GROWTH, STRUCTURAL CHANGE
AND OPTIMAL POVERTY INTERVENTIONS

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Foreword

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Abstract

The paper investigates the relationship between growth and structural change in the economy and their implications on poverty alleviation. To better understand this relationship, the paper proposes disaggregation of the components of GDP growth (which is basically a weighted average of sectoral growth rates) and investigation of their separate implications on poverty. The relevance of "modern economic growth" involving significant structural changes in the economy to poverty reduction experience in LDCs is also explored. The thesis is advanced that the particular type of growth process experienced, rather than simply the rate of growth, is crucial in explaining poverty reduction. Hence, there is a need to separately examine the cases of the low-income LDCs as their structural features make their growth processes and required antipoverty interventions different from LDCs in general. The paper finds that the experiences of the People's Republic of China, Indonesia, and India lend credence to these views which appear also to be corroborated by simple econometrics inferences drawn from data on 59 LDCs. Some of the important conclusions are: while growth of food production in all case studies has favorably impacted on poverty, nonprimary sector growth does not appear to have unambiguously had this effect; pursuit of aggregate GDP growth maximization as an antipoverty strategy without consideration of the type of growth process involved may not be appropriate in all sets of LDCs, especially not in low-income LDCs; that policies for development of human resources must be central to antipoverty strategies in all cases; and that macroeconomic factors do impact on poverty, especially inflation which has a negative influence. Some implications for Bank operations are drawn in the conclusion.
I. Introduction

The growing unanimity among economists about the benefits of economic liberalization policies has often spilled over, somewhat hastily, into the domain of poverty alleviation and reduction of inequities in societies. Apart from accelerating growth and industrialization, these policies are also cited as remedies for reducing poverty, through their growth-generating impact. A number of studies have also attempted to link growth to poverty reduction. Though the association may be true when considering aggregate gross domestic product (GDP) growth, closer scrutiny of the different facets and contributory components of growth are necessary to design optimal poverty interventions. Growth may come about in a variety of ways but different types of growth processes may have entirely different effects on poverty. Concerns about the social dimensions of a developmental strategy should therefore focus on designing appropriate growth strategies and other complementary interventions that aid poverty alleviation rather than simply advocating growth regardless of its nature and implications.

The World Bank (1990) in an authoritative and celebrated study on poverty (World Development Report) concluded that, "the countries that have been most successful in attacking poverty have encouraged a pattern of growth that makes efficient use of labor and have invested in the human capital of the poor. This two-part approach is the basic strategy for the reduction of poverty proposed in this Report."

While this is substantially correct, the recommendation of promoting "growth making efficient use of labor" may need further elaboration as it is subject to different interpretations. As will be explained later in the paper, it may be useful to break up growth which is basically a weighted average of sectoral growth rates into its sectoral components and investigate the differential impacts of the separate sectoral growth rates on poverty. It is also necessary to investigate to what extent the structural change in the economy is responsible for poverty reduction, if at all. This will help to identify whether or not poverty reduction is brought about by modern economic growth in the Kuznetsian sense (which involves substantial structural transformation of the economy) and in what way the generally accepted association of overall growth with poverty reduction needs qualification. Other important issues which also need investigation are the time usually required for growth to have the desired impact on poverty alleviation, and whether the association of growth or its sectoral components with poverty alleviation also hold in the case of the low-income less developed countries (LDCs), and for Bank developing member countries (DMCs) which is our special concern.

The central underlying mechanism through which modern economic growth is considered by many to impact on poverty is simple. Rapid growth causes the secondary and tertiary sectors with high labor productivities to expand at the cost of the primary sector. Assuming that labor productivities are higher in nonprimary activities compared to primary, the large-scale migration of population from primary to nonprimary activities would raise the migrants' incomes and the growth process would act to siphon off vestiges of poverty from the primary sector which predominantly is home to these economies' poverty-stricken populations. This is the primary modality through which presumably growth filters down to remove poverty.

1 See Kuznets (1966) for an elaboration of the definition of modern economic growth. Essentially, it involves a process where growth is accompanied by major structural change in the economy; from a dominance of the primary sector in output and employment to that of the secondary and tertiary sectors. In this paper structural change is defined in this sense.
In the real world, however, there are a large number of alternative scenarios through which growth occurs and has occurred in recent times. The impact on poverty has also not been uniform. In particular, the development experience and poverty interventions needed can be quite dissimilar in different sets of economies even among developing countries. The least developed economies have characteristics different from other developing countries, for instance, and prescriptions that may be true for other LDCs may not apply to them. In this paper we attempt to investigate other possible patterns of growth and particularly the cases of the least developed low-income economies and Bank DMCs and try and relate them to the experiences of the other developing economies in recent times, to see where the similarities and prescriptions apply to them and where they do not. Many of these economies with low incomes, large primary sectors, and low development of human resources would pose challenges to the success of the growth strategy cited in the previous paragraph as a method of poverty alleviation involving large transfer of population, if such a strategy does indeed reflect the real world situation in such economies.

In Section II the theoretical underpinnings of the growth process and structural transformation accompanying growth under different conditions is investigated a little more closely. A more rigorous exposition has been placed in the appendix to avoid distracting readers from the main thrust of the argument. In Section III an attempt is made to relate the theoretical analysis to the growth experiences of People's Republic of China (PRC), Indonesia, and India. In Section IV some stylized conclusions are drawn from simple econometric analyses using readily available data, relating to LDCs and Bank DMCs. Finally, the arguments are summarized in Section V, some policy conclusions are advanced, and recommendations having operational significance are attempted.

II. Growth, Structural Change, and Poverty Alleviation

The large and growing literature on the relationship between economic growth and poverty has produced both optimists and pessimists in the debate on the issue. While there is obviously no disagreement that eventually in the very long run sustained growth will eliminate all poverty, the debate is whether growth can impact favorably on poverty also in the short or medium term.

The World Bank's team of economists generally supports the idea that growth has beneficial effects on poverty. The World Development Report 1990 (WDR) proposed this view which has often been repeated in separate papers such as the important study by Fields (1989) which concluded that economic growth nearly always is associated with a reduction in absolute poverty in Third World countries though there is no relationship evident between growth and inequality. This idea has also found support in the Asian Development Outlook (ADO) of the Asian Development Bank (1994a) where the relationship between economic growth and poverty has been illustrated graphically.

The number of skeptics is also large, however. Those holding a contrary position include Dreze and Sen (1989) who deny any inevitability of the growth process impacting favorably against hunger and poverty. Their simple and elegant view may be summarized in the statement that growth may at best generate higher aggregate incomes but these do not necessarily translate into entitlements of food and basic necessities due to factors such as existence or otherwise of employment opportunities, structure of relative prices, and nature of social and legal rights. A high level of gross national product (GNP) per head,
they argue, provides merely the opportunity for improving nutrition and basic capabilities which may or may not be seized in the form of determined public action. On the other hand, several countries not fortunate to have achieved high per capita income levels have nevertheless attained better nutrition and health standards primarily through focused public support. There is also a growing body of literature which has produced evidence that income levels often bear little relationship to improvement of social indicators (see, for example, Aturapana et al. 1994). Others have pointed to the important question of distribution of income having an important and obvious bearing on who benefit from the growth process and who do not. The case of Brazil which has experienced fairly rapid economic growth without adequate favorable trickle down effects on poverty levels owing to extreme social inequity is often cited as an example. This skepticism about growth has led to advocacy of direct interventions for fulfillment of basic needs and poverty alleviation as opposed to the trickle down theory, and has influenced the idea of safety nets, importance of spending on social infrastructure, and even the idea that there should be greater multilateral lending on social sector investments. In the last decade the World Bank's social sector lending rose from $0.7 billion (5 percent) to $3 billion (15 percent). The ADB has also decided to significantly step up social sector lending.

Though empirical evidence on both sides of the debate abound, there is little serious analytical examination of the growth and poverty relationship. The leading thesis on this issue was that of Kuznets (1955) which started off a large body of enquiry on the now famous inverted U hypothesis. In this paper the basic thesis advanced was that growth would initially cause a widening of income disparities owing to its differential impact on different sectors—the nonprimary sector mainly experiencing rapid advancement and high productivity growth at the initial stages and acting as a catalyst for income mobility by inducing people from low-income low-productivity occupations to move higher up in the income scale. Several negative effects of adjustment to growth are also likely, Kuznets felt. This idea of adverse implications of growth is also explored by other authors. In the dual economy framework of Lewis (1976), for example, where a modern (M) sector coexists with a traditional (T) sector, the growth process can cause a downward lowering of incomes due to a number of factors such as terms of trade deterioration for the T sector at a rate faster than technical progress in the sector; technological unemployment caused by adoption of labor-saving technology in the M sector; drain of capital, labor, and entrepreneurship from the T sector to the M sector, etc. However, if growth continued for some time, and it was possible to sustain growth, Kuznets was optimistic that the dynamics of income mobility and diffusion of high productive employment opportunities would eventually reduce income inequalities. In a country experiencing sustained growth, greater income mobility would result than in a slowly growing or stagnant economy. Kuznets (1966) hypothesizes therefore that upward income mobility is a direct function of economic growth.

In an important paper on poverty, Tendulkar (1992) extends the Kuznets' thesis on growth and income mobility to poverty. Using the essential Kuznets' idea about the income mobility generating aspect of growth, Tendulkar feels that growth can help in eradicating several categories of poverty if it is successful in overcoming the barriers to income mobility. In an interesting taxonomy on classes of poverty, Tendulkar divides poverty-

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2 Sachs (1990) provides evidence on this point.
3 For an exposition of the basic needs literature, see Streeten (1981) which provides an extensive bibliography.
4 Kuznets (1973) provides a description of the problems of adjustment to the growth process.
affected households into those which are within the ambit of economic forces (who alone can be helped by growth) and those outside. The latter can only be helped through social security measures. The former type can be broken down further into "transient" and "persistent". The "transient" are characterized as households essentially pursuing viable economic activities but temporarily rendered unviable due to temporary natural (such as weather variations) or economic causes (such as terms of trade changes). On the other hand, persistent poverty is due to essential unviability of economic activities pursued by some households due, for instance, to insufficient assets to achieve viable labor productivity, insufficient scale of operations to achieve organizational or managerial economies, or insufficient employment opportunities at adequate wages. Growth, if taking place at sufficient rapidity, can impact favorably on certain types of both classes of poverty by increasing income mobility. The magnitude of growth determines the extent of income mobility by the removal of barriers to it, and hence the impact on poverty. However, it is also obvious that growth alone cannot impact on all types of transient or persistent poverty.

The above analysis shows that growth may not necessarily be able to remove poverty as growth itself generates adjustment problems and dislocation and can cause downward income mobility, and is not also able to impact on all classes of transient and persistent poverty. Despite the adjustment problems, however, Kuznets remained optimistic about the eventual impact of the growth process. But in his Nobel lecture, Kuznets (1973) did make several important distinctions between the growth experience of the developed countries on the eve of their entry into modern economic growth and the LDCs. First, the LDCs that account for the largest part of the world population are at much lower per capita levels than the developed countries just before their industrialization. Second, the developed countries were the most advanced countries in the world, not economically lagging countries at the lowest ends of the development scale. The population sizes of some of the LDCs are far larger than most of the developed countries at the beginning of their industrialization, and they did not face the rapid population increase faced by the LDCs today. Finally, though a far greater stock of technology is available to the developed countries beginning to industrialize, the stock of appropriate technology may be quite limited.

Moreover, the basic characteristics of modern economic growth that characterized the growth path of the industrialized economies differs greatly from the growth characteristics of the LDCs. The main features of modern economic growth discernible in the Kuznets exposition are (a) structural change of the economy led by the nonprimary sector, (b) technological progress mainly in the nonprimary sector, and (c) globalization. We have described earlier the mechanics of the growth process and its possible implications for poverty. The dynamism for such growth comes basically through accumulation of capital, growth of nonprimary sector output and productivities, and migration of labor to nonprimary sector activities. In recent decades the experience of LDCs suggests, however, that the growth potential of the primary sector is also enormous, both through greater augmentation of physical as well as human capital, and along with the latter the absorption of new technologies. It is now being increasingly realized that growth of human capital provides another powerful stimulus to growth, apart from physical capital accumulation.

The World Bank's highly influential study on eight high-performing East Asian economies (World Bank 1993) has also revealed, for instance, that these economies where

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5 Kuznets (1966) provides a full characterization of this growth process.
growth has been accompanied by sharp declines in poverty, were also characterized by
dynamic agricultural sectors, caused by very rapid technological progress in agriculture
and high public investment support, as well as high rates of human capital augmentation.
The importance of education and agrarian reform (which often is an important constituent
of primary sector development) was also voiced by Fields (1995), while arguing in favor of
promoting broad-based growth to reduce poverty. The nontraditional types of growth
processes experienced by several developing countries in recent times may have had a lot
to do with their growth processes being associated with significant reductions in poverty.
Indeed recent experience of which we shall elaborate further in the next two sections, has
shown that there has been steady and rapid expansion of the primary sector and augmentation
of human resources which has provided major impetus to growth processes in many
LDCs, particularly poorer ones, and has been instrumental in poverty reduction in these
countries.

In a major study on monsoon Asia, Oshima (1993), for example, showed empirically
that the Kuznets curve differs greatly for Asian countries compared to the Western world, a
fact which Kuznets himself had foreseen as mentioned earlier. Specifically, the inverted U
curve begins sloping downward at per capita GDP levels much lower than $1000 compared
to $2000 for the Western industrialized world. The downturn occurs for Asian countries at
stages of development when agriculture still occupies the predominant position in the
economic structure of these countries. This implies according to Oshima that agriculture led
the way in inequality reduction as compared to industry in the West. It also suggests that
raising rural productivity levels has been an important factor in combating poverty in these
countries where poverty is mainly a rural phenomenon and urban poverty substantially a
spillover from rural areas.

The principal difficulty encountered by all enquiries into the growth and poverty
relationship is the fact that, economic growth is too aggregative an index and conceals
many important economic processes that take place during growth and development. In
fact much of the differences in the issue would subside if a disaggregative look is taken. It is
therefore one of the main propositions of this paper that it is not growth alone that we
should look at, but the process of growth which can be immensely varied. One convenient
way to view the issue (and perhaps appropriate to the questions we are asking) is to
disaggregate growth into its sectoral and structural change aspects, knowing that economic
growth is a weighted average of sectoral growth rates corrected by a factor influenced by
the extent of structural change experienced.¹

For simplicity, assume that the economy is divided into two sectors: primary and
subsistence, and nonprimary and surplus generating. As poverty is mainly concentrated in
the primary sector, the growth dynamism and along with it the removal of poverty comes
about through rapid accumulation of capital in the nonprimary sector. Productivity of labor
in the nonprimary sector being higher, both owing to superior technology as well as greater
capital use, labor would migrate from primary to nonprimary sectors seeking higher wages.
In this situation, the rate of decline of the share of the primary sector in total employment
will be directly related to the growth of capital stock in the nonprimary sector and it would
indeed be true that modern economic growth determines the rate of labor absorption from
the primary to the secondary sectors and so the rate of decline of poverty in the economy.

¹ See Appendix 1 for a further elaboration of this idea.
If however we assume, as is increasingly becoming clear, that one of the most important stimuli to economic growth and development is growth of human capital, and also allow for investment of physical capital in the primary sector, such as through irrigation schemes as well as technology infusion into that sector, several alternative scenarios unfold. There will be a tendency for marginal productivity of labor to be augmented due to human resource development (HRD), and differences in marginal productivities in the two sectors will depend upon the elasticities of human capital with respect to output of both sectors as well as the elasticities of physical capital with respect to output. The growth of the modern sector depends in this scenario not just on the rate of capital accumulation but also inversely on the extent of capital allocation to the primary sector and on the manner in which human capital impacts on the productivity of labor in both sectors.

Thus if the spread of human capital merely has the effect of increasing efficiencies in both sectors, and the infusion of knowledge and skills is uniform in both sectors, marginal productivity of labor will be uniformly augmented and this by itself would not lead to any greater incentive to migrate. If however, the benefits of human capital acquisition have differing impacts (for example, literacy may lead to greater benefits in the primary sector by allowing rapid acquisition of technology but may not significantly alter efficiencies of labor in nonprimary activities) then it would slow down migration from the primary to the nonprimary sectors.

Another important factor which has impacted somewhat differently between primary and secondary sectors and has had significant impact in recent decades on primary sector growth and development, is the infusion of new technology in the agricultural sector. This technology has been often found to be scale-neutral in agricultural production and has therefore acted powerfully as an anti-poverty force. Application and the use of the new technology which demands intensive application of fertilizers and pesticides with new high-yielding varieties of seeds and superior water management, requires high literacy and therefore HRD is crucial for their acquisition and use. Technology infusion of this nature would also raise agricultural productivities and slow down migration to the secondary sector.

An implicit assumption that we are making is that primary sector growth does not worsen income distribution. This is possibly correct insofar as food production is concerned and may not be true for all agricultural production which may involve commercial production of cash crops in plantations etc. Sachs (1990) has shown how in the Brazilian case, despite a booming export led agricultural growth, food production has been lagging behind and may have contributed to persistence of poverty. Dreze and Sen (1989) have pointed to the importance of food production in the overall strategy against poverty in Africa. They have also pointed to the differences between agricultural growth and food production growth on poverty. Cash crops for example lead to more volatile incomes as they are dependent on markets to a greater extent. They cite evidence also that cash crops displace land-producing food and the means of production are generally less equitably distributed in cash crop production as compared to food production. The argument that food imports can substitute for self sufficiency in food is not practically sound especially in

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7 There are several studies showing the linkage between agricultural productivity and literacy. Chatterjee (1989) for instance uses cross sectional district level data in Assam, India to establish a linkage between rice yields and literacy. Though extension can be a temporary substitute for HRD, it is possibly not sustainable in an environment of rapidly changing technology.
the case of large economies. In view of this, I have mainly used the food production index when studying the impact of primary sector growth on poverty. On the other hand, nonprimary sector growth, often using labor saving technologies, is known frequently to impact unfavorably on income distribution and so on poverty.

In any case, the growth and development process involves many other scenarios apart from the growth of the nonprimary sector which may not always provide the main dynamism for development even if the unfavorable income distribution aspect is ignored. Powerful forces of growth in terms of human capital acquisition and potential for new technology absorption as well as capital augmentation exist in the primary sector, waiting to be unfettered. Growth processes that rely on such forces appear to impact more favorably on poverty alleviation as they impact directly in the raising of incomes and productivities in the sector most affected by poverty. Primary sector expansion, particularly food production and HRD, have perhaps had more favorable impacts on poverty alleviation, and as we shall see later, these rather than the process of modern economic growth that we have described, are possibly responsible more for the recent sharp declines in poverty witnessed in many developing countries. Rather than the poor having to migrate from their present occupations in the primary sector, in many instances their incomes are increased in the primary sector itself. Some of the above ideas are explored a little more rigorously in Appendix 1.

A growth process depending on growth of the nonprimary sector to lift the economy's average income and consumption levels by its own capacity to build a surplus or through other surplus-creating activities such as exports of manufacturing or even foreign aid has entirely different implications on poverty reduction, as compared to a growth process driven by increasing productivities of labor in the primary sector itself either through conscious policies of investment in the primary sector in schemes of irrigation, spread of high-yielding varieties of crops etc., or of investments in primary education and health. Moreover, when a social dimension, such as poverty elimination, is added to society's objectives, simple market-based strategies alone, involving removal of market imperfections, which may maximize growth may not be optimal from the social point of view. The recent successes of many developing Asian economies in reducing poverty levels dramatically such as PRC and Indonesia owe perhaps as much to rapid development of the primary sector particularly the food economy and growth of HRD through massive investments in schooling and health care, as they do to pursuit of economic policies conducive to growth in general, industrialization, and globalization.

If one looks carefully at the data on overall economic growth and its apparent association with poverty reduction (as we shall do presently in the next sections) one would find an equally strong association of growth of agriculture and HRD with success in poverty reduction. Moreover, our conclusions carry more strongly in the cases of the least developed economies which need to grow fast while attempting to rapidly reduce their large poverty-stricken populations.

In fact, a policy of expansion of the nonprimary sector alone without developing the skills of the labor force may perpetuate poverty. Growth could occur through migration of labor from the primary sector but lack of skills would force the migrants into low-skill and low-wage jobs such as in construction and other manual trades leading to a spillover of the rural poor into urban areas. It is not surprising, therefore, that in Indonesia the spread of basic education came hand in hand with, and may have helped spur on, rapid increases in agricultural productivity, growth, and poverty reduction. Insufficient schooling and possibly
also vocational schooling at the secondary level is, however, now posing some difficulties for rapid industrial growth and growth of the tertiary sector while the tendency of urban poverty to reduce is markedly less than the drop in rural poverty. The tendency of modern industry to adopt labor-saving technologies in many instances in these countries has also robbed the opportunity presented by rapid industrial and export growth to alleviate poverty.

An attempt will now be made in the next section to relate the ideas presented above to the development experience of the three most populous economies of Asia. Next, in Section IV, our study will be enlarged to include the experiences of LDCs in general, and Bank DMCs in particular.

III. Growth and Poverty in People’s Republic of China, Indonesia, and India: A Comparison

People’s Republic of China, Indonesia, and India are three of Asia’s (and indeed the world’s) most populated countries. Together, they also account for a little less than half of all poverty in all developing countries. A comparative picture of growth rates and literacy (as an index of HRD) is shown in Table 1. While PRC and Indonesia have had remarkable success in poverty reduction, India has not been as successful. A comparison of their experiences would therefore be illuminating.

Throughout the period 1976-1991, PRC experienced very high annual per capita GDP growth rates, which averaged 7.4 percent. At the same time, PRC also achieved very high growth rates of agriculture resulting in the high average per capita agriculture growth of 3.4 percent for the entire period. The period 1976-1985 saw particularly high per capita agricultural growth of 3.9 percent; this was the period associated with the sharpest reduction of poverty in the country. The poverty incidence fell from 28 percent in 1978 to 8.6 percent in 1984.8 Considering the fact that for the entire period 1976-1991 the share of agriculture in total employment remained well above 70 percent, it is quite clear that PRC’s reduction in poverty was driven mainly by its success in strategies designed to improve agricultural performance.

The main elements in PRC’s agricultural strategy were explicit attempts to raise productivities through improved technologies and practices combined with the extensive reforms undertaken in the sector, deregulation of agricultural prices, and the introduction of the contract responsibility system.9 The rapid agricultural growth was also possible in large part due to the massive investments in irrigation that had been made earlier (PRC has one of the highest irrigation coverages among developing countries—46% of arable land area in 1990—though obviously other factors mentioned above were also crucial). The growth of agricultural prosperity also led to growth of some off-farm rural employment in tertiary and rural industries which may have also helped in the poverty reduction process. Quite clearly, however, it was not the high GDP growth rates alone that were responsible for poverty reduction in the case of PRC. In fact some adverse macroeconomic byproducts of high economic growth spurred on mainly by industrial growth, such as inflation

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8 Poverty data on People's Republic of China is from World Bank (1992).
9 See Lin (1994) for the structural transformation within agriculture in People's Republic of China and its impact on agricultural growth.
particularly of subsistence goods, may have decelerated the decline in poverty in the late 1980s. The policies of fiscal decentralization also pushed responsibility for social services to local governments with inadequate resources. However, the main cause for lower poverty reduction in the later period is lower agriculture growth. This strong association of poverty reduction with agricultural growth in PRC is now well recognized. Future poverty reduction strategies would also have to plan closely on agricultural interventions (see World Bank 1992 and Moinuddin 1992 for similar conclusions).

### TABLE 1
Growth Rates, Structural Change and HRD Attainment

<table>
<thead>
<tr>
<th></th>
<th>People's Republic of China</th>
<th>Indonesia</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP growth</td>
<td>9.26</td>
<td>7.56</td>
<td>8.69</td>
</tr>
<tr>
<td>Population growth</td>
<td>1.22</td>
<td>1.48</td>
<td>1.31</td>
</tr>
<tr>
<td>Per capita GDP growth</td>
<td>8.04</td>
<td>6.08</td>
<td>7.38</td>
</tr>
<tr>
<td>Agriculture growth</td>
<td>5.15</td>
<td>3.67</td>
<td>4.66</td>
</tr>
<tr>
<td>Per capita agriculture growth</td>
<td>3.93</td>
<td>2.39</td>
<td>3.36</td>
</tr>
<tr>
<td>Agriculture share in employment</td>
<td>81</td>
<td>73</td>
<td>70</td>
</tr>
<tr>
<td>Agriculture share in GDP</td>
<td>42.2</td>
<td>26</td>
<td>35</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>65</td>
<td>70.5</td>
<td>51.5</td>
</tr>
<tr>
<td>Literacy, males</td>
<td>79.2</td>
<td>87</td>
<td>77.5</td>
</tr>
<tr>
<td>Literacy, females</td>
<td>51.1</td>
<td>68.1</td>
<td>57.7</td>
</tr>
<tr>
<td>Mean years schooling</td>
<td>5.0</td>
<td></td>
<td>4.1</td>
</tr>
</tbody>
</table>


Another important factor quite clearly impacting on poverty in PRC is improvement in HRD attainment. As shown in the table, of the three countries, PRC and Indonesia have extremely high literacy attainment. Other HRD attainment indicators are also significant in PRC, such as educational enrollment ratios and primary school completion rates, and health indicators such as life expectancy, health coverage, etc. These HRD attainment indices have also undeniably impacted on population growth rates which have been comparatively much lower in PRC than the other two countries.

Indonesia's poverty reduction experience is similar in many ways (World Bank 1994). Between 1970 and 1990, the population under poverty declined from 60 percent to about 17 percent. One of the main factors undoubtedly responsible is the rapid growth in food production with the average growth rate between 1975 and 1990 exceeding 5 percent per annum. Like PRC, Indonesia made massive investments in irrigation and had arable irrigated area coverage of 35 percent in 1990. Unlike PRC, however, Indonesia's reduction in poverty could potentially have been the result of structural change as the share of agriculture in employment declined rapidly from 70 percent in 1965 to about 56 percent in
1991. A study of factors responsible for reduction in poverty in Indonesia during the structural adjustment period using decomposition analysis showed, however, that the within-primary-sector improvement in poverty ratio was much more important than intersectoral migration from the primary to the secondary sector. Within-sector improvement in incomes in rural agriculture was responsible for over 70 percent of the total reduction in poverty in the period of the structural adjustment, with within-sector improvements in industry and services accounting for 25 percent. Intersectoral shifts accounted for only 10 percent of the improvement in poverty. About 55.5 percent of total poverty reduction was accounted for by improvement in the incomes of self-employed farmers and 15.7 percent in wages of agricultural laborers. The study also suggests that government adjustment programs that benefit rural areas are crucial in poverty reduction, and also that rural infrastructure investments were also important factors in poverty reduction in Indonesia (see Ravallion and Huqpi 1991, Quibria 1993).

Similar to PRC, Indonesia also made rapid advances in HRD attainment which are closely associated with poverty reduction all over the world. Against a life expectancy of 70 years in PRC in 1992 (as against 47 in 1960) Indonesia had attained 62 which is a vast improvement from 41 in 1960. Adult literacy levels and mean years of schooling in Indonesia came to exceed even PRC’s excellent performance by 1991 as shown in Table 1. As stated earlier, the high HRD attainment definitely helped in improving labor productivities and as they are more equitably distributed than physical assets, must have been a powerful antipoverty factor in Indonesia. HRD would have contributed by increasing incomes, helping access new agricultural technologies, and helping in migration to off agricultural employment and higher ‘income mobility’. As importantly, HRD attainment has contributed to sharp reduction in population growth rates thereby helping to raise per capita GNP and per capita food availabilities, and through this route contributed immensely to poverty reduction in Indonesia.

In contrast to PRC and Indonesia, India’s poverty reduction achievement has not been as impressive. Between 1970 and 1988 the proportion of people below the poverty line has fallen from 45.5 percent to 33.5 percent (World Bank 1989). Also, in India, overall agricultural investments have in recent years been small and stagnating. Irrigation coverage was only 25% in 1990. Agricultural growth rates have also been quite modest in comparison. Large subsidies on current inputs prevented sufficient availability of public funds for investments in agriculture for which private investment is unlikely, even if financial markets were perfect (which they are far from), given the low private returns. As seen from Table 1, India experienced insufficient per capita agricultural growth rates, which is one of the core explanations for poverty in India. In 1976-1991, India’s per capita agricultural growth averaged only 1.38 percent, which is much less than half of that experienced by PRC or Indonesia. Also, unlike PRC, a greater migration to off-farm employment took place even though two thirds of all employment remained in agriculture. A lot of the poor who migrated did so without adequate skills owing to poor HRD attainment in India and may have contributed to the spillover of the rural poor in urban areas.

Poor growth of agriculture, insufficient HRD attainment, and high population growth are at the root of India’s poverty malaise. High capital intensity in industry further accentuated the labor absorption problem, so that even though moderately good industrial growth rates have been achieved, it has not impacted on poverty. At the same time, inflation, especially in food, has in recent years aggravated the problem and has led to some disaffection with the economic reform program.
IV. Some Empirical Insights

To obtain empirical insights into the issues raised in this paper, a preliminary analysis was made of the data on poverty and possible correlates from cross-country data sets published in the Human Development Report (HDR) (United Nations Development Programme 1994) and various issues of the WDR. There are obvious limitations of using poverty data in the cross-country context as the poverty indices are somewhat country-specific. Also as Srinivasan (1994) has pointed out, there may be some data deficiencies when using HRD data from the HDRs. In the absence of availability of standardized cross-country data on poverty, however, use has routinely been made of the existing data. A number of regressions were run, both simple and multiple. For simpler exposition the regression results are summarized in Appendix 2, while the principal conclusions are presented in the main text.

Data on 59 countries were used, the countries being selected on the basis mainly of existence of poverty data and data of possible explanatory variables, from the list of LDCs in the HDR 1994. (Economies with per capita incomes above $3,500 in 1991 have been excluded.) Poverty is defined in this paper as the percentage of people in absolute poverty in the total population, given by the head count index, i.e., number of people living below the poverty line which is the income level below which a minimum nutritionally adequate diet plus essential nonfood requirements are not affordable. The choice of this measure was due to its use in the HDR which is the source of our poverty data. To investigate the cases of the least developed economies, the subset of 26 countries classified as low-income economies in the WDR (i.e., with per capita GNP less than $650 in 1991) were studied separately, and in addition, the cases of 17 Bank DMCs were studied. Data sources for the Bank DMCs are however different in some cases as the HDR and WDRs do not report on several Bank DMCs. The blanks were filled in from the ADO 1994 and Key Indicators of Developing Asian and Pacific Countries (Asian Development Bank 1994b).

The basic matters of enquiry were (i) to what extent do growth factors explain poverty, (ii) which components of growth when disaggregated—sectoral growth rates and structural change—are significant factors in explaining poverty, and (iii) which are the significant factors in an expanded poverty equation involving growth factors as well as other factors in explaining poverty. Figure 1 shows scatter diagrams of poverty regressed on per capita growth, per capita food production growth, per capita industrial growth, and per capita services growth. (As in the last two cases the regression coefficients were not significant, regression lines have not been shown.) These show the apparent relationships (as multiple regressions present a truer picture) of simple regressions and highlight the close negative relationship between poverty and GNP growth, as well as poverty and food production growth. No relationship can be perceived for industrial sector and services sector growth with poverty.

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10 The sample of 59 LDCs was selected on the basis of availability of poverty data from the list of LDCs in the Human Development Report 1994. The low-income LDCs are a subset comprising Sri Lanka, People's Republic of China, Indonesia, Nicaragua, Egypt, Honduras, Lesotho, Kenya, Madagascar, Pakistan, India, Ghana, Haiti, Nigeria, Zambia, Bangladesh, Tanzania, Nepal, Equatorial Guinea, Burundi, Rwanda, Malawi, Mozambique, Ethiopia, Mali, and Chad.
FIGURE 1
Scatter Diagrams of Poverty on Aggregate and Sectoral Growth Rates
Three basic equations were used whose rationale is explained in more detail in Appendix 1. Equation (1) explains poverty using growth and other relevant variables:

\[ \text{Pov} = f(c, \text{pcgr}, \text{infl}, \text{expo}, \text{cgexp}, \text{lit}, \text{school}, \text{hrdexp}, \text{irrig}) \]  

where

- Pov = share of people in poverty in total population
- pcgr = per capita growth of GDP
- infl = inflation
- expo = share of exports as percentage of GDP
- cgexp = central government expenditures as share of GDP
- lit = adult literacy level
- school = mean years of schooling
- hrdexp = public expenditure on health and education
- irrig = percentage of arable land under irrigation
- c = other factors explaining poverty

To discover which components of economic growth are relevant in explaining poverty, we use:

\[ \text{Pov} = f(\text{pcfoodgr}, \text{pcigfr}, \text{pcservgr}, \text{emplchange}) \]  

where

- pcfoodgr = per capita food production growth
- pcigfr = per capita industrial sector growth
- pcservgr = per capita services sector growth
- emplchange = percent change in share of agriculture in total employment

Equation (2) also isolates the extent to which growth factors explain poverty. The sectoral growth rates are then used as separate variables in place of economic growth along with other variables in equation (1) to find out their importance in the expanded poverty equation. Employment change is dropped as it is dependent on some factors explaining poverty in (1) to avoid multicollinearity; irrigation is also dropped as it obviously is closely related to food production growth. This yields our third set of equations:

\[ \text{Pov} = f(\text{c}, \text{pcfoodgr}, \text{pcigfr}, \text{pcservgr}, \text{infl}, \text{expo}, \text{cgexp}, \text{lit}, \text{school}, \text{hrdexp}) \]  

We now turn to the main regression results.

A. Growth and Poverty

Though for the sample of all LDCs, aggregate per capita growth did impact favorably in multiple regression on poverty and with a significant coefficient, in the case of the Bank DMCs and the low-income LDCs, the growth variable was not found to be significant. In simple regression, the beneficial impact of growth had also been observed, though the relationship appeared to weaken for the shorter growth period (1980-1991) in the case of Bank DMCs and low-income LDCs. The result of growth having a favorable impact on poverty conforms to the theories of growth optimists referred to earlier, a relationship which has also been illustrated in the ADO 1994. However, interestingly, this
result does not appear to hold in multiple regression as mentioned above for low-income LDCs and Bank DMCs which have a large number of low-income LDCs in their fold.

This finding suggests that in advocating growth as a policy measure to reduce poverty, the stage of development of an economy should be taken into account. Though being offered tentatively at this stage (confirmation would have to await better data availability) the finding is quite intuitive, if we also observe results of disaggregating growth and witness the differential impact that sectoral growth rates and structural change have had separately on poverty. Thus when growth is disaggregated and its components, i.e., sectoral growth rates and structural change, are alone used to explain poverty, we find that the only two factors within growth that significantly impact favorably in reducing poverty in the case of all LDCs are growth of food production and structural change (regression 5 in Appendix Table 1). The impact of nonprimary sector growth variables, namely, industrial growth and service sector growth, are not significant. In the case of all LDCs these two components of growth, namely growth of food production and structural change, have been important and hence growth itself has had a beneficial effect. When low-income LDCs are considered, however, their possibilities of major structural change and income mobility in the short term have been limited unlike in the case of all LDCs. This is also borne out by the simple regression results which show that while in the case of all LDCs, growth has been significantly associated with structural change, this association does not appear to be significant in the case of low-income LDCs and Bank DMCs. Thus it has not been possible for growth alone to impact significantly on poverty in these economies, especially as nonprimary sector growth unlike primary sector growth has not unambiguously assisted in poverty alleviation.

This argument also conforms to the findings relating to the eight high-performing East Asian economies studied by the World Bank. The dynamism of the agricultural sector noted in these economies has probably been a major factor in reducing poverty both directly by increasing the incomes of poverty-stricken people resident in the rural areas as well as by inducing rapid structural change with the help of other favorable factors such as human development.

B. Disaggregated Sectoral Growth and Poverty

In all three sets of economies food production is found to be consistently significant and an important explanatory variable impacting favorably on poverty. In the case of industrial growth, no significant impact on poverty in the case of the low-income LDCs and Bank DMCs is observed. In the case of Bank DMCs, industrial growth for the period 1980-1991 is in fact seen to impact adversely on poverty as the coefficient is positive, though not significant. In the case of all LDCs, per capita industrial growth significantly impacts adversely in case of the period 1970-1991, though it is seen to impact beneficially for the shorter period 1980-1991. Per capita services sector growth generally does not have any significant impact on poverty in Bank DMCs and low-income LDCs. For the sample of all LDCs, services growth for 1980-1991 is seen to have an adverse impact, though for the 1970-1991 period it is favorable.

Thus in general, nonprimary sector growth cannot be said to have unambiguously assisted in poverty reduction, while growth of food production is seen to have invariably impacted significantly and favorably on poverty. This result appears to corroborate our
analysis in Section II. Rapid labor-saving technical progress in the nonprimary sector or inappropriate use of new technology may have been at the root of this problem.

C. Structural Change and Poverty

The experience of LDCs in general on one hand and low-income LDCs and Bank DMCs on the other, appear to be greatly divergent when structural change is considered as an instrument of poverty alleviation. In the sample of all LDCs, structural change has aided in poverty reduction. However, in the case of the low-income LDCs and Bank DMCs, structural change did not figure significantly in aiding poverty reduction in the regressions. This tends to imply that within-sector improvements of poverty levels were more important than intersectoral migration of population as a significant cause for poverty reduction in these economies.

D. Globalization, Macroeconomic Factors, and Poverty

An important feature of modern economic growth is globalization of the economy and growth of exports. Simple regression analysis of poverty on export growth (between 1970-1991) revealed that there was a significant impact of export growth in reducing poverty. In multiple regression, however, export growth did not come up as a significant factor with other growth factors, possibly picking up most of the explanation offered by export growth. Indeed as a significant association is seen between export growth and growth of food production in simple regression, when both are used in multiple regression, multicollinearity is inevitable thus explaining the result. The association of export growth with growth of food production shows that primary sector development which may be spurred on by primary sector exports may assist in reducing poverty.

Inflation was found to be an important factor in causing poverty in all LDCs and Bank DMCs. However this did not appear to be a significant factor aggravating poverty in the case of the low-income LDCs nor did it assist in explanation of poverty and so were dropped from the regressions for these economies. In all sets of economies, government expenditure as a whole did not help poverty alleviation except when it was used for HRD or primary sector development.

E. Poverty, Agricultural Growth, and Food Production

In simple regression analysis, growth of per capita food production was seen to have a significant negative relationship with poverty in the full sample of 59 LDCs. This is not hard to see in view of the importance of the primary sector in these economies and the very significant relationship between rural poverty and poverty in such economies. Other correlates found in simple regression which significantly associated with poverty reduction were fertilizer and pesticide consumption, and percentage of irrigated area in total arable land area. In the case of the low-income LDCs, the agriculture correlates were found to impact even more significantly in reducing poverty: per capita food production growth, irrigation, and fertilizer consumption all significantly impacted in reducing poverty. Con-
sumption of pesticides had favorable impact, though at the 10% level of significance. The greater significance of the agricultural correlates in the low-income LDCs in simple regression is due obviously to the much greater importance of the primary sector in these economies. This is also evident from the fact that rural poverty provides a very large explanation for poverty in these economies.

The importance of primary sector growth indices in poverty reduction was largely corroborated in multiple regression analysis. Irrigation, which is a proxy for infrastructural investments in the primary sector is a significant explanatory variable for poverty reduction in all three samples. This finding also conforms to the World Bank study of high-performing East Asian economies which found that these economies had generally allocated a larger share of their public investment to rural areas than did other low-income and middle-income economies. In all sets of economies in our study, growth of food production is seen consistently to have significant implications for poverty alleviation. Interestingly, agricultural growth for reasons stated in Section II does not figure significantly when used in place of food production.

F. Poverty and Human Resources Development

In simple regression analysis, for the full sample of 59 countries, adult literacy, mean years of schooling, and enrollment in secondary schooling are all very significantly related to poverty reduction. HRD attainment also had strong implications for growth and agricultural production. Long-term growth is significantly related to both enrollment in secondary schooling and adult literacy levels (though at the 10 percent level of significance), while pesticide and fertilizer consumption are significantly related to adult literacy, mean years of schooling, and secondary enrollment at the 5 percent level of significance. Growth of per capita food production is also significantly related to secondary school enrollment as well as mean years of schooling (though the latter is significant at the 10 percent level of significance). Structural change is strongly associated with all the HRD indicators of literacy, schooling, and secondary school enrollment. In the case of low-income LDCs and Bank DMCs, mean years of schooling and secondary school enrollment are found in simple regression analysis to be significant explanatory variables for poverty reduction. In these economies, secondary schooling also appears to impact significantly on growth of per capita food production and fertilizer application. Other HRD indicators however do not appear to significantly influence food production or input applications. The association of literacy and schooling with poverty is also observed in the case of Bank DMCs. (The main simple regression results may be seen in Appendix Table 2, though due to space limitations not all results referred to have been shown.)

In multiple regression analysis, for the 59 LDCs, literacy, (or alternatively, schooling), as well as public expenditure on health and education were found to be significantly related to poverty reduction. In the case of low-income LDCs, schooling and public expenditure on health and education also were significant in explaining poverty reduction. In the case of Bank DMCs, literacy and, alternatively, mean years of schooling were found to be significant.
V. Summary and Conclusions

This paper has investigated the relationship between growth and poverty reduction and advanced the idea that to better understand the factors behind the relationship it may be of interest to disaggregate the constituents that make up growth and study their relative importance along with other relevant factors in explaining poverty in LDCs. Apart from attempting a theoretical explanation of the relationship between growth and poverty based on a sectoral decomposition of the growth process and the dynamics of structural change, the cases of three of Asia’s most populous economies were studied and an attempt was made to extract some patterns from data on LDCs using simple econometric methods.

The analysis may provide some useful insights into the growth process and its implications for poverty. Firstly, poverty reduction has perhaps more to do with primary sector growth, especially food production, than growth in general. Oshima’s (1993) hypothesis that inequality reduction results mainly from primary sector growth in many Asian economies seems to be borne out by the evidence presented here. The evidence of the three Asian countries studied in detail in Section III strongly supports this contention. The frequently observed association of growth with poverty reduction could possibly be due to the inclusion of food production as an important element in the index of per capita GDP growth. Thus, when the sectoral sources of growth are broken down and used separately to investigate their impact on poverty in our econometric study, only food production growth appears unambiguously as a significant factor in poverty reduction in all the three samples studied, namely Bank DMCs, low-income LDCs, and LDCs in general. The popular Kuznets type explanation for the downturn in inequality, relying on structural change in the economy, does not seem to be relevant for the low-income LDCs and Bank DMCs in general though for all LDCs in the sample extracted from the HDR, of which the low-income economies are a subset, structural change does play a role in mitigating inequality and poverty. This finding also conforms to Oshima’s findings for monsoon Asia. Also, an important primary sector investment index, which can be used as a good proxy for infrastructural investment in the sector, namely irrigation, appears repeatedly in the data as a factor impacting very favorably on poverty reduction. The impact of nonprimary sector growth on the other hand, appears to be ambiguous; growth of industries and services appear often not to have aided poverty reduction. These findings have obvious implications for operational policy. We cannot rely merely on growth and trickle down—especially modern economic growth to solve the poverty problems of low-income LDCs and Bank DMCs. The analysis reveals that it is perhaps not growth per se that is relevant as an instrument of poverty alleviation but the process of growth relying heavily on primary sector development, especially development of the food economy.

Secondly, development of the food economy is more crucial than simply agricultural development from the poverty point of view. The results of the econometric studies for LDCs in general and for Bank DMCs, point consistently to the importance of food production. Food security and poverty reduction appear to go hand in hand. Again this has important operational implications. The idea that imports can take care of food shortages is appealing but without a strong public distribution system with all its administrative and financial implications which are best avoidable, poverty will be difficult to tackle. Instead a policy of rapid food production should be at the core of all antipoverty strategies, as has been suggested by Dreze and Sen (1989), and as indeed many LDCs have wisely adopted.
Thirdly, policies for development of human resources must also be central to anti-poverty strategies, from the point of view of enabling opportunities for income mobility and creating a better distribution of human capital assets where physical asset distribution is not feasible. HRD indices have a strong impact on primary sector development and also aid in income mobility and structural change in the economy. Obviously, however, literate and schooled human capital alone will not solve the problems of poverty and development, but their development should be adopted in conjunction with policies that provide opportunities for proper utilization of such human capital.

Finally, macroeconomic factors do affect poverty. Inflation is an important contributor to increasing poverty as can be expected. This has important operational implications—economic stability which is advocated for sound economic management and growth is also desirable from the social point of view. The results also reveal that big governments do not necessarily imply lower poverty unless government expenditure is used toward the development of factors that reduce poverty such as HRD.

The above results gleaned from the experience of developing economies suggest that a simple generalization about the impact of growth on poverty may not be sufficient when devising optimal poverty interventions for these economies. It is necessary first to analyze specific growth processes rather than growth in general. As we have seen, structural change alone does not appear to have helped poverty alleviation and when the impact of overall GDP growth is studied separately as tertiary, industrial, and primary sector growth, the nonprimary sector growth variables do not unambiguously impact favorably on poverty while food production growth unambiguously does. It also needs to be borne in mind that economies differ widely according to their stage of development and this needs to be remembered when drawing up antipoverty measures. In view of this, a general conclusion that appears to emerge is that it is necessary not merely to promote growth as an instrument of poverty reduction, but to promote a process of growth, that takes into account the differential impact of different components of the growth process on poverty and their relevance given the stage of development of an LDC. Growth involving rapid development of the secondary and tertiary sectors at the cost of the primary sector (modern economic growth) may not be the answer to the poverty problem in all circumstances especially in the case of least developed economies and also as we have seen in the case of Bank DMCs.

From the Bank’s operational point of view, the above conclusions have a number of implications. First, there is a need to study a little more closely the consequences of the growth processes for developing Asian economies, such as by disaggregating the sectoral components of growth and studying their separate impacts on poverty, before accepting any generalization about the implications of growth on poverty alleviation. This would be necessary in order to help spur on the type of growth that aids in alleviation of poverty—a problem that continues to plague economies in this region more than any other. To do so would also require better standardized data on poverty and factors which influence poverty to be identified. Second, in the Bank’s overall strategy for poverty alleviation, a demarcation may appear warranted between economies according to their stage of development. As we have seen the usual prescriptions about LDCs in general may not apply to the low-income ones. Stand-alone growth strategies may not be sufficient to alleviate poverty in their cases; primary sector interventions appear to be more relevant; and major structural transformation is unlikely with growth especially in the medium term.
Infrastructural investments in the primary sector, such as in irrigation, may therefore continue to be important and need to be pursued not only for their strong impact on agricultural productivities and growth but also for their impact on poverty reduction. In several Bank documents studying irrigation projects, however, conclusions not favoring irrigation appear to have been reached based primarily upon current agricultural price data which lowered internal rates of return. The thinking that "hard" interventions such as irrigation should be substituted by "soft" interventions such as rural credit and capacity building may need further examination especially for low-income DMCs in view of the strong and favorable poverty alleviation effects of irrigation which we have noticed; and if this is included in the weightage for calculation of the expected internal rates of return, may make public investments in primary sector infrastructure more attractive. Finally, the universally accepted HRD interventions for all LDCs appear in our brief survey to be particularly relevant and necessary for LDCs especially those with low incomes, both for their important contribution to aiding poverty alleviation as well as their strong and favorable impact on growth.
Appendix 1

A. The Poverty Model

Poverty is dependent on several factors, but our special enquiry in this paper is to investigate the implications of growth on poverty, in particular the elements in the growth process which explain poverty. Let us start with a generalized model of poverty where poverty is a function of per capita growth (pcgr); macroeconomic factors of which inflation (infl), globalization given by share of exports in GDP (expo), and share of government expenditure in GDP (cexp) are important; human resources development status given by literacy (lit), mean years of schooling (school), and government expenditure on health and education as percent of GDP (hrdexp); key physical infrastructure impacting on poverty of which irrigation is a proxy (irrig); and other factors (c):

\[ \text{Pov} = f(c, \text{pcgr, infl, expo, cexp, lit, school, hrdexp, irrig}) \]  \hspace{1cm} (A.1)

An important hypothesis advanced in this paper is that growth is too aggregative an index and its various components have differential impacts on poverty which need to be studied separately. If, for example, we break up per capita growth which is a weighted average of sectoral growth rates, we have

\[ \text{pcgr} = a_1 \cdot \text{pcagr} + a_2 \cdot \text{pcigr} + a_3 \cdot \text{pcservgr} \]  \hspace{1cm} (A.2)

where

- \( \text{pcagr} \) = per capita agricultural growth
- \( \text{pcigr} \) = per capita industrial growth
- \( \text{pcservgr} \) = per capita services sector growth
- \( a_i \) = share of output of ith sector in GDP

When major structural changes occur in the process of growth, however, the equation (A.2) will not correctly reflect the actual magnitude of growth, as correct weightage will not be reflected. A correcting factor involving a structural change variable would have to be added to equation (A.2). To investigate the differential impact of the three sectoral growth rates and structural change on poverty, therefore, the model would have to be modified to the form

\[ \text{pov} = c + c_r \cdot \text{pcagr} + c_r \cdot \text{pcigr} + c_r \cdot \text{pcservgr} + c_r \cdot \text{emplchange} \]  \hspace{1cm} (A.3)

where \( \text{emplchange} \) = change in share of agriculture in total employment

It may be noted that in the last term of the above equation, change in share of agriculture in employment is taken rather than output, as from the point of implications on poverty, changes in employment would be more relevant. The above equation thus presents a rationale for investigating the relationship between poverty, sectoral growth rates, and structural change. (Disaggregation can logically be taken further by breaking up the sectors into constituent components if they help in explaining poverty. Indeed, for the agricultural sector, a further disaggregation into food and non-food production has been made in the empirical analysis as food production rather than agricultural production as a whole has been found to be significant for poverty reduction. In the regressions explaining poverty, food production growth rather than agricultural growth has therefore often been chosen.) To investigate the relevance of the important (significant) constituents of growth which impact on poverty, the concerned variables are reintroduced in an expanded poverty equation. However, as the structural change variable is itself determined by some of the
other variables on the right hand side of equation (A.1)\(^1\) it is omitted from the expanded poverty equation. Also when disaggregated growth is taken, because irrigation is closely associated with growth of food production, it is omitted from the equation:

\[
Pov = f(c, pcagr, pcigr, pcservgr, infl, expo, cexp, lit, school, hrdep)\]  \hspace{1cm} (A.4)

B. Method Used in Empirical Analysis

The methodology used in the econometric analysis was a combination of different approaches. First, the basic sets of variables chosen to explain poverty were obtained from the model described above. Also, clues about the choice of variable to use when several were available (such as the best index for HRD) were obtained both by using a simple regression framework, and also in a multiple regression framework using the F-test for inclusion of variables (which basically provides a test of whether the last variable included in a multiple regression significantly captures a part of the remaining variation or explanation.) Heteroskedasticity was not specifically corrected for as the error terms did not appear visually to be correlated with size of variables. In the absence of specific knowledge about the functional form of the above equations, linear forms are used. Non-linear forms may be more appropriate—or they may not be; many studies such as the ADO 1994, for instance (where poverty is plotted against growth in essentially a linear relationship), also uses a linear form. The use of cross-sectional data has obvious limitations but owing to data paucity the analysis is constrained to being basically cross-sectional in nature. As the basic objective was to discover broad relationships, no more than what is revealed through simple econometric analysis is being attempted. There are obvious data limitations mainly in the cases of the sample of least developed economies and Bank DMCs where degrees of freedom are somewhat low for some multiple regression runs. However, the objective is to present a preliminary test of our basic

\(^1\) Let \(F_1\) and \(F_2\) characterize the production functions in the nonprimary and primary sectors respectively which for simplicity are assumed to be of the Cobb-Douglas constant elasticity:

\[
F_1 = d_1 \left( K_1 t_2 \right)^{b_1} L_1^{b_1} A_1^{a_1} \hspace{1cm} (i)
\]

\[
F_2 = d_2 \left( K_2 t_2 \right)^{b_2} L_2^{b_2} A_2^{a_2} \hspace{1cm} (ii)
\]

where \(A_1\) and \(A_2\) are efficiency indices. Migration would take place until the marginal productivities of labor are equated over both sectors. Taking partial derivatives with respect to \(L_1\) and \(L_2\) we get

\[
\frac{L_2^{1-b_2}}{L_1^{1-b_1}} = \text{const.} \frac{K_2^{a_2} A_2^{a_2}}{K_1^{a_1} A_1^{a_1}} \hspace{1cm} (iii)
\]

To simplify the analysis assume \(b_1 = b_2 = b\). Then the share of the primary sector in total employment can be shown to equal:

\[
\frac{L_2}{L_1 + L_2} = \frac{1}{1 + \left( \text{const.} \frac{K_1^{m_1} A_1^{m_1}}{K_2^{m_2} A_2^{m_2}} \right)} \hspace{1cm} (iv)
\]

where \(m_1 = a_1 / (1-b)\); \(m_2 = a_2 / (1-b)\); \(n_1 = a_1 / (1-b)\); \(n_2 = a_2 / (1-b)\).

This share would decline with capital accumulation in the nonprimary sector 1, i.e., as \(K(1)\) increases, and would increase if human resources development favors the primary sector 2, i.e., as the \(A_1\) augmentation exceeds \(A_2\). The above model yields the following relationship:

\[
\text{empilch change} = f(\text{secondary sector growth, primary sector growth, HRD}) \hspace{1cm} (v)
\]
propositions based on readily available data. There is no doubt that getting more data and refining the econometric analysis may improve the results but it is doubtful whether the basic propositions will be affected.

The poverty index used was the average for 1980-1990. Average per capita growth rates economywide were available both for the period 1965-1980 as well as for the more recent period 1980-1991; an average long-term growth rate for 1965-1991 was computed based on these using time periods as weights. Both the average for 1980-1991 and 1965-1991 were used to discover their relative importance. Average sectoral growth rates were available for the period 1970-1980 and 1980-1991. The averages for 1970-1991 were computed, and per capita growth rates obtained by subtracting population growth rates for the corresponding periods. Average per capita food production growth was only available for the period 1979-1991. Structural change was studied for the period 1965-1992. HRD indices for literacy, mean years of schooling, irrigation, fertilizer and pesticide use, exports as share of GDP, government expenditure and public expenditure on health and education used latest available statistics. Inflation was the average annual rate for the period 1980-1992. The detailed list of variables used is shown at the bottom of Appendix Table 2 in Appendix 2.
Appendix 2

The main multiple regression results have been placed in Appendix Table 1, separately for all LDCs studied, Bank DMCs, and low-income LDCs. The simple regression results are in Appendix Table 2. For the set of multiple regressions for all LDCs (regressions 1 to 5 in Appendix Table 1) a number of conclusions are indicated. The first regression which uses the model corresponding to equation (A.3) in Appendix 1 shows the usually observed relationship between growth and poverty, with the growth variable being significant. Other variables also appear as significantly influencing poverty levels, namely literacy, public expenditure on health and education, and irrigation which is an index of primary sector investment. Variables tested but not appearing to aid in explanation were exports both as a share in GDP as well as growth of exports, and share of government expenditures in GDP. This pattern is also confirmed when per capita growth for the shorter 1980-1991 period is taken as shown in the second regression.

Regressions 3 and 4 disaggregate the growth index into its sectoral components, and correspond to equation (A.4) in Appendix 1. The only difference in these two regressions is that while in regression 3 the nonprimary sector growth variables relate to the longer 1970-1991 period, in regression 4 they relate to the shorter 1980-1991 period. In both regressions, food production growth, literacy, and public expenditure on health and education are seen to significantly aid in poverty reduction. Nonprimary sector growth variables cannot, however, be said to unambiguously assist in poverty removal. When the longer (1970-1991) period is taken, a positive industrial growth coefficient indicates an adverse impact while a negative services sector growth coefficient indicates a beneficial impact. When the shorter period (1980-1991) is taken, this is reversed. The inflation coefficient has positive signs in both regressions supporting its known role as aggravating poverty, but it is significant only in regression 3.

Regression 5 which corresponds to equation (A.3) in Appendix 1, has been used to determine the impact only of growth factors including structural change on poverty. It reveals that only 25 percent of the explanation is provided by these variables, and that only food production growth and structural change have significant coefficients.

Regressions 6 to 9 relate to Bank DMCs. For these countries, data is generally readily available only for the shorter 1980-1991 period. Owing to smaller sample size, the explanatory variables were kept to a minimum so as to preserve maximum degrees of freedom. Only one HRD index, literacy, was therefore employed and public expenditure on health and education was omitted. The regressions 6, 7, and 8 for Bank DMCs generally conform to the pattern for all LDCs, except that per capita GDP falls to be significant in explaining poverty in the Bank DMC sample. However, food production growth as in the case of all LDCs appears to have a significant impact in reducing poverty as do literacy improvements and irrigation. Nonprimary sector growth variables impact differently as in the case of all LDCs. Inflation is also seen to have a positive coefficient which is also significant in regressions 7 and 8. Regression 9 shows the isolated impact of growth variables including structural change on poverty. Unlike all LDCs, in Bank DMCs structural change is not a significant factor in explaining poverty reduction.

Regressions 10 to 14 deal with low-income LDCs. In this sample, as in the sample of Bank DMCs, the coefficient of aggregate per capita GDP growth is also positive but fails to be significant. As in the other two samples, growth of food production remains significant when growth is disaggregated. The nonprimary sector growth variables do not have significant coefficients. Interestingly, instead of literacy, mean years of schooling is found to be significant for poverty removal in these economies along with public expenditure on health and education. Irrigation coefficient is also found to be significant. Inflation, however, did not appear relevant in explanation.

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2 Since multicollinearity can be suspected between the two nonprimary sector growth variables, the entire set of regressions was also run using only the per capita industrial growth variable to represent the nonprimary sector. The results, however, remained broadly similar for all coefficients in terms of their sign and significance.
and was not used. Regression 14 representing impact of sectoral growth variables alone shows very weak overall explanation; in view of minimal explanation offered by nonprimary sector growth variables, these were omitted and only food production growth was found significant at the 10 percent level. Structural change, though beneficial, was not significant.

Overall, these regressions show that while aggregate per capita GDP growth impacts favorably on poverty in the sample of all LDCs, this does not appear to be true in the samples of Bank DMCs and low-income LDCs. When growth is disaggregated into its sectoral components, in all cases food production growth significantly aids poverty removal while nonprimary sector growth variables do not unambiguously do so. Human resource development indicators and primary sector investment (given by irrigation) also impact favorably in all cases. Inflation has adverse consequences on poverty. Structural change is a significant factor only in the sample of all LDCs and not in the other samples of low-income LDCs and Bank DMCs. Exports and government expenditure are not seen to provide any significant explanation for poverty in any sample.
### APPENDIX TABLE 1

Main Regression Results  
(dependent variable: poverty)

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>All LDGs</th>
<th>Bank DMCs</th>
<th>Low-income LDGs</th>
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<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td></td>
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<td>full model aggregate growth</td>
<td>full model disaggregate growth</td>
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<td>116.82**</td>
<td>88.47**</td>
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<tr>
<td>(8.30)</td>
<td>(8.65)</td>
<td>(7.97)</td>
<td>(6.95)</td>
</tr>
<tr>
<td>Per capita GDP growth, 1965-1990</td>
<td>-4.02**</td>
<td>(2.50)</td>
<td>-4.12**</td>
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<tr>
<td>(2.50)</td>
<td></td>
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<tr>
<td>(2.48)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per capita food production growth, 1979-1991</td>
<td>-2.44**</td>
<td>(-2.27)</td>
<td>-3.75**</td>
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<tr>
<td>(2.48)</td>
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<tr>
<td>Per capita industrial growth, 1970-1991</td>
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<td>(2.28)</td>
<td>-0.70</td>
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<td>(2.17)</td>
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<td>Per capita services growth, 1970-1991</td>
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<td>(0.70)</td>
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<td>Change in share of agriculture in employment, 1965-1990</td>
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<td>(-2.24)</td>
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<td>(2.50)</td>
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<tr>
<td>Mean annual inflation, 1980-1991</td>
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<td>(1.19)</td>
<td>(0.80)</td>
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<td>(1.38)</td>
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<td>Adult literacy rate, 1992</td>
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<td>(3.59)</td>
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<tr>
<td>Mean years of schooling, 1992</td>
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<td>(2.91)</td>
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<td>Public expenditure on education &amp; health as % of GDP, 1990</td>
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<td>(1.09)</td>
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<td>Irrigated land as % of arable land, 1987-1990</td>
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<td>(2.33)</td>
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** Coefficients statistically significant at 0.05 level  
* Coefficients statistically significant at 0.10 level  
Note: Coefficient is top number in each cell; the corresponding t-value is in parenthesis.
APPENDIX TABLE 2
Simple Regression Results

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Explanatory Variable</th>
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<th>Low-Income LDCs</th>
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Note: Abbreviations for variables in regressions are as follows:

Pov = average % of population in absolute poverty, 1980-1990
ruralpov = average % of rural population in absolute poverty, 1980-1990
pcgr = per capita growth of GNP, 1965-1991
pcsergr = per capita services growth
empch = change in share of agriculture in employment, 1965-1991
agemsh = average share of agriculture in employment, 1990-1992
expo = exports as percentage of GDP, 1991
import = imports as percentage of GDP, 1991
pcloodgr = per capita growth of food production, 1975-1991
irrig = average % of irrigated land in total arable land, 1987-1990
fert = fertilizer consumption per hectar, 1990/1991
pest = average per capita pesticide consumption, 1982-1984
lit = adult literacy rate, 1992
school = mean years of schooling, 1992
sec87 = secondary school gross enrollment ratio, 1990
cgexp = central government expenditure as % of GNP, 1991
infl = average annual inflation rate, 1980-1992
pcig8091 = per capita industrial growth rate, 1980-1991
pcser8091 = per capita services sector growth rate, 1980-1991
References


