as in a democratic country the government cannot abstain from intervening in the market in such circumstances. It became increasingly difficult to ascertain what would have happened had the government decided not to intervene. Consequently, it becomes difficult to refute or to accept the argument for the trickle down effect. However, as the argument appears to centre entirely on the growth of employment as a vehicle to reduce the incidence of poverty, the question of the trickle down effect can be resolved by investigating not only the impact of growth on poverty but also by examining the relationship between the incidence of poverty and capital formation. It is the form of capital formation rather than its absolute value, which will determine the growth of employment and will be reflected in the incidence of poverty. Therefore if the trickle down effect did take place in India at any period we should expect to have not only a very high correlation between the capital formation and the GDP (GDPAG) but also a negative one with the incidence of poverty. Thus we need to examine the relationship between these three variables to see whether there exists any correlation between them. Our main aim is to examine whether poverty was consistently falling with the rise in the GDP and what was its relationship with the capital formation.

Data on rural poverty (POVRU) are taken from the World Bank's web site (http://www.worldbank.org/poverty/data/indiadata.htm). Normally, there are two methods that are used for the measurement of poverty: head count ratio (HCR) and the poverty-gap index (PGI). The HCR indicates the proportion of the population living below the poverty line and the PGI mainly measures the depth of the poverty, that is the spread of the poor living below the

poverty line.[7] As our primary purpose is to examine whether the percentage of the rural population living below the poverty line over the years has consistently declined or not, rather than to measure the depth of the poverty, we decided to use the head-count ratio to examine whether any direct relationship can be established between the growth rate and poverty. The National Sample Survey, which provides the data on poverty has not been conducted every year and consequently to calculate the trend in poverty one has to take these gaps into consideration. This means any calculation of the trend in poverty will always be accompanied by some degree of inaccuracy and therefore can lead to bias in the interpretation; this is specially the case when the poverty figure fluctuates between every round. For our chosen sample between 1951 and 1991, there are 12 missing values, and consequently we have filled the gap by interpolating from the observed values. A total of 41 observations covering the period 1951-1991 have been used for the calculation of the trend. We chose 1991 as the cut-off point for our sample mainly for three reasons. First, there was a change in agricultural policy in 1991. Secondly, although two more rounds of NSS data have been collected, the questionnaires have been changed and as a result these data are not compatible with the previously collected data.[8] Finally, it is known that

[7] In addition to the above, there was a new method of measurement introduced by Foster, Greer and Thorebecke (1984), referred to as the FGT, comprised of the HCR, the (squared) poverty-gap ratio and the relative inequality amongst the poor as measured by the squared coefficient of variation. This method has been regarded as the most comprehensive method of capturing the severity of poverty. See Tendulkar (1998) for more on this issue. See also Kumar *et al.,* (1996) on the arbitrariness and subjectivity associated with the poverty line. These authors suggest using consumption deprivation of a staple food item used by the poor, such as cereal in India. They demonstrate that their index satisfies all the axioms of a poverty index, except the focus axiom, which they reject. See also Mehta and Venkatraman (2000) on this issue.

[8] In addition, Deaton (2001) points out that there are errors in both the NAS and the NSS approaches to measuring consumption. In general, errors in variables or errors in measurement are long-standing problems in economics and often can give spurious correlations. There always remain some statistical discrepancies between NSS and NAS data on the same variable. In the case of India, it was observed that the discrepancy between NSS based consumption and NAS based consumption has been growing during the post-reform period. That the ratio of NSS consumption to NAS consumption is declining could mean that either NSS based consumption is underestimated or NAS consumption is overestimated. Historically this discrepancy has been marginal, and the recent widening has caused concern. As NSS consumption expenditure is the basis for official poverty counts, the discrepancy suggests that some better-off households may have been left out of the survey, thereby producing a low mean consumption-expenditure. Hence the number of people below that mean spending would be smaller, whether this is arising from the problem mentioned above or whether it is arising as a result of changes in the questionnaire, the answer to which we do not know. But this should not be the basis for establishing a decline in poverty, as it may provide a misleading picture. Consequently, we decided to ignore the post-reform period. See also Deaton and Dreze (2002) for more on this issue. See Jha (2000) who argues that poverty in fact has increased following the financial reforms.

in the early 1990s the number of people living below the poverty line increased by 13 million and subsequently the Indian government allocated Rs 350 billion to address this poverty (Mehta and Shah, 2003), and as the agricultural growth rate slowed down in the 1990s, the issue of the trickle down effect does not arise for this decade. Data on GDP in agriculture and capital formation in agriculture (CAPAG) are taken from several issues of National Accounts Statistics, published by the Central Statistical Organisation, India. GDP in agriculture has been used as a proxy for rural income and capital formation in agriculture has been used as an approximation (or indication) of rural investment, with the aim being to measure the impact of the latter in the context of growth and poverty reduction.

Changes in the incidence of poverty are normally calculated with reference to changes in the per capita GDP. The result of our preliminary investigation using this method indicates that the decline in the incidence of poverty (with respect to changes in the per capita GDP) was so great that it raises the question of why India was unable to eliminate poverty altogether. We know India is not even close to eradicating poverty, which suggests there must be some methodological problem with this calculation. The above result was also much greater than the modest decline that was observed from the difference between the measurement starting point and end point. Consequently, we decided to divide the incidence of poverty by the GDP growth rate and found that the reduction in the incidence of poverty following a rise in the GDP growth rate comes close in proximity to the difference between the measurement starting and ending points. This led us to investigate why the measurement of the incidence of poverty with respect to the per capita growth rate gives such an unexpected result. Accordingly, we decided to divide the long period into sub-periods to see whether some irregularities could be observed in the calculation of the incidence of poverty with respect to changes in the per capita growth rate. As the per capita GDP growth rate is normally calculated with respect to changes in the rate of growth of population, we find that changes in the rate of growth of population cause very large

changes in the per capita GDP growth rate compared to actual changes in the GDP growth rate. For example, in our sample period we found that when the rate of growth of the rural population changed between 1964-1975 and 1976-1991 from 2.1 percent to 1.7 percent respectively, the per capita GDP growth rate jumped from 0.6 percent to 1.4 percent, which is a rise in excess of 100 percent, while in reality GDP increased at the rate of only 0.5 percent during that period. This suggests that perhaps the per capita GDP growth rate is extremely sensitive to changes in the rate of growth of population over time, and is therefore liable to give an exaggerated estimation of the incidence of poverty. This problem is not noticeable in the long period data; however, it becomes apparent once we divide the long period into sub-periods. It shows that as the rate of growth of the rural population started to change, i.e. increasing at a declining rate, and that this decline inflated the growth in the per capita GDP, specially in the 1976-1991 period. This in turn gives an unreliable estimation of the reduction in the incidence of poverty, suggesting that it may not be an appropriate method to use for analysing the level of poverty.[9] An important point to note is that a rise or a decline in the growth of population may alter the value of per capita GDP, but a reduction in the incidence of poverty ultimately relies on an increase in the GDP growth rate (Dreze and Sen, 1995). Consequently, we decided to examine the impact of the GDP on the level of poverty. The above three variables are graphed in Figure 1, and in Table 1, we present the trend rates of growth for all the three variables.

[9] It appears that in the recent Indian election the BJP relied on this method of estimation, while the Congress Party relied on foot soldiers for their information, and as left political parties decided to support the Congress Party, there was no shortage of foot soldiers. Therefore, Congress had more accurate information about the rural scene. Accordingly, they addressed rural concerns in their campaign, which enabled them to win the election.

Figure 1: Rural poverty, GDP and Capital formation

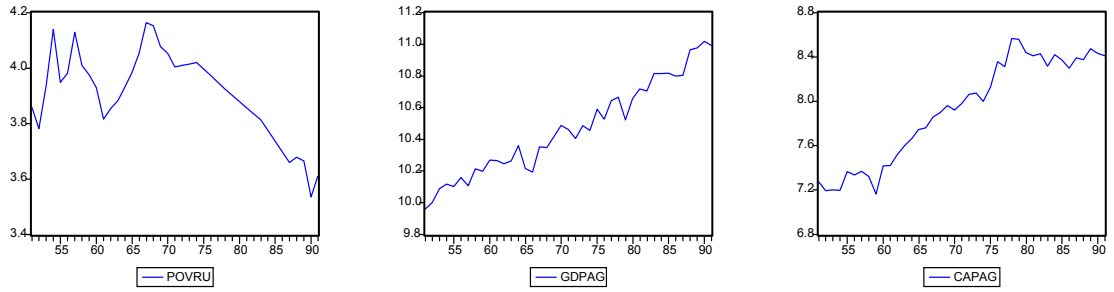

Table 1: Trend rates of rural poverty, GDP and capital formation in agriculture (%): 1951-1991

	Rural poverty	*Agricultural GDP*	*Agricultural Investment*
1951-1991	**-0.8**	**2.4**	**3.7**
1951-1961	0.4	2.8	1.6
1961-1971	2.7	2.3	5.5
1971-1981	-1.7	2.6	5.9
1981-1991	-2.9	3.1	0.4

Note: Trend rates are calculated as the OLS regression coefficients on time.

In relation to the longer time period, Table 1 suggests that poverty has fallen marginally with rises in both the growth rate and capital formation. Although this finding tends to support the view of those who claim that the trickle down effect worked in India, the result is not robust. Consequently, we decided to break this long period arbitrarily into four sub-periods to examine whether a systematic trend can also be found between these three variables during these sub-periods. As all the policy changes overlap with each other between the 1960s and 1970s, any impact of policy changes upon these three variables to some extent will either be neutralised or minimised, thereby allowing us to investigate whether the trickle down effect did take place during these sub-periods. If the trickle down effect did take place we would expect to observe a systematic trend between these three variables i.e. in the initial period, poverty may rise mildly with the rise in the GDP and capital formation, then it should start to fall. Our result reveals that no systematic relationship can be found between the trend in poverty with either the growth rate

or the capital formation. It shows that while poverty was rising throughout the 1950s and 1960s, with rises in both the growth rate and capital formation in the subsequent two sub-periods, poverty was falling with the rise in the growth rate. Interestingly, capital formation peaked in the 1970s and then declined in the 1980s, and the poverty appeared to have declined at a faster rate during the last sub-period compared to the previous periods. This shows that there exists no systematic relationship between the capital formation and the incidence of poverty. In fact, the puzzling feature of the 1950s and 1980s observations is that the growth rate was somewhat higher when the capital formation was low, raising a question about the nature of capital formation in the 1960s and 1970s. More importantly, the 1980s observations reveal that the poverty was falling at a faster rate compared to the previous sub-period. This raises an interesting question in relation to the 1980s, which is, what happened during this period to produce such a puzzling result?

In order to investigate this issue, we decided to divide the entire 40 year period into three sub-periods, now broadly following the policies that dominated each of these sub-periods, namely the pre-green revolution, green revolution and post-green revolution, to examine the impact of each policy upon the variables concerned and what caused the policy changes. The pre-green revolution period was dominated by the idea of implementing land reform policy and the promotion of cooperative based farming, while the green revolution was dominated by the adoption of HYV seeds and an intensive application of inputs in the highest productive areas. The philosophy behind the green revolution was that technical progress sponsored by the state would eliminate institutional impediments. The post-green revolution period was dominated by the government's policy of increasingly divorcing itself from the strategy of the green revolution, and the promotion of the government's poverty alleviation programme. Although the poverty alleviation programme was officially launched in 1972, the effectiveness of this policy did not eventuate till the late 1970s and throughout the 1980s. From the mid-1970s the

government increasingly alienated itself from the strategy of the green revolution, and instead of concentrating applications of inputs in the most productive areas, decided to spread the inputs more sparingly. The government, with the help of the nationalised banks, started to channel credit increasingly in favour of small and marginal farmers at a lower interest rate.[10] This in turn not only improved the small and marginal farmers' access to modern inputs such as fertilizer, but also made it possible to distribute fertilizer more sparingly. During the sixth and seventh five-year plan periods, i.e. 1979 to 1983 and 1984 to 1989, the government undertook various programmes to address poverty.[11] The government introduced the Integrated Rural Development Programme (IRDP), the National Rural Employment Programme and the Rural Landless Employment Guarantee Scheme, the latter two merging into Jawahar Rozgar Yojana.[12]

Accordingly we divided the sample; the first period is from 1951 to 1963. We end this period in 1963, as the green revolution marked a departure from its land reform policy and cooperative based farming. India adopted the HYVP in 1964-65, so the second period is from 1964 to 1975. As the government changed its strategy from the mid-1970's onwards, we end the period of the green revolution in 1975. The third period begins in 1976 and ends in 1991 when the process of liberalisation started. By "departure" we do not mean that the Indian government officially abandoned the policy of land reform and tenancy legislation, but that this policy, which dominated the minds of policy makers in the early years of independence, to some extent subsided. In fact, it was always the responsibility of each individual state to implement the policy. We present our results in Table 2 below.

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[10] Small farmers (i.e. with up to 2 hectares) improved their share of institutional credit from 39 percent to 45 percent between 1978-79 and 1982-83 (Desai, 1988). Between 1970-71 and 1981-82 the credit advanced to small farms from Primary Agricultural Credit Societies increased at the rate of 14 to 18 percent per annum as against the average rate of 12 percent per annum; the credit advanced by Scheduled Commercial Banks for such farmers also increased at the rate of 22 percent, as opposed to the average rate increase of 20 percent, between 1977-78 and 1984-85 (Haque and Verma, 1988)

[11] These were the years when India witnessed the separatist movement in Punjab. We cannot ascertain what led to this movement; we can only make a passing observation, which happens to coincide with the displacement of tenant farmers. Earlier on there was a disturbance in the rural area in West Bengal, which may have caused the subsequent state government to implement tenancy legislation.

[12] For further details on these issues see Rao (1994), Rath (1985), Dantwala (1985) and Hirway (1985)

Table 2: Trend rates of rural poverty, GDP and capital formation in agriculture (%) during different policy regimes: 1951-1991

	Rural poverty	*GDP in Agriculture*	*Investment in Agriculture*
1951-1991	**-0.8**	**2.4**	**3.7**
1951-1963	-0.3	2.4	2.6
1964-1975	-0.2	2.6	3.8
1976-1991	-2.7	3.1	-0.2

Note: Trend rates are calculated as the OLS regression coefficients on time.

Table 2 suggests that the poverty was falling in all three sub-periods but the magnitude was very different for each period. For example, during the pre-green revolution period our results show that poverty declined at a rate less than the GDP growth rate, suggesting that the land reform, tenancy legislation and cooperative based farming had a negligible impact on reducing poverty. This is largely because other than in a few states, the respective state governments were unable to implement the land reform and tenancy legislation policies effectively. The main aim during this era was to promote growth via redistribution, but in reality the scale of distribution was insignificant and consequently we find that it was unable to make any appreciable impact upon poverty. As the 1950s policy was neither able to make any appreciable inroads in the reduction of poverty nor able to deliver a high growth, this may suggest why the government decided to change its policy.

The next period is the green revolution, and the idea was that the states would sponsor the technical progress, and that this progress would take care of the institutional barriers, thus meaning any barriers to the reduction of poverty would be automatically removed, and no exogenous intervention would be required. Thus the issue of the trickle down effect does arise here.[13] But we find that average poverty during this period declined by just 0.2%, which is even lower than the previous period, while the growth rate was marginally higher compared to the pre-green revolution period. This perhaps reconfirms all the early findings, i.e. poverty and

[13] It was argued that the technical progress stimulated by the state would itself eliminate the institutional impediments to progress, thus meaning the adoption of the HYVP would simultaneously solve the problems of

inequality both rose at a faster rate in the green revolution belt, thereby slowing down the fall in the reduction of the incidence of poverty.[14] Interestingly, when we compare the relationship between capital formation and the rate of growth of output, the relationship shows a very weak link. While capital formation grew by 1.2 per cent per annum more than that in its previous era, output grew merely by 0.2 percent more than in the previous period. This raises the question of what was the nature of the capital formation, which had such a marginal impact upon the rate of growth of output? This in turn led us to compare the relationship between capital formation and poverty. It shows that the number of people living below the poverty line declined at a slower rate per annum compared to the previous period, with a 1.2 per cent greater rise in capital formation compared to the previous period. This also raises a question about the nature of the capital formation, which had a negligible impact upon the growth rate but appeared to have a significant adverse impact upon poverty. This was the period when large-scale mechanisation began, which was initially observed in Punjab and subsequently in many other parts of rural India.[15] The above findings therefore may explain why the government decided to change its policy yet again.

Let us consider our last period, where the government not only intervened with its employment-generating scheme, but also to allocate credit in favour of small and marginal farmers. We observe that poverty was declining at a much faster rate with the rise in the growth

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food shortages and poverty. See Cummings and Ray (1969) for more on this issue.

[14] See Bardhan (1974), who observed that while the average farm income grew in Ferozepur (Punjab), from Rs. 90 to Rs.432 between 1956-57 and 1969-70, the small farmers' share of income declined from 8.18 percent to 7.84 percent in the same period. Saini (1976) found that 60 percent of households' farm income declined between 1955-57 and 1967-69 in Muzaffarnagur (Uttar Pradesh), while in Ferozepur (Punjab) the gain from the new technology was confined to 10 percent of households, mainly large farmers. Land owned by large farmers also increased by 9.5 percent between 1955-56 and 1967-68 in Punjab. But this average hid a significant range of variation in the rate of expansion, with farm sizes of 20 to 25 acres only expanding by 4 percent while farms of 100 to 150 acres expanded by 40 percent (Rudra, 1969). See also Ladjensky (1969a and 1969b) for similar observations. See Basu (1982) for more on this issue.

[15] The production of tractors, which began in the early 1960s, grew at 26 percent per annum, with investment reaching Rs 1.5 billion in 1979. In 1980 the annual production reached 60,000 tractors, compared to the US production of 197,000 in 1978. The use of tractors for cultivation grew at 15.1 percent per annum between 1951 and 1979. Power tillers only entered the rural scene in 1965-66 with a supply of less than 700 units, but by 1974-75 the cumulative total of machines available was about 16,000 (Rudra, 1992). The total number of tractors increased from 54,000 to 444,000 between 1965-66 and 1978-79; the number of tube wells also

rate. Interestingly, we also observe that during this period the growth rate was much higher compared to any other previous periods, and capital formation was negative, implying that most of the government spending was in the form of the allocation of credit and inputs. In this period, the government concentrated more on the distribution aspect, and consequently we not only observe a higher growth rate, but also for the first time observe that poverty was declining in India at a much faster rate compared to the previous era.[16]

An important point to note here is that when a longer time period is considered, it is altogether not too difficult to find a declining trend in the incidence of poverty with the rise in the growth rate. But to conclude from this that the trickle down effect has taken place in India, is altogether a different matter. To prove that the trickle down effect took place, there is a need to show that at any point in time during this period either the government did not intervene regarding the distribution, or else poverty was falling consistently with the rise in the growth rate, irrespective of the government intervention. Our preliminary examination shows that the trickle down effect has never taken place in India; rather it is the government redistribution policy in the late 1970s and 80s, which not only produced a higher growth rate but also reduced the incidence of poverty at a much faster rate. To reconfirm our preliminary findings, we need to undertake further rigorous empirical tests, to which we turn now.

3. Empirical testing of the poverty-growth nexus

Re-confirmation of our preliminary findings depends upon whether in our empirical investigation we find the trickle down effect did or did not take place. With this in mind, we undertake further re-examination of the trickle down hypothesis, by investigating the impact of capital formation and GDP in agriculture on rural poverty using the longer time series data from

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increased from 100,000 to 1,744,000 during the same period (Rudra, 1992).

[16] See Alesina and Rodrik (1994) and Persson and Tabellini (1994) on this issue. They argue that inequality is not only harmful for growth, but to achieve a higher growth rate we need a better distribution. Contrary to the above findings, Forbes (2000) argues that inequality is good for growth.

1951 to 1991.

We can postulate from the analysis in the previous section that the rate of change in the incidence of poverty depends upon changes in capital formation and output in agriculture or that these variables are dynamically related in a multivariate set up. In other words, we are investigating whether a change in the CAPAG causes a change in the GDPAG, which leads to a change in the incidence of poverty or vice-versa. While comparisons over a long time period between 1951 and 1991 suggest that the incidence of poverty declined with economic growth, a sub-period analysis suggests that there is considerable variation in the rate of change in the incidence of poverty with a rise in the GDP, implying that the impact of the growth rate on the reduction in poverty may be negligible. An examination of the correlations with the stated period, presented in Table 3, reveals that the simple correlation of the level of poverty (or poverty index) with the GDPAG is –0.65, while the correlation of poverty with CAPAG is –0.45. Although the negative correlation seems to be true from a theoretical standpoint, the results are not robust.

Table 3: Correlation Matrix

	POVRU	GDPAG	CAPAG
POVRU	1.00	-0.65	-0.45
GDPAG		1.00	0.90
CAPAG			1.00

Consequently, we decided to undertake Granger Causality tests to assess the direction of the causality. Table 4 shows that there is a bi-directional causality between GDPAG and POVRU. This implies that income growth is a necessary pre-condition for the reduction in poverty, and also an increase in poverty may adversely affect economic growth.

Table 4: Pair-wise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Probability
GDPAG does not Granger Cause POVRU	39	7.25644	0.00237
POVRU does not Granger Cause GDPAG			0.01987
CAPAG does not Granger Cause POVRU	39	2.47288	0.09938
POVRU does not Granger Cause CAPAG			0.65184
CAPAG does not Granger Cause GDPAG	39	1.63921	0.20911
GDPAG does not Granger Cause CAPAG			0.72801

The above bi-directional feedback result suggests that there is a need to undertake further tests in order to investigate whether there exists any long-term relationship between the variables, running from income growth to reduction in the incidence of poverty via higher capital formation.

In this examination, first, we need to test the stationary properties of the time series involved. This is because many time series are non-stationary or integrated of order one, I (1), implying the presence of a unit root. The presence of unit roots is tested for all three variables in logarithms using the augmented Dickey-Fuller (ADF) test. There is evidence of a unit root in all the three series, which means they are all I (1) or they are non-stationary. The results are presented in Table 5 below. When the variables contain such properties, running OLS regression will produce spurious results. However, Granger (1988) argued, if the I(1) series move together, they share a common stochastic trend and their linear combination is stationary, which indicates that they are cointegrated, implying the existence of a meaningful long-run equilibrium relationship.

Table 5: ADF Unit root test results

	ADF in levels		ADF in 1st differences		
Variables	Without trend	With trend	Without trend	With trend	~I( )
POVRU	-0.96	-2.62	-5.95**	-6.33**	I(1)
GDPAG	-0.26	-3.37	-7.01**	-6.99**	I(1)
CAPAG	-1.22	-1.15	-4.74**	-4.85**	I(1)

Note: The ADF unit root test is given as follows. The aim is to test if $H_0: \alpha_2 = 0$ against $H_0: \alpha_2 \neq 0$ corresponding to y_t is integrated vs. y_t is not integrated, and the test is based on one lag.

$$\Delta y_t = \alpha_0 + \alpha_1 t + \alpha_2 y_{t-1} + \sum_{j=1}^{k} \beta_j \Delta y_{t-j} + u_t$$

Critical values are: 5%=-2.9399, 1%=-3.6117 (without trend)
5%= -3.5312, 1% = -4.2165 (with trend)

where y is the series under consideration, t is the time trend, α_0, α_1, α_2, and β_j are parameters, k is the number of lagged differences included to capture any autocorrelation, and u is the error term.

As the Granger causality test is only valid in the context of any pair of variables, in order to undertake a multivariate cointegration test we need to use the Johansen's cointegration

technique (Johansen, 1988). As our variables are stationary in first differences (see Table 5) they support Johansen's VAR model in first differences. This technique tests the null hypothesis of no cointegration against the alternative of cointegration, and yields two likelihood ratio statistics for the number of cointegrating vectors, namely, the maximum eigenvalue and the trace statistics. The Johansen cointegration framework is used to examine the possible long-run relationships between agricultural output, capital formation in agriculture, and the rural poverty index. Table 6 shows the trace statistics (i.e. likelihood ratio) when testing for cointegration. The results show that there is a stable equilibrium relationship between poverty, GDPAG and investment in the long-run. The null hypothesis that r=0 is rejected means there exists a meaningful long-run relationship between these three variables.

Table 6: Testing for Cointegration

No. of CEs	Eigenvalue	Likelihood ratio	95% Critical Value
R=0	0.548960	34.33208*	29.68
R≤1	0.066964	3.280284	15.41
R≤2	0.014689	0.577129	3.76

Note: R is the number of cointegrating equations; the test assumes linear deterministic trend in the data. * L.R. test indicates 1 cointegrating equation at 5% significance level.

As the results suggest the presence of a long-run relationship between these variables, the construction of an empirical model for examining the linkages among them will include an error-correction term. Therefore we will be deriving a short-run model from the long-run relationship, which will allow us to assess the poverty response, following a shock to GDP or investment. The estimates of the long-run and the dynamic model are provided in Table 7. The results suggest that rural poverty has been negatively affected by changes in the agricultural output, while capital formation has contributed to an increase in poverty. It is interesting to note that while 1% increase in agricultural output leads to a 1.2% decline in rural poverty, capital formation increases poverty by 0.5% in the long run, *ceteris paribus*. Both these coefficients are highly significant.

Table 7: VEC estimates of Poverty rate, rural GDP and Capital formation

Cointegrating Eq:	Long-run		
POVRU= 12.74 – 1.19 * GDPAG + 0.46 * CAPAG			
	(-7.888)	(5.492)	
Short-run			
Error Correction:	D(POVRU)	D(GDPAG)	D(CAPAG)
CointEq1	-0.540981	-0.125725	0.180834
	(-5.76437)	(-1.12138)	(1.18528)
D(POVRU(-1))	0.047165	0.050653	0.225046
	(0.38346)	(0.34472)	(1.12550)
D(GDPAG(-1))	0.410461	-0.342249	0.092010
	(2.78083)	(-1.94092)	(0.38345)
D(CAPAG(-1))	-0.113953	-0.154857	-0.173996
	(-1.17198)	(-1.33318)	(-1.10079)
C	-0.011755	0.039670	0.035746
	(-1.11508)	(3.15005)	(2.08591)
R-squared	0.501933	0.227035	0.157658
Adj. R-squared	0.443336	0.136098	0.058559
Sum sq. resides		0.110448	0.157627
S.E. equation		0.056995	0.068089
F-statistic		8.565962	2.496615
Log likelihood		59.06353	52.12760

Note: Sample (adjusted): 1953-1991; t-values in parentheses.

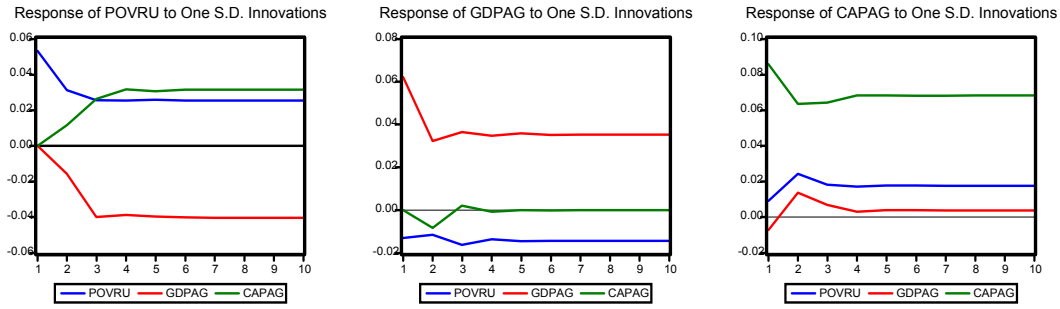
In the short run, however, an increase in agricultural output growth significantly increases poverty by 0.41%. But the coefficient of the error correction term is negative and significant, meaning that 54% of the deviations from the long-run equilibrium is being reversed in the following year. This indicates a very fast adjustment. It appears that such an adjustment can only take place provided some external body (e.g. government) intervened in order to reduce the poverty.

In order to reconfirm this result we undertook a cumulated impulse response analysis. This analysis allows us to further re-examine how, if an unanticipated shock is given to GDPAG, it would impact on the poverty rate. The anticipated shock analysis can be conducted using the estimated coefficients. In order to analyse the impact of unanticipated policy shocks (or innovations), Sims (1980) suggested employing the impulse response functions (IRF), which are obtained from the moving average representation of the VEC

model. It has been argued that the distributed lag coefficients estimated using VEC do not provide a clear understanding of the implied dynamic behaviour of the model. The use of impulse response coefficients will enable us to analyse the dynamic behaviour of a variable when random shocks are given to other variables. Thus the IRF describes the effect of an innovation ('shock' of one standard error) in a given variable on the movement of itself or another variable in the system. The ordering of the variables in the VAR is important since the first variable is only affected contemporaneously by a shock to itself; the second is affected contemporaneously by shocks to the first and to itself, and so on.

Figure 2 reports the impulse responses to one-standard deviation shock in each of the variables in the system, which provide a better device to analyse the shocks. As expected, given the fact that we found the existence of cointegration, the impulse responses show that the short-run effects eventually decay back to a constant in the long run. The impulse responses exhibit the effects of shocks in terms of annual percentages. A one percent shock to GDPAG produces a negative impact on POVRU – declining by 0.02% in the first year and 0.04% in the second year, after which the impact dies out eventually (see 1st panel), and with a positive initial impact on CAPAG (see 3rd panel). The shock also affects the variable itself and the impact decays gradually, which is true for the other two variables as well. With regard to the effects of CAPAG, there is a positive response on POVRU, suggesting that it is the nature of capital formation that explains why poverty increases.

Figure 2: Short-run impulse responses



The above analysis also suggests that the reduction in poverty has a positive impact upon economic growth. The shocks to POVRU show that it reduces GDPAG (see 2nd panel) and, as CAPAG rises following a shock to poverty (see 3rd panel), it has a marginal positive impact on GDPAG subsequently.[17] All these impulse responses do reflect that the model is stable in the sense that they are smoothed out with a decaying response.

The above analysis suggests that when a longer period was considered the argument that economic growth trickles down automatically to the poor has not been proven to be correct for India, as poverty appears to have increased following an increase in labour-saving capital formation, thereby preventing output growth from reducing poverty permanently. Therefore, the incidence of poverty that was declining since the late 1970s and throughout the 1980s must be the result of the government's anti-poverty measures. But the question that needs to be answered is why, in a labour-surplus economy, when the wage rate is low, the growth rate is not accompanied by a growth in employment? In other words, why did the trickle down effect not take place in India? It is to this issue we turn now.

[17] The positive impact of capital formation on total output in agriculture can emerge only to the extent such capital formation takes place in areas, such as investment in irrigation, that is usually undertaken by the public sector; see Mallick (1993).

4. An explanation of why the trickle down effect did not take place in India

The issue of the trickle down effect principally emerged in the context of Indian agriculture during the period of the HYVP. The higher yield of the HYV and its shorter maturity opened up the possibility of multiple cropping, which offered to increase the rate of growth of output and also to open up the possibility for further employment growth. Therefore, it was reasonable to assume that the growth in agricultural output would reduce the price of food, and would increase the demand for labour, and these two effects in turn would directly work in favour of the poor. But this did not take place. The analysis in our previous section reveals that there exists a high correlation between capital formation and GDP, yet in the VEC framework its impact on output is negligible. Furthermore, we find that capital formation does not contribute to a reduction in the incidence of poverty. Yet if poverty has to be reduced via growth in employment, theoretically we should have found a negative impact of capital formation on poverty. But a positive relationship has emerged because of the fact that a substantial portion of the capital formation has taken place in the form of acquiring labour-saving devices, and consequently we find that its contribution to the output is negligible. It reconfirms our point made in the second section that this was largely due to the increasing mechanisation during the green revolution period, which greatly concentrated not only on acquiring land-saving devices, but also on labour-saving devices, especially by large farmers. The puzzling pattern of this form of mechanisation does raise the question of why, in a labour-surplus economy, when it is unlikely that the growth of employment will be accompanied by a rise in the wage rate, would a landlord prefer to opt for labour-saving devices when the wage rate is so low? In order to understand this apparently peculiar behaviour by the landlords, we need to investigate the conditions under which the production system operates.

Prior to the introduction of the HYVP, Indian agriculture was predominantly cultivated by tenants and small farmers. Most of the literature on the rural economy concentrated on the

distributional aspect of the economy, owing to the existence of high levels of poverty, and therefore the literature focused on the exploitative aspect of the relationship between landlords and tenants, whether the authors followed neoclassical (e.g. Mellor, 1968) or Marxian (e.g. Bhaduri, 1973) models. As a result, some of the subtle complexities under which the operational aspect of the production system was formed have been either neglected or not received much attention.

Two thirds of the land area under cultivation used to depend directly upon rainfall, and as a result the return from agricultural investment always remained subject to the uncertain whims of nature. This uncertainty in relation to future income in the case of the rural sector primarily arises from four factors, two of which concern rainfall: the level of rainfall and the distribution of rainfall. Thus the cultivable area, which is not under the control of an irrigation facility is more susceptible to crop failure if the rainfall is below normal. Even normal rainfall may have an adverse consequence upon the crop if the distribution of the rainfall affects the timing of the availability of water. These factors not only cause a variation in the yield per unit of land, but also cause a variation in labour input requirements. For example, if the crop production is below normal, specially due to the mal-distribution of rain, less labour will be required during the harvesting period, but this could not be predicted during the sowing period, implying that part of the labour force will remain idle. Similarly, if crop production is above normal, part of it may be lost in the absence of a reserve stock of labour to draw on at critical times. Also heavy rainfall may cause an outbreak of fever during the sowing period. Thirdly, adverse financial circumstances may affect the health of the labour force during the harvesting period. Finally, the expectation of changes in the relative price ratios of competing crops introduces uncertainty in relation to the allocation of resources among different crops for individual farmers.

All of these factors amount to uncertainty in relation to future rates of return on

investment in the agricultural sector. Landlords are aware that there is nothing they can do about the uncertainty that follows from the whims of nature. But the landlords recognise that they can reduce the uncertainty that otherwise would follow from the adverse financial circumstances of their labour force and from a possible lack of a steady supply of labour that may be required at critical times. Accordingly, they opened up credit facilities for their tenants and their labour force. It is this method of minimising uncertainty that resulted in interlocking of the land, the labour and the credit market. Much of this credit market operates on the basis of a congruence of interest, where landlords know that in the absence of a credit facility, they will not be able to draw on labour at critical times. Furthermore, if the health of the labour force becomes adversely affected due to malnutrition during the harvesting period, much of the harvest may be lost. Similarly, as the labour force knows that it is the landlord who comes to rescue them on their rainy days, they feel obligated, and make themselves available to assist the landlords when the latter are in need, and this in turn also ensures the availability of these credit facilities. But this congruence of interest largely arose owing to the backward technology and poverty of the labour force. Where there is backward technology, manpower is the most precious asset, which can be bought, which means that in conjunction with wages, landlords have to offer other benefits in order to ensure a steady availability of labour. These benefits were not only non-accountable in wage bills, but some of them were not even accountable in monetary units, as it involved time and effort to develop and manage a relationship between landlords and tenants that ensured a steady flow of labour, which could be conceived of as quite costly.[18] The uneasy equilibrium that was formed between the landlords and their tenants or labour force was not understood. Therefore, it was not recognised that the landlord would have the incentive to opt for technology which would not only reduce the uncertainty that follows from the whims of nature, but also the uncertainty that otherwise follows from the poorly nourished, and unsteady availability of the

[18] See Basu (1997) for more on this issue.

labour force. This means landlords would have an incentive to acquire both forms of devices: land-saving as well as labour-saving.

In addition to the above, the tenancy system in India principally emerged owing to the backward technology, which put a severe physical limitation on the number of acres of land that an individual farming family could cultivate. For example, in Punjab, a family of five labourers with a pair of bullocks can cultivate a maximum of 10 acres, beyond which it is physically not possible. As we move towards the eastern and southern belts of India, this physical capability reduces even further among farmers, and as a result a family of five would not be able to cultivate even 10 acres. For the sake of simplicity we assume that the average farming family at best can cultivate 10 acres of land. This means that any farmer whose land holding size is greater than 10 acres will be required to hire tenant farmers. Under the tenancy arrangements, normally the share of the harvest is divided equally between the landlords and their tenants. Now imagine a landlord whose holding size is 25 acres, which is not uncommon in the state of Punjab; in the absence of labour-saving devices, he/she had to lease out 15 acres of land. This means, that under the tenancy arrangement, landlords were losing harvest, which is equivalent to the output of 7.5 acres of land in every harvesting season. Given this scenario, with the availability of tractors, a landlord knows that his family labourers can now cultivate not only 25 acres, but even more, thereby preserving the entire harvest within their own family. This provides them with an additional incentive to opt for labour-saving devices, i.e. by opting for labour-saving devices landlords can change the tenancy arrangement and have much to gain from it.

Let us illustrate this scenario. For the sake of simplicity, we assume a production function: $Y=F(T)$, where $F'(T)>0$ and $F''(T)<0$ and total costs consist of fixed and other costs (F). Let θ be the net share of the landlord and β is the tenant's share.

A profit maximising landlord will then maximise the following

$$\pi = \theta.Y - \beta.T - F$$

First-order condition

$$\frac{\partial \pi}{\partial T} = \theta.\frac{\partial F}{\partial T} - \beta = 0$$

Second-order condition

$$\frac{\partial^2 \pi}{\partial T^2} = \theta.\frac{\partial^2 F}{\partial T^2} < 0$$

We assume the following production function, where the share of the tenant is 50%, and '*A*' captures the notion of technological change:

$$Y = A\sqrt{T}$$

From the first-order condition we derive the following, which can be interpreted as the equation for the landlords' demand for tenants:

$$T = \left(\frac{\theta.A}{2.\beta}\right)^2$$

The above equation suggests that if θ approaches 1, under this condition technological change can increase the demand for tenants. This means the relationship between technological change and demand for tenants can only hold provided it is accompanied by a reduction in the tenants' share of the harvest (β). If the tenants' share remains rigid, then the landlord would opt for labour-saving devices in order to reduce the demand for tenants. This may explain why the green revolution was accompanied by a reduction in the demand for tenants.[19] The other factor, which contributes to the adoption of labour-saving devices follows from uncertainty with regard to the supply of labour.

Owing to the existence of extremely low wage rates, with smaller plot sizes, which did not necessarily reflect the size of the landlords' holdings, landlords would have neither the

[19] Dasgupta (1995) observed that 10 percent of the cultivated land and less than 10 percent of agricultural labourers in more recent times operated under the tenancy system

incentive nor the will for it to be economically viable for them to adopt large-scale mechanisation. Hence the assumption was made that multiple cropping would increase the number of days of employment, and therefore the market would take care of the poverty. What was perhaps not recognised was that the existence of aisles does not prevent a tractor moving from one plot to another, and therefore if the landlord's land holding size is sufficiently large, economies of scale would not be a barrier to tractorisation. In the absence of any analysis of the production system, it was not recognised whether landlords would have the incentive to opt for both forms of devices, eg land-saving and labour-saving, once they were made available to them, in order to minimise the uncertainty that would otherwise follow.

Those who adopted the HYVP, who happened to be rich and middle class farmers, received most of the benefit from institutional credit agencies.[20] Initially these farmers obtained loans at a cheaper rate and with reduced collateral requirements for the installation of irrigational facilities and the purchase of inputs. The installation of irrigational facilities is a vital land-saving device, and it reduces the uncertainty that arises from the less than normal rainfall and the mal-distribution of rain. This meant landlords were not required to make provision for a steady flow of labour at critical times, and could plan their total requirements in advance. In addition to this, landlords recognised that if they extended the HYV cultivation into that land which was cultivated by their tenants, landlords could benefit also from the increase in output per unit of land. However, under tenancy agreements, although the tenants' share of the harvest might remain the same, in terms of the absolute amount, there would be an increase, while landlords would bear the major cost. Some of the landlords decided to offer these inputs as a loan, which in turn enabled them to take a greater share of the increasing absolute amount of the harvest in the form of interest, which otherwise would have been available to the tenants. Other landlords,

[20] It was observed in Ferozepur that while the amount borrowed by small farmers owning less than 6 hectares declined from Rs. 252 to Rs. 245 per hectare between 1967-68 and 1971-72, during the same period, medium (6-14 hectares) and large farmers' (more than 14 hectares) borrowing increased from Rs. 86 to Rs. 305 and from Rs. 87 to Rs. 425 per hectare respectively (Dasgupta, 1976). See Basu (1982) for further on this issue.

specially the large ones, recognised that, given the supply of labour, if they could change the tenancy arrangements they would not have to go through this elaborate system, and perhaps could take the entire gain that followed from this HYVP. This meant that now landlords would be cultivating with hired labour, and as a result, the landlords' operational holdings would increase, given the ownership size of the land. In the past, landlords' operational holdings used to be much smaller compared to their ownership holdings, while in the case of tenants it was vice versa.[21] But to change this arrangement landlords required further mechanisation.

Although the initial allocation of loans was mostly invested in devices that could be categorised as land-saving, this caused the value of their land to increase, compared to that of those whose land size was not sufficient to make the installation of irrigation facilities economically viable.[22] In the process this further increased their access to the loan market. The existence of cheaper rates reduced the repayment rate on loans, and this meant borrowers could borrow even larger amounts than was possible at a higher rate. Furthermore as the government reduced the collateral requirements under the priority sector loan arrangements, they did not have to offer collateral of a higher value that is required under normal banking operations.

As a result these borrowers received more loans of a considerably larger size than was possible in the absence of this policy and subsequently they used these loans to purchase machinery categorised as labour-saving, e.g. tractors, harvesting and threshing machines. This opened up the opportunity for landlords to change the tenancy arrangements, but instead of increasing, reduced the scope of employment in the rural areas.[23] Consequently, the green

[21] See Rudra (1971) for more on this issue. Large farms' operating area increased by 12.50 percent between 1967-68 and 1971-72, while the smaller and medium sized farms' operating areas declined (Dasgupta, 1976). Similarly Vyas (1976) observed that in Surat (Gujarat), between 1961 and 1971, while the number of cultivators and other workers (ie non-agricultural workers) in the agricultural workforce declined, there was a significant rise in the availability of agricultural labourers.

[22] For example, between 1967-68 and 1971-72, in Ferozepur, the value of non-farm assets increased by 57 percent and the value of land increased by 60 percent. The value of assets owned by large farmers was 3.25 times greater than that owned by small farmers in 1967-68, and this ratio increased to 4.21 times by 1971-72 (Dasgupta, 1976).

[23] For further discussion on this issue see Bhalla (1987), who observed that the inverse relationship between farm size and labour inputs per hectare continued to become sharper, thereby lowering the value of employment

revolution, instead of reducing the incidence of poverty, caused it to escalate in the rural areas, and the government had to intervene to directly attack poverty.

5. Conclusion

The analysis and econometric tests that have been undertaken in this paper suggest that there is little or no evidence to claim that the trickle down effect has taken place in India. In short, it will be unwise to claim that growth alone will be sufficient to take care of poverty; the evidence and the analysis that have been provided indeed suggest that some form of external intervention will be required to reduce poverty. Growth can only directly address the issue of poverty provided it is also accompanied by growth in employment. In this sense the green revolution technically offered a unique opportunity to address the issue of poverty owing to its multiple cropping opportunity. The higher yield of HYV and its shorter maturity period opened up scope for multiple cropping, which in turn not only offered a higher rate of growth in output but also a greater rate of employment. Thus it was anticipated that this in turn would reduce poverty, and consequently the claim was made that the technical progress sponsored by the state would automatically eliminate institutional impediments.

But this anticipation was based on the assumption that the existence of extensive surplus labour is unlikely to put much pressure on raising the wage rates, thereby ruling out the possibility that the growth in employment would bring capital-labour substitution. But some crucial factors were overlooked, i.e. tenancy cultivation was a predominating feature of Indian agriculture, landless labourers constituted only 15 to 17 percent of the total labour force, and therefore wage rates were not a major part of the equation; rather it was the tenancy itself. It was the backward technology and the uncertain conditions under which cultivation took place, arising from the whims of nature and the poverty of the rural workforce, which to some extent

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with respect to agricultural output. For an early study on this issue see Rudra (1971), Binswanger (1978), Rao (1979) and Laxminarayan (1982). For an excellent summary of this issue see Rudra (1992), where he points out that labour displacement due to tractorisation, according to government sources such as the NCA, (1976) was around 15 percent, while according to Laxminarayan (1982) it was around 58 percent. See also Rao (1994) on

tied landlords to the rural workforce, i.e. the tenants. Landlords not only had a share in the good fortune of an abundant harvest but also often had to share disproportionately the fate of the poor harvest, as they had to feed their tenants. Therefore they always had the incentive to opt for technology that would free them from the fate of their tenants. This is irrespective of the adoption of the HYVP. The HYVP made it easier for landlords to adopt both technologies, e.g., land-saving as well as labour-saving devices. Consequently, we observe that despite very high capital formation during the period of the green revolution, its contribution to the growth rate was marginal and the difference in the growth rate between the pre-green revolution and green revolution periods is marginal, but it had some significant adverse impact upon employment owing to a change in the structure of cultivation.

It is the investment in labour-saving devices that prevented the emergence of the trickle down effect. This suggests that, without investigating the system, perhaps it is not wise to make assumptions, even for a poorer country, based merely on observations of the existence of surplus labour, that capital-labour substitution is unlikely to emerge.

Poverty that was declining with the higher growth rate during the late 1970s and throughout the 1980s was largely a result of a variety of government measures, including both direct anti-poverty measures and the adoption of a more egalitarian distribution of credit and inputs to smaller and marginal farmers. But the problem with these measures is that they do not form a permanent platform on the basis of which one can attempt to eradicate poverty. As we have observed, during 1991, following the financial reform, when the government attempted to address the macroeconomic stability, this meant cutting expenditure on anti-poverty programmes and the removal of various subsidies that were given to agriculture, and poverty was on the rise again and the government had to intervene immediately. The sorry state of our knowledge is that we have yet to find a platform upon which to formulate a policy that will

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this issue.

permanently improve the conditions of poor people. In an unequal society, growth alone does not provide such a platform.

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