PRO-POOR GROWTH -

THE RELATION BETWEEN GROWTH IN AGRICULTURE AND POVERTY REDUCTION

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TABLE OF CONTENTS

The Connection - Agricultural Growth and Poverty Reduction .. 1

The Basic Data..... 2
Defining Poverty..... 3
Growth and Poverty Reduction - General Relations... 4
The Structure of Growth - Poverty and Agriculture.. 6
The Structure of Growth - Rural and Urban..... 11
Lags..... 11
Asset Distribution..... 12
Poor Areas..... 13
Transient Poverty..... 13
Education..... 13
Food Security..... 14
Multipliers..... 15
Public Sector Investment..... 16

The Explanatory Theory..... 17
The Wages Goods Argument..... 18
Employment in Agriculture..... 19
Technology..... 19
Land Area..... 20
High Value Commodities..... 21
Employment..... 22
Agriculture Led Non-Farm Growth..... 22
GDP..... 23
Employment..... 25
Agribusiness and Consumption Goods..... 26
Rich Peasants and Income Distribution..... 26
When Do Real Wages Rise and Employment Elasticities Decline?..... 27

Employment Numbers 28

Egypt 29
Nepal 30

Programs to Reduce Poverty 31

Agricultural Growth 31
Increased Potential 31
Knowledge 31
Capital 32
High Value Commodities 32
Realizing the Potential 33
Technology 33
Infrastructure 34
Broad Participation 34

Small Scale Enterprise 36
Demand 36
Education 36
Credit 37
Special Programs Targeted to the Poor 37
Child Survival 37
Food Security and Safety Nets 37
Uncertainty and Fluctuations 38
Unresponsive Areas 38
Skewed Income Distribution 38

Foreign Aid 38

Conclusion 39

REFERENCES 41

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Asian countries have seem extraordinary reduction in poverty in the past few decades. Food insecurity as famine has left the stage (Mellor and Gavian, 1987.) In Africa, poverty is steadily growing, famine is so ubiquitous that complex, permanent famine early warning systems have been developed, in apparent disbelief that Africa can ever prosper. Meanwhile, the pace of poverty reduction has declined in Asia and the remaining problems seem more intractable (Cornea, 1999.)

Why these contrasting relations? What does analysis of the wide diversity of experiences tell us about what to do? Do we have a theory to explain the data and the practice? And, where in that context do programs targeted directly to the poor fit?

This paper shows the importance of agricultural growth, particularly through its effect on employment in the small scale rural non-agricultural sector. It then shows the importance of public expenditure on agricultural growth and hence on poverty reduction and draws conclusions with respect to development expenditure and particularly for foreign aid.

The Connection - Agricultural Growth and Poverty Reduction

We now have data confirming the existing theory that high rates of agricultural growth greatly reduce poverty. The data also suggest that the connection is complex, working indirectly through stimulus of the large, rural and market town, small scale and non formal sector. The following sections review those data, relate them to the underlying theory, and set the stage for stating a policy package for drastic reduction in poverty.

The Basic Data

Until recently, there were insufficiently long periods of rapid increase in incomes in a sufficient range of contemporary low income countries to study causes of poverty change. The exceptions were isolated micro studies. A decade or more of rapid growth in a wide range of countries has changed that situation. Recent compilations of data on poverty levels for a large number of countries allows study of factors associated with changes in poverty levels and facilitates conclusions about causality. Improvements in methodology have helped extract more information from the data than was previously possible.

The initial basis for current cross section analysis was the continuing set of large scale sample surveys, carried out throughout India by the Indian Statistical Institute, over very diverse physical, economic, and social conditions, and finally extending into a recent period of rapid growth. This data set, using a similar methodology over time and across large areas provides a truly unusual opportunity for analysis of poverty relationships.

Reinforcing the Indian data, is a large, cross national, inter-temporal data set developed by Klaus Deininger and Lyn Squire (1996) that also includes ample number of countries with rapid economic growth and with a wide range of structures of that growth. In addition, data for a few Southeast Asian countries that have experienced rapid growth has become available, as has data for China covering its recent rapid growth. Together these data sets tell a detailed story of the sources of poverty and its decline in the context of growth.
Initially, only the relation between overall growth and poverty was analyzed. The breakthrough in knowledge that shows it is the structure of growth that matters came from a series of empirical studies by Martin Ravallion and his colleagues at the World Bank. These studies examine the separate effect on poverty of growth by sector of the economy. Further studies, using a quite different methodology, by Peter Timmer, then at Harvard University, and his colleagues, provide independent corroboration of the basic relationships in the Ravallion studies as well as additional insights.

It is the consistency of results from varied studies with each other and with earlier micro studies and the further consistency with prior theory that gives such power to the findings.

In this section, the data will be briefly summarized for the general relationship between growth and poverty; then the effect of different structures of growth will be examined, with particular emphasis on the role of agricultural growth; next is review of the modifying effect on these relationships arising from differing initial income distributions and the presence of lags in the relationship; that will be followed by data on the geographic aspects of poverty and growth and on transient poverty.

The data will underline the importance of indirect effects of agricultural growth to poverty reduction. Therefore, attention will be given to data on the size of multipliers from agricultural to non-agricultural growth. Government expenditure is of special importance to the growth of the small scale agriculture that is particularly important to poverty reduction. And so, the role of public expenditure in agricultural growth will be analyzed. That will lead to important conclusions about the composition of poverty reduction focused foreign aid.

Following presentation of the data on these many related issues will be discussion of the theory behind these data that explains the otherwise surprising relationships. A brief review of data for Egypt and Nepal will be presented. Finally, policy conclusions will be drawn for achieving rapid reduction of poverty.

Defining Poverty

The contemporary focus on poverty in high income countries is on the relation between growth and the distribution of income. The concern is with inequality of distribution, rather than on the proportion of the population falling under some absolute poverty line. For low income countries, the focus is on the number and proportion of people falling under an absolute poverty line. The choice of focus is a philosophical one. Amartya Sen makes the case that in very poor countries it is the incidence of absolute poverty that most matters (Sen, 1976.) In any case, support for foreign aid and mass concern about poverty in low income countries is on famine, inadequate food intake, and levels of absolute poverty considered unacceptable. Hence this paper focuses on reduction of absolute poverty, although at several points data on change in distribution of income will be presented.

Absolute poverty has long been defined in terms of the income required to provide a minimal food intake for a healthy life and the associated consumption of those so poor that the minimum food intake is all they achieve (Dandekar and Rath 1971.) The traditional measurement of absolute poverty is the proportion of the population falling under the defined poverty line. Refinements examine the distribution of those under the poverty line. Generally little difference is found in the relation between growth and the variant measures.

This analysis will therefore concentrate on the simpler measure - the proportion of the population falling under the poverty line. That is, we will ask to what extent has the proportion of the population obtaining inadequate food intake and associated essentials for a healthy life changed.

Growth and Poverty Reduction - General Relations

The traditional interpretation of basic data on economic growth led to the conclusion that in the early stages of economic

growth inequality tended to increase. Inequality decreased only during later stages of growth. This pattern is often called a J curve, for its distinctive shape, or the Kuznets curve, for the data generated by Simon Kuznets that was thought to document this relationship (Kuznets, 1955.) Most of the analysis that led to this conclusion was based on historical data for the currently high income countries.

Even before the current wealth of data on poverty reduction, time series for Taiwan showed that its pattern of growth provided decreased inequality right from the start (Lee, 1971.) Now that the relation of agricultural growth to poverty reduction is better understood and documented, the Taiwan case is important for lessons about the processes that rapidly reduce poverty.

Taiwan to the contrary, a range of literature from 1971 to 1995, covering developing countries, seemed to support the Kuznets hypothesis about worsening of income distribution in early stages of growth. More recent literature, based on more sophisticated data analysis finds contrary results.

Bruno, Ravallion and Squire (1996) reviewed 63 surveys for 44 countries spanning 1981-92 and found no support for the worsening of income distribution. They further reviewed data from 45 countries for which time series data were available and found the bulk of variation in income distribution accounted for by differences among countries and only 7 percent accounted for by variation over time within countries. From these data, the distribution of income is quite stable overtime within countries.

India has the best, and perhaps only long term set of comparable data on income distribution in a large developing country encompassing considerable geographic variation in the various poverty related variables. These data give "no sign that higher growth rates in India put upward pressure on overall inequality (Bruno, Ravallion and Squire, 1996.)" A large number of other studies confirm that growth does not worsen income distribution and therefore it does reduce absolute poverty (Fields, 1989, World Bank, 1990, Squire 1993, Lipton and Ravallion 1993, Ravallion 1995.)

If the distribution of income does not change with growth then a simple calculation shows to what extent population is lifted above any given absolute income line. It is on this basis that

the World Bank estimates the poverty reducing effect of growth. As we will see later such simple estimates ignore the substantial variance in this average relation and shift attention away from the critical policy requirements for poverty reduction. In particular, it distracts attention from the requisites of pro-poor growth.

Timmer shows, based on analysis of the Deininger Squire (1996) data that "each one percent increase in per capita income for the overall population is matched by a one percent increase in income of the bottom forty percent in the income distribution." (Timmer, 1997.) That is, growth is neutral to the distribution of income. All income classes participate equally.

Datt and Ravallion (1998) contrast for India the period 1958-75 when real consumption per person declined at the rate of 0.93 percent per year with 1976-94 when real consumption grew by 1.76 percent per year. In the former period, the proportion of the population in poverty increased at a rate of 1.18 percent per year, while in the latter period it declined at 1.91 percent per year.

Timmer (1996) also shows for Indonesia that between 1970 and 1995, a 25 year period, the income of the lowest quintile in income distribution rose from a level equal to half the poverty line to more than twice the poverty line. The two lowest quintiles had a rate of growth of income of 6.1 and 6.8 percent per year, while the average was 4.9. Thus, not only was absolute poverty reduced rapidly but the distribution of income became more equal.

With a quite different measure, analysis of 20 countries shows an elasticity of poverty reduction with respect to income increase of 2.12 (Bruno, Ravallion and Squier, 1996.) Ravallion estimated the elasticity of poverty reduction (proportion of the population below the poverty line) with respect to income for India as -2.2 (Datt and Ravallion 1989, 1983 data) and for Indonesia as -2.1 (Ravallion and Huppi, 1989, 1984 data.) A figure of -2 means that starting with 40 percent of the population below the poverty line and a one percent rate of increase in the per capita income the ratio would drop to 39.2 percent in the first year. It would drop to 36 percent with a five percent growth rate, and would drop in half in seven years.

Ravallion and Huppi (1989) show for Indonesia between 1984 and 1987 the proportion of the population under the poverty line

declined from 33 percent to 22 percent - that is a drop of one third in three years.

Ravallion and Chen (1996) show for China a generally higher elasticity of poverty reduction with respect to average consumption. Using the World Banks $1.00 per day, which is comparable to the measures that start with minimal calory intake and the goods and services that go with that in the consumption basket of the poor, the elasticity is -3.1. That is a 10 percent increase in average consumption drops the proportion in poverty by 31 percent.

A broader definition that brings half the population under the poverty line drops the elasticity to -2.6 - that is a ten percent increase in average consumption brings about a 26 percent decreased in poverty. The elasticity drops substantially for definitions that place a higher proportion of the population in poverty - in half for one that places 75 percent of the population in poverty, compared to the 2.6 for 50 percent in poverty. Thus, growth brings disproportionately large reductions in poverty for the groups furthest below the poverty line.

All the preceding studies calculate relations between growth and more complex definitions of poverty and in every case the impacts are roughly the same, or somewhat more favorable for the very poorest.

It is notable that while studies for all countries show a major impact of growth on poverty reduction there is nevertheless substantial variation in the magnitudes of the poverty decline. In relating growth to poverty reduction, the most widely used number is the average relationship, with the conclusion that growth is good for poverty reduction. But, the variation suggests that something important is being hidden. That is the subject of the next section.

The Structure of Growth - Poverty and Agriculture

The structure of growth matters very much to the extent of poverty reduction. If poverty reduction is the objective, then certain structures, or sectors, must form the core of that growth. Two recent studies give detailed data on this issue. They confirm similar results from earlier but much less comprehensive data. The two recent studies are by Ravallion and

Datt (1996) for India and Timmer (1997) for a cross section of a large number of countries.

The two studies are quite different methodologically and in source of data, but find the same striking relationship. These studies are reinforced by several for individual countries. While this paper draws on all the studies shedding light on the structural issues, it does draw particularly heavily from India. That is advantageous because it does allow the picture to be drawn from a single basic source without the weakness of cutting across very different countries. However, the Indian experience, like that of any one country has specifics of its own. In any case, the India data is confirmed by the cross national study from Timmer, individual studies for other countries, and by the theory. Thus, the Indian data do end up being compelling.

Preceding the studies of Timmer and Ravallion, Montek Ahluwalia (1978) presented data showing that increased agricultural output per head of the rural population decreased poverty. Dharm Narian furthered this analysis with important conceptual additions (Mellor and Desai 1985.) He too shows a major effect of agricultural growth in reducing poverty. Mellor and Desai (1985) elaborate at length on the relations, the supporting data, and alternative views.

For both Ahluwalia and Narian, the data cover a period when both agricultural growth and poverty fluctuated considerable but there was not sustained agricultural growth or poverty reduction.
Thus, their analyses essentially deal with a situation not of steady growth but of fluctuations in income. In practice, those fluctuations were substantially driven by the varying effect of weather on agricultural production.
It is the Ravallion and Datt (1996) work for India that is recent enough to include periods with far higher agricultural growth rates than the earlier studies as well as sustained growth beyond previous peaks and declines in poverty far beyond previous troughs.

Ravallion and Datt relate change in yields of crops to poverty. They show that reduction in poverty is a result of growth within sectors, not the transfer of labor from a low earning sector to a high earning sector. The latter is the basis for the Kuznets J curve. But what is truly striking is that agricultural growth and tertiary sector growth have a major effect on poverty reduction and manufacturing growth does not. Further, the

service sector growth that has the favorable effect is the small scale portion of that sector, which we will show later is itself closely related to agricultural growth.

The Ravallion and Datt data show that 84.5 percent of the substantial poverty reduction in India in the period of analysis was due to agricultural growth. That is truly startling data. They also show little effect of the many programs that directly target the poor.

Growth of manufacturing in India has historically been biased towards large scale capital intensive industry, so the manufacturing data may be somewhat biased as compared to a market oriented structure (Mellor 1976.) But, the Timmer (1997) data confirm the Ravallion Datt findings for a large cross section of countries.

The various studies show that industrial growth does reduce poverty from the direct effect of income increase, but it concurrently has an unfavorable effect on the distribution of income thereby reducing the effect on the poor. Agricultural growth, including its indirect as well as direct effects, does not have the unfavorable distributional effect.

In a later article Datt and Ravallion (1998b) also relate rural wage rates and food prices to poverty. All three have a substantial effect. Of course, rural employment and hence wages are importantly influenced by the volume of agricultural production, as we will point out later. Food prices are also related to agricultural production.

Ravallion and Datt show that wage rates are important to poverty reduction and that higher farm productivity is closely associated with higher wage rates. Similarly, food prices are important and higher farm productivity reduces food prices. Thus, it is farm production that drives poverty reduction. In a later section, we will elaborate on this relation of agricultural growth to non-farm employment and hence to wage rates.

Peter Timmer (1997) uses the Deininger-Squire data set for poverty and purchasing power for 35 developing countries and relates those data to agricultural GDP per capita. "A one percent growth in agricultural GDP per capita leads to a 1.61 percent increase in per capita incomes of the bottom quintile of the population."(p.3) Unlike Ravallion Datt, Timmer shows a

positive elasticity for industrial GDP, but the agriculture elasticity is 38 percent larger than the industrial elasticity.

The 27 countries and 181 observations (studies) from 1962 to 1992 in the Timmer sample of the Deininger-Squire data include 3.3 billion people in 1995 or two thirds of the population of low and middle income countries as classified by the World Bank (Timmer 1997.) On average, agriculture accounted for 25 percent of GDP and 51 percent of the labor force. Countries are roughly equally divided among regions of the world, with some under-representation of Africa.

Note that Ravallion and his colleagues relate agricultural output per unit of land to poverty reduction while Timmer relates agricultural output per worker. Ravallion provides a sound theoretical argument for his approach. And, the mechanism of agricultural output growth is largely increased yields of specific crops and increased intensity of agricultural production, consistent with Ravallion's argument.

However, since this paper focuses on the linkage to non-agricultural growth both in interpreting the Ravallion and Timmer data and in employment calculations it is what is happening to incomes for farm families that is important. That is better measured by income per worker.

Ravallion (1998) focusses on the real labor earnings per acre and agricultural productivity. His model brings in three variables, the productivity of labor in agriculture, yields in agriculture, agricultural wage rate, and food prices. The former two have about equal weight and the food price elasticity is also high. Of course, all three are related to agricultural production and incomes as we will elaborate later.

Yield is shown to have a major effect on the real wage rate, and the effect is eight times larger in the long run than the short run, showing that it takes time for this important component of poverty reduction to show itself.

As we will point out below, this lag is too much if the wage effect is entirely from agricultural labor where the tightening of the labor market would be immediate. It is consistent with the argument presented below, that the wage effect comes from the

agricultural stimulus to non-farm employment. This point is neglected in the empirical data but not in the theoretical arguments.

While the emphasis here is on the simple measure of the proportion of the population under the poverty line, it is notable that agricultural growth reduces inequality among the poor as well as lifting the poor above the poverty line.

Ravallion's data do show that non-agricultural output growth explains decrease in poverty, but only if agricultural output per acre is excluded as a variable. That means that the non-agricultural output stimulated by the agricultural output is important but gets picked up by the agricultural yield figure when the latter is included. That implies that the non-agricultural growth that reduces poverty is that part stimulated by the agricultural growth.

In the Timmer (1997) sample of countries output per capita is three times higher in non-agriculture as agriculture. This means that agricultural growth does much more for employment and poverty reduction than non-agricultural growth while non-agricultural growth has much more of an impact on over-all growth rates.

Datt and Ravallion (1998) do not find a declining trend in the elasticity of employment with respect to agricultural output. The power of the relationship holds up over time. Thus, the current decline in the rate of poverty reduction is due to decline in the agricultural growth rate, not due to declining power of that variable.

Huppi and Ravallion (1990) find that wage earnings of poor self employed farmers grew faster than earnings from any other source and were a major cause of decreased poverty. Wage earnings of poor farmers in Central Java doubled over three years. Since wage rates changed little in the period the effect was largely from increased employment. Most of the employment growth came from a booming rural non-farm sector. Growth in cash crop income was more important to the non-poor than the poor (strengthening the case that it is the indirect effects of agricultural growth that affects the poor.)

Ravallion (1989) shows that the poor lose from agricultural price increases in the short run, but not in the long run. That is consistent with price increase stimulating increased demand

for labor through increased agricultural production in the long run. See also Mellor (1978, 1968.)

Gini coefficients for sub-sectors of the economy tend to be unstable. However the following data from Sharma and Poleman (1993) corroborate other evidence on the high degree of equality in specific agriculture related sub-sectors. They show increments to crop income alone skews the distribution towards the well to do, with a Gini coefficient of 0.86, far above the Gini coefficient for the economy in total. That finding is of course consistent with early critics of the green revolution. See also Adams (1999) on this point.

In sharp contrast to crop income, the Gini coefficient for dairy production, which is very important to the poor in India because of its labor intensity, is 0.11. That is an extraordinarily low Gini coefficient, but is quite consistent with the observation that dairy animal numbers vary little by size of farm, sales of dairy products are inverse to size of farm, and the well known impact of increased dairy production on the poor. The Gini coefficient for off-farm work in rural areas is a still low 0.22. That also reinforces the data that show off farm income of the rural poor is an important source of poverty reduction (Adams, 1999). Thus, when rising agricultural incomes are spent in those sectors they redistribute income towards the poor.

The data show clearly that it is growth of agriculture that reduces poverty, not growth in general. One misleading interpretation should be avoided. Typically high overall growth rates are achieved when agriculture grows rapidly. That is because the resources used for agricultural growth are only marginally competitive with other sectors and so fast agricultural growth tends to be additive to growth in other sectors, as well as being a stimulant of growth in the labor surplus non-tradable sector (Mellor 1976.)

The countries that grew the fastest from 1985 to 1995 experienced a narrowing of the income gap (Timmer 1997.) That means that agricultural growth resulted in faster over-all growth and an improvement in the income distribution. Thus, emphasizing agriculture in order to improve income distribution does not result in slow growth. The sectors are more complementary than competitive. Conversely, leaving out the forces that accelerate agricultural growth, as has been increasingly the case in the past decade provides slower growth and leaves out the poor.

The average elasticities cited at the beginning of this section are strongly influenced by high agricultural growth rates. Thus, it is grossly misleading to think of those elasticities as applying to some average growth rate. Those are substantially the elasticities when agriculture grows rapidly. In the 1990's, prior to the economic setback in East and Southeast Asia, overall
growth rates were high, but agricultural growth rates had slowed, and hence the pace of poverty reduction declined.

Thus, agricultural productivity increase has a major effect in reducing poverty, and the effect is relatively greater in its impact on the poorest and the distribution of income among the poor. Industrial growth has much less or even no effect in reducing poverty (Ravallion and Datt 1996 and Timmer 1997). Service sector growth has no effect for the large scale part and a substantial positive effect for the small scale portion (Ibid.)
If growth occurs leaving the agricultural sector out, two onerous burdens fall on the poor. First the over-all growth rate will be lower and secondly the part that reduces poverty will be missing. As we will show later, rapid agricultural growth is more easily achieved now than some decades ago, but it does require overt actions by government.

The Structure of Growth - Rural and Urban

Ravallion and Datt (1996) also analyze the Indian data according to urban and rural income. They find that the rural urban population shift (the Kuznets effect) has little effect in reducing poverty. Neither does urban growth.

Urban consumption growth increases inequality in urban areas, while rural growth improves the urban distribution.
The impact of rural growth on poverty reduction is nearly three times as great as urban growth. The point, as we will emphasize later is not that rural growth should be pursued in place of urban growth, but rather that agriculture and the rural sector should not be neglected. If it is neglected, employment will increase little and poverty will increase substantially.

That is presumably because increased rural incomes reduce the que of urban unemployed waiting for jobs (see Todaro, 1969, Harriss and Todaro 1970.) Rural growth of course has a major

impact on reducing rural poverty. Ravallion and Datt (1996) find that rural growth reduces urban poverty even more than does urban growth. Urban growth does not reduce rural poverty.

Lags

Datt and Ravallion (1998) find significant lags in the impact of agricultural growth on poverty. The effect on rural wage rates is eight times as large in the long run as the short run and the over-all effect on poverty reduction is five times as large. The over-all lag is importantly influenced by the lag in adjustment of wage rates. The wage rate adjustment presumably lags because of lag in increased employment, which is in turn due to the expenditure patterns for increased farm incomes.

About half of the long run effect of increased agricultural output on the welfare of the poor occurred within three years of an initial gain in farm yield (Ravallion and Datt 1996.) As we shall see later this is powerful evidence to support that it is the agricultural stimulus to non-farm employment that is driving the poverty decline.

Asset Distribution

The literature generally notes the impact of skewed distribution of income and of assets in slowing growth. That in turn is seen as slowing poverty reduction. The more detailed data show that agricultural distribution is at the heart of the problem.

Timmer finds a major effect of income distribution on the effect of agricultural growth on poverty reduction. In the most revealing part of his exposition, Timmer shows that if agriculture grows at (the relatively slow) rate of 3 percent per year, and non-agriculture grows at a rate to give overall growth at 5 percent, then for countries with small gaps between the top and bottom quintiles the bottom fifth in the income distribution experiences a 241 percent increase in income after 25 years, while the top fifth experiences a 211 percent increase. However, if the income gap between these quintiles is large, more than twice the average per capita income, the incomes of the poorest quintile increase by only 75 percent while the top quintile increases by 273 percent.

"Agricultural growth, when the distribution of income is quite equitable, raises the average contribution to growth for the five income level quintiles by 5.5 percent, and the elasticities decline for each successively higher income quintile, confirming an improvement in the distribution of income" (Timmer, 1997.) In contrast, the rich in countries with large income disparities benefit considerably from agricultural growth, while the poor are not reached by growth in either the agricultural or non-agricultural sectors (Timmer, 1997.) Indeed, with such inequitable asset distribution, the 95 percent confidence interval includes zero response of income of the poor to growth from either sector.

When income growth is highly skewed to the rich, growth in agricultural productivity is no more successful in reducing poverty than growth in other sectors (Timmer, 1998.) Again, this finding is important to understanding process as developed later in this paper.

Ravallion (1997) shows that high inequality provides lower growth and even lower reduction of poverty. The elasticity of poverty reduction with respect to growth declines sharply with increasing inequality. With a very low Gini coefficient of 0.25 the elasticity is a very high 3.33; while it drops almost in half to 1.82 with a Gini coefficient of 0.59. Birdsall, et. al. (1995) show similar results.

Despite his pioneering work on the impact of agricultural growth on poverty, Ravallion did not bring that structure into analysis of the effect of inequity on poverty. We will show later that the importance of income distribution confirms an important part of the relation between agricultural growth and poverty reduction.

Poor Areas

Ravallion and Wodon (1997) find that in Bangladesh investment in poor areas gives low returns. In a study of southern China, Jalan and Ravallion (1996) find that returns to household investment are lower in poor areas than less poor areas. Again, our later discussion will relate this to agriculture and its effect on poverty and draw policy conclusions for dealing with poor areas.

Transient Poverty

Jalan and Ravallion (1997) show that the poor are least able to buffer adversity. Fluctuations in agricultural production (affecting employment and prices) are a major source of transient adversity. They show that the lower a households wealth the least well are they ensured against fluctuations in income and hence in food security. Mellor's earlier analysis of production induced food price fluctuations reached similar conclusions (Mellor 1968, Mellor 1978.)

Most striking, Jalan and Ravallion note that transient poverty is so large, that targeting on current consumption as a means of redressing chronic poverty is no more efficient than no targeting at all. This suggests that targeting the poor is not likely to be an efficient means of reducing poverty. That turns the emphasis even further to achieving a pro-poor structure of growth as the principal means of reducing poverty.

Education

Datt and Ravallion (1996) find that female education and literacy have an important effect on poverty reduction.

Ravallion shows that investment in education reduces poverty. Kerala's rate of poverty reduction was high due to favorable initial conditions, e.g. for education, but if its agricultural growth rate had been the same as the average for India there would have been a dramatic increase in the rate of poverty reduction.

Improved human resource development alone works through increasing the export of labor e.g. Kerala. That is, improving education results in poverty reduction through migration of male members of the household, hardly a desirable approach from the point of view of family cohesion and welfare. Agricultural growth makes the employment in the same area as the agricultural growth thereby facilitating preservation of the family unit. In both cases, increased education is good for poverty reduction.

Bourguignon and Morrisson (1990) show that a one percent increase in the percent of the labor force with secondary education or more increases by 6 to 15 percent the share of

income received by the bottom 40 to 60 percent of the income distribution. Other studies confirm this relation (Papanek and Kyn 1986) but that the equality of distribution (the Gini coefficient) is not increased.

Food Security

Eventually, agriculture led growth raises incomes sufficiently so that food security is achieved despite major fluctuations in agricultural prices. However, while that process is proceeding, price fluctuations have a major impact on food security (Mellor 1968, 1978.). Indeed, the major fluctuations in the poverty percentage in India in the decades prior to the sustained growth following 1980 were largely due to fluctuations in food production leading to fluctuations in food prices and employment. That is, poverty and food security were directly linked.

Governments in Asia have therefore consistently tried to insulate their poor from food price fluctuations, especially those externally generated by the thin international market for rice and consequent extreme fluctuations in rice prices (Siamwalla, 1983.) Timmer (1996) points out that stabilization schemes in East and Southeast Asia contributed to economic growth as well as insulating the poor from those price fluctuations.

Timmer shows (1996) that for a country such as India, 60 percent of the population is under the poverty line and 30 percent is vulnerable to famine. What happened in Asia was rapid growth, with improved distribution of incomes at the same time that domestic food prices were stabilized (See Mellor, 1968, 1978) With the growth rates of Malaysia, Thailand and Indonesia since the mid 1960's the escape from famine levels of food insecurity has been made in less than two decades (Timmer 1996.)

Ravallion, 1989, concurs with recent work by Bouis and Haddad (1992) and others (e.g. Behrman 1991) that income elasticities for calories at the mean are quite low, e.g. 0.15. However he shows that even so, at the level of consumption at which caloric intake is deficient the elasticity is about unity. That is, calory consumption by the poor increases proportionately with income.

Further, the percentage increase in incomes of the very poor may be quite large relative to the average, further affecting the impact of income on nutrient intake (Timmer 1996.) For those below the poverty line, simply making employment available at all times brings very large percentage increases in income. Because the base incomes are very low these large percentage increases in incomes of the very poor have little effect on the average increase in income.

Thus, even though the income elasticity of demand for food may be low, with large percentage increases in income of the poor, the total increase in food consumption will be very large. Thus, the right structure of growth brings major improvements in food security - a la Asia in the 1980's.

Multipliers

The multipliers to output and employment from increased agricultural incomes are important because they tend to be oriented towards non-tradable goods and services that use underemployed labor. Thus, they stimulate a sector that cannot be stimulated by increased foreign demand and mobilize resources that would otherwise be idle.

Block and Timmer's model of the Kenyan economy shows the domestic multipliers from agricultural growth to be three times as large as those for non-agricultural growth (Bloc and Timmer 1994.) That is because the linkages from agricultural growth are much more towards the domestic economy and within that to use of resources that are underemployed, as compared to the non-agricultural sector.

In the Timmer study, the multiplier effects are largely worked out within four years. The multiplier he finds for agriculture is 1.64; that for non-agriculture is 1.23. Note that the multiplier to the sectors directly stimulated by agriculture will be much larger than the over-all multiplier since they occupy a smaller proportion of the economy and receive a large impact.

Multipliers for agriculture from data for Malaysia are 1.8, and 1.5 for Sierra Leone and Nigeria (Hazel and Roll 1990); for India 1.6 (Hazel, Ramaswamy and Rajagopalan 1991)(see also Bell, Hazel and Slade 1982; Hazel 1984; Haggblade, Hazel and Brown 1987; Dorosh and Haggblade 1993.) Rangarajan (1982) using the

same model as Timmer found a multiplier of 1.7 for agriculture, compared to 1.5 for industry (Rangarajan, 1982.)

Delgado (1998) notes a finding of Hazel and Roll (1983) that because of the low level of commercialization in African agriculture, the multipliers to the non-farm sector are much weaker than in Asia. Delgado then goes on to show that a high proportion of agricultural output in Africa is comprised of non-tradables and the multipliers to the non-tradable sector as a whole are indeed as high as in Asia.

Delgado (1985) points out that because of the high transactions costs, particularly for transport, the high income elastic, high value commodities such as livestock and horticulture are largely non-tradables, particularly outside the region - in this case West Africa. He also finds that much of the basic cereal production is non-tradable because of specifications that are not well suited to international markets. Thus, increased farm incomes from increased productivity of resources from technological change cause income increases that are largely spent for goods and services that otherwise lack effective demand and that mobilize underemployed local resources.

The conclusion from the Delgado analysis is the multipliers to non-tradables from agricultural income growth ranges from 1.96 for Niger to 2.88 for Burkina Faso. The impact of getting agriculture moving is 2 to 3 times as large as the initial agricultural growth.

Public Sector Investment

Later we argue that agriculture requires substantial public sector investment and hence that the indiscriminate, or perhaps more correctly the bias against agricultural sector investment associated with the structural changes of the 1990's has slowed agricultural growth and hence slowed poverty reduction. The following data confirm that public investment is far more important to agriculture than to other sectors.

The Block Timmer analysis of Kenya shows that the multiplier of public sector investment in agriculture is far greater than for non-agriculture - 1.96 compared to 0.37 (Block and Timmer, 1994) This is consistent with the data for Latin America from Victor Elias showing high rates of return to public sector investment in agriculture (Elias 1985.)

Datt and Ravallion (1998) show that public investment is important to agricultural growth. In a regression they showed that the elasticity of yield with respect to public expenditure was 0.29 - a high figure given the large size of agriculture relative to state spending. Thus state spending reduces poverty through its effect on farm yields.

These data show that recent pressures to reduce public sector deficits when applied across the board have a disproportionate effect on agricultural growth. This means that there is a disproportionate effect on the reduction of poverty. Poverty reduction efforts must address this complex issue.

It has been common for the reformers whose policies do so much for industrial growth to insist on drastic reductions in public expenditure which in effect hits agriculture very hard. An even handed approach to development that makes the public expenditures that agriculture requires will foster employment creation and poverty reduction from the agricultural side as well as increasing the rate of GDP growth. That is a further argument for balanced growth.

Price discrimination against agriculture also has important multiplier effects. Lipton (1977) has emphasized this point in a general argument, quite aside from specific effects on poverty. Although this exposition emphasizes increased agricultural production through technological change and mobilizing underemployed resources to produce high value commodities, a transfer of income from non-agriculture to agriculture has a favorable effect in reducing poverty. That is because the multipliers to growth and even more to employment are more powerful in the agricultural sector.

Conversely, price policies that discriminate against agriculture are inimicable to poverty reduction. See the earlier citation of Ravallion's data that show in the short run higher agricultural prices hurt the poor and in the long run benefit them. That is consistent with this analysis. Having said that, technological change and mobilizing underemployed resources are a preferable means of accelerating agricultural growth and poverty reduction.

Thus, the Washington consensus policy reforms are very helpful to agricultural growth and poverty reduction through their price effect but very deleterious through the effects of

indiscriminate reduction of public expenditure which strikes agricultural growth very hard.

The Explanatory Theory

The preceding data make a powerful case that it is agricultural growth and essentially only agricultural growth that brings about poverty decline in low income countries with a substantial agricultural sector. However what is shown is a strong association. We need an explanation of that association to have confidence in a conclusion that has such powerful policy implications. That explanation greatly predates the data (see Johnston and Mellor 1961, Mellor and Johnston 1984, Mellor and Lele 1973, Mellor 1976, Mellor 1992.) It depends very much on multipliers of agricultural growth on the employment intensive rural non-farm sector.

The following associations require explanation. First, the decline in poverty with agricultural growth (and by indirection the lack of decline with manufacturing and large scale service sector growth.) Second, the substantial lags in the full effect of the agricultural growth on employment and poverty reduction. Third, the lack of impact of agricultural growth on poverty reduction when income and assets are highly skewed towards the rich. Fourth, the rather prompt increase in wage rates in response to high agricultural growth rates - increases that occur far sooner than can be explained by increased labor requirements in traditional agriculture.

We will deal with these associations by discussing food as a wage good, employment directly in agriculture, and employment created by the expenditure of increased farm incomes on non-farm goods and services. It is the latter that is most powerful and helps explain all four of the associations noted here. It should also be noted that the knowledge of the details of the rural and small town non-farm sector stimulated by agriculture is incomplete. The following pages will review the current state of knowledge of this sector and make a strong circumstantial case for its importance. But, the definitive set of facts on this sector is lacking.

The Wages Goods Argument

The wage goods argument that so dominated the literature on development in the 1950's is of course still valid (e.g. Lewis 1954, Johnston and Mellor 1961.) However it will be dealt with only briefly here, since the literature itself is accessible and clear and because the arguments below on employment are so powerful that they dominate the wage goods argument. If agriculture grows fast enough to play its full employment role it can be shown that food prices will in fact decline slightly (Lele and Mellor 1981.)

The wage goods argument in brief is that when the poor become employed they spend on the order of 80 percent of their incremental income on food (Lipton 1972.) If agricultural production is stagnant and employment increases rapidly, food prices will rise, pushing up wage rates and hence the cost of producing labor intensive goods and services and so the employment growth will slow.

This approach has sometimes been incorrectly described as a closed economy approach, that is trade is not allowed to fill the wage goods gap. International prices are thought not to be influenced by the growth in employment and demand for food from individual developing countries. If domestic food prices rise, exports can be increased to pay for food imports. There are two reasons why this argument is not correct.

First, the collectivity of developing countries, or even China or India alone will influence world food prices if their employment grows rapidly and agriculture stagnates. Second, food is so large an item in national consumption that rapid employment growth with stagnant agriculture will soon result in such large food imports that it is highly unlikely that exports can generate sufficient foreign exchange.In that case, the currency will devalue pushing up food prices in domestic currency even though international prices may be constant. Of course, export led growth, where the bulk of additions to GDP come from exports, will generate sufficient foreign exchange to meet the needed foods imports.

In any case, the wage goods theory is unlikely to be tested because, as indicated below and by the data above, employment is unlikely to grow rapidly as a percent of the total labor force unless agriculture is also growing rapidly. For the reasons shown below, agricultural production growth and employment tend to go together.

Fast agricultural growth countries do in fact increase their agricultural imports. That is to say they generate so much employment (and poverty reduction) that their own agriculture cannot keep up. However, that is primarily because of rapid growth in consumption of livestock and the inability to keep up with the demand for livestock feed (e.g. Taiwan, China.)

Employment in Agriculture

Agriculture is of course by far the largest employer in essentially all low income countries. Development may be usefully described as an economic transformation in which the size of the agricultural sector declines - indeed the next section will point out that rapid agricultural growth itself accelerates its own relative decline (Mellor 1966.)

For poor countries, with well over half the labor force directly engaged in agriculture, it will be many decades before agriculture ceases to be a major factor in employment. The major sources of employment growth in agriculture are: (a) yield increasing technology; (b) increased land area; and, (c) change in the composition of output to high value commodities.

Technology

A major source of growth in poor countries must be technological change in its dominant basic food production sector. Because of land limitations it is yield increasing improved technology that dominates (Hayami and Ruttan 1985.) Such technology increases labor productivity as well as land productivity. Most obviously, it takes much less labor to harvest the increased production than the original level of production.

Many studies have been made of the impact on agricultural employment of yield increasing technology. The work of Hanumantha Rao for India is representative (Rao 1975.) The elasticity of employment ranges from a high of 0.6 to a low of 0.3. That is for each ten percent increase in output employment at best increases six percent and maybe as little as three percent. Since an increase of 10 percent from yield increasing technology alone is likely to take up to three years, and population may have grown by six to 9 percent, such increase in employment cannot even take care of the natural increase in the

farm population let alone tighten labor markets - there will not be an impact on poverty reduction.

If the elasticity of employment with respect to output is only 0.3 then the situation is far worse. In practice in labor surplus countries with very poor laborers, i.e. much poverty, the elasticity is more likely to be at 0.6 representing no substitution of improved labor saving methods for labor.

Land Area

If the land area can be increased and the poor are large in number then production will be increased symmetrically - that is just as much labor will be used on the additional area as on the base area. That provides an elasticity of employment of one - for each ten percent increase in production, employment will increase by ten percent. From an employment point of view that is good, from a growth point of view it is not so good since resource productivity is not increasing. In any case, for most countries it is of at most modest relevance.

Throughout Asia, essentially all the land that can be brought into agriculture has already been brought in. In the 1950's, production did grow substantially from increased land area, even in India, but that ran out by the mid 1960's and land expansion is not now an important source of agricultural growth. Even in Africa, often thought of as land rich, the additional land that can be brought into agriculture is generally much less productive than old lands. In any case, the average amount of land per farmer is declining in Africa.

An exception to land scarcity in Africa is in the traditionally disease prone areas, where disease control can open large areas for high productivity cultivation - as happened a few decades ago in malaria infested areas of Asia.

High Value Commodities

A much more likely possibility is increase in production of high value commodities - particularly horticulture and livestock. These commodities are highly labor intensive. Transfer of area from field crops results in a large increase in labor

requirements. As long as real wages are constant, increased production of these crops is likely to occur with little increase in labor productivity. The increased production occurs because of increased demand and hence it is profitable without increased factor productivity. That is in contrast to basic field crops in which the incentive to increase production comes not from increased demand but from decreased cost of production.

Thus the elasticity of employment with respect to high value commodities may be close to unity - say 0.9 to allow for some scale economies.

One of the major changes of the past few decades with respect to agriculture in low income countries is the increase in potential for rapid growth in production of high value commodities. This increased potential comes from two sources. The major opening of trade potentials with structural adjustment in low income countries and the GATT rules allowing low income countries to exploit there potentially powerful comparative advantage in labor intensive agricultural commodities. For horticulture, recent health trends in high income countries have further expanded this market.

Concurrently, accelerated growth in low income countries rapidly expands the domestic market for income elastic commodities, particularly livestock products, but also horticulture. These two tendencies feed on each other - larger domestic markets encourage increased output, a portion of which can then be shifted to the high quality export markets.

The result is potential for 6 to 10 percent growth rates for a major portion of agriculture. Those are rates comparable to what a vigorous non-agricultural sector achieves - and for a very large sub-sector. That makes possible much higher over-all rates of growth in agriculture - more nearly four to six percent than the three to four percent that was considered exemplary a few decades ago. See for example the four to six percent agricultural growth rates achieved by high growth rate countries (Mellor 1991.)

And, high rates of growth in this employment intensive sector expands employment within agriculture at a rapid rate. In a middle income country, horticulture plus livestock will comprise on the order of half of incremental agricultural output. A simple average with yield increasing technology (the average of 0.9 and 0.6) would give an average elasticity of 0.75. In low

income countries, the sum of the high value sub-sectors might be more nearly 25 percent - giving a weighted average elasticity of 0.675.

Employment

Developing countries achieving rapid growth in agriculture now average 4 to 6 percent growth rates. If we take 4 percent for a low income country and an average employment elasticity of 0.675 then employment grows at 2.7 percent, roughly enough to take care of the natural labor force expansion in the agricultural sector but making no contribution to tightening of labor markets and rising real wages.

In a middle income country achieving 5 percent growth and an elasticity of .75 for employment growth, employment grows at 3.75 percent, significantly faster than natural labor force growth and hence contributing to modest tightening of the labor market. But that seems insufficient to explain shift from considerable underemployed labor to rising real wages in just a few years, as is evidenced in the data presented above.

It would seem that we under explain agricultures large impact on labor markets through its own absorption of labor. We have even less explanation of the effect of skewed land distribution and lags. Where the poor are large in number, employment elasticities with respect to output would be at least as high in areas of skewed land distribution as in peasant societies, and employment increase in agriculture would be instantaneous with growth in output. For all of this, we must look to agricultures impact on employment in the non-farm sector.

Agriculture Led Non-Farm Growth

The circumstantial evidence is strong that agricultures powerful poverty reducing effect comes substantially through its impact on the rural, non-agricultural, small scale sector. There is considerable knowledge of this sector from the studies of Liedholm and his colleagues (Liedholm and Meade, 1987.) They conclude that this sector is large, employment intensive, expands readily in response to increased demand, and is largely driven by agricultural demand.

Nevertheless, the evidence about the size of the sector, the proportion of incremental farm income spent in this sector, and the employment intensity is meager. The evidence of its links to agriculture and its importance to employment calls for intensive study. The following paragraphs summarize the current state of knowledge of this sector.

Because the agricultural sector in low income countries is so large, accelerated growth into the four to six percent range adds immense purchasing power (Mellor 1992.) That is because this growth is substantially driven by improved technology (yield increasing crops of the green revolution) and mobilizes previously under-utilized farm family labor resources within agriculture.

Several empirical studies cited above document that farmers spend a substantial proportion of incremental income on locally produced non-farm goods and services. Liedholm and Meade turn that around and state that the rural non-farm sector derives a high proportion of its demand from agriculture. Since this is a large employment intensive sector it is logical to turn to these forces to explain the powerful effect of agriculture in increasing employment and reducing poverty.

This argument is also consistent with the lag in the effect of agricultural growth, the fact that highly skewed distribution of income from land removes the poverty reducing effect, and the important wage increasing effect of agricultural growth. Further, the power of this income effect causes a tightening of the labor market that cannot be explained by the agricultural growth alone. Because it is the income growth that drives the process it does not matter that the initial income effect is concentrated in the hands of the middle peasant rather than the poor. The poor benefit in the next round.

Three questions arise about this process. How large is the sector that is driven by agricultural incomes and is it a tradable or non-tradable sector? How employment intensive is this sector.? And, to what extent is it driven by purchase of production goods and to what extent by consumption goods?

GDP

There are two ways to get at the issue of the size of the agriculture driven non-farm sector. One is by surveys of the production pattern and source of demand for output for the sector thought to serve agriculture and the other is through analysis of the consumption patterns for incremental income of farmers. Neither type of information is well developed. Farmer expenditure data rarely give sufficient breakdown to allow analysis of the relevant parts of expenditure. Surveys of small business in rural and market town areas are infrequent and usually lacking in detail with respect to sources of demand.

Delgado spells out in some detail why it is the non-tradable sector that is important to the employment increasing poverty reducing impact of agricultural growth (Delgado, 1999.) The non-tradable (products and services that do not enter international trade) sector cannot be stimulated to growth by international exports. The labor force and production systems are such that they are not employable in the short run producing goods and services for other than the rural market.

Of course, in the long run with education and gradual integration of markets labor will move into tradable sectors. The story of low incomes is the slow pace at which that change occurs. In the meantime, rapid growth in demand for such output provides employment, expands the number of entrepreneurs, and creates a favorable environment for the transition to tradables. The interaction between agriculture and this large sector is an important part of the transition to a modern economy.

Currently a major emphasis on stimulating growth in low income countries is on exports and the question arises why cannot any stimulus provided by agriculture to employment growth be more easily provided by foreign demand. In some respects the very thought is somewhat silly. Is it reasonable to think that all or even the bulk of incremental demand for the vast labor resources of all low income countries can come from the high income countries?

Of course, an important supplement can come from exports and that increment is apt to make the difference between moderate and rapid growth. Also, exports of labor intensive commodities provide the foreign exchange to allow import of capital intensive commodities thereby allowing domestically available capital to

concentrate on labor intensive goods and service. But, in general, much of incremental demand must come from domestic sources.
One might ask also how reasonable it is to think that the bulk of the now widely dispersed population with already existing housing infrastructure can be accommodated in the short run in the major cities near ports that are essential for competition in international markets? Thus, the issue is not one simply of tradable versus non-tradable.

In any case peasant farmers spend a high proportion of incremental income on low quality goods and on non-exportable goods and services. Examples are expanded housing, personal services, increased lower level education, increased health services, local transport. Note that where labor is cheap, prospering farmers hire a substantial addition of labor so as to devote family labor away from farm production to education, leisure, and marketing activities (Hayami and Kikuchi 1999.) These are all non-tradable and are produced primarily by labor with very little capital.

Consumption studies suggest that in middle income countries, e.g. Egypt, this sector, located in market towns and rural areas has an initial GDP roughly equal to that of agriculture (Mellor, 1999.) It is striking that even at this stage of development the sector is large and non-tradable. In Africa, with very low incomes, it may be only one fifth the size of agriculture (Delgado, 1999.)

In very low income societies, with minimal commercial differentiation, as in most of Africa, the multipliers from agricultural growth to the non-farm sector are much weaker than in more differentiated societies. However, Delgado, in a careful analysis for sub-saharan Africa points out that marginal propensity to consume non-tradable agricultural commodities is very high.

In rural Africa with high transaction costs derived from poor communications systems much of agriculture is non-tradable. That is certainly true of much of livestock and horticulture sub-sectors, but it may well apply to the coarse grains as well. Since these are labor intensive sectors, with high propensities to consume them, considerable employment is generated within agriculture itself. Thus, an initial boost to income from yield increasing technological change may greatly increase employment through multipliers back into agriculture itself.

In this review the high value, high income elastic parts of agriculture are counted as agriculture, albeit a part of agriculture the demand for which may come importantly from rising farm incomes. Thus, the non-farm sector is seen as more limited, but nevertheless large. But, with this more restricted definition it should be recognized that in very poor societies the employment multipliers from agricultural growth may be quite large because of this circularity back into agriculture.

In middle income countries the agriculture driven non-farm sector may be as large as agriculture (Mellor 1998.) The incremental income in farmers hands will be spent more than proportionately in that sector. That is the income elasticity of demand is well above 1.0

Employment

Employment elasticities in the agriculture driven non-farm sectors are high, close to one. Increased output is driven by increasing demand, as long as real wages are constant, there is little incentive to increase labor efficiency. Since very little capital, nor land, is employed in this sector virtually all the gross income is return to labor.

Empirically, compared to farming, with half as much GDP in the sector, twice the labor intensity, the initial labor force is the same size as for agriculture. Typically in low income countries, about half of farmers base income is spent on production services and locally produced consumption goods (Bell et. al. 1980, Hazel and Roll 1983.)

With an average income elasticity of demand for these commodities of 1.5, employment expands at 1.5 percent of the base year for each percent increase in the rate of growth of agricultural income. With a 5 percent growth rate in agriculture the growth rate of employment is 7.5 percent. That compares with agriculture at a 5 percent growth rate and an employment elasticity of 0.75 of 3.75 - the additions to employment in the agriculture stimulated local non-farm sector is twice that of agriculture. That is the key point about the agricultural growth impact on poverty.

Agribusiness and Consumption Goods

Fertilizer and other chemical and mechanical inputs to agriculture take place in the tradable sector and tend to be imported or produced by capital intensive processes. Increased demand for such goods does not add much to employment and that demand could have been provided from sources other than agriculture.

In contrast, the local marketing service for these inputs and for output are labor intensive non-tradable and the increase in demand from agriculture stimulates production and employment that are net additions to the economy that could not come from other sources. That will remain true as long as there is poverty representing inadequate employment opportunity for the wage earning classes.

Studies of marketing margins suggest that the stimulus to the rural and market town non-tradable sector is equal to about 10 percent of the value of incremental agricultural production since a high proportion of incremental production depends on purchased inputs and is marketed.

Consumption studies in Asia show about 40 percent of incremental income is spent on locally produced non-farm goods and service Hazel et.al.) These are all highly labor intensive in their production.

Thus, consumption goods comprise about three-quarters of incremental demand for non-tradable and production services about one-quarter. It is the consumption expenditure that is dominant (Mellor and Lele 1972.)

Rich Peasants and Income Distribution

A substantial literature in the immediate post green revolution period stated that the green revolution concentrated incremental income in the hands of the land owning classes, including the middle peasant or kulak to use the Marxian term. Consequently the poor did not participate in income growth. The concentration of income led to further concentration of land ownership. That was the basis for much of the anti-green revolution spirit of the 1970's.

This exposition points out that in fact increased agricultural incomes in the hands of the middle peasant or kulak has powerful

employment linkages, but they take time to operate. The initial studies did not allow for that time and in any case were only concerned with the direct affect of income growth.

The important point is that an initial skewing of the benefits of agricultural growth towards the higher income rural people is not antithetical to poverty reduction. The issue is not the initial distribution of the increased income but the expenditure patterns from that income. Middle peasants in low income countries spend a high proportion locally on non-tradables thereby providing a stimulus to production and particularly to employment that cannot be obtained in any other manner.

Delgado carefully documents that in Africa, incomes and commercial differentiation are so low that the non-farm goods and services receive relatively little stimulus but that the increment to demand for agricultural non-tradables is very large. That stimulates a large increase in demand driven production of high value agricultural products (livestock and fruits and vegetables) and even for some non-tradable basic staples. Thus, an initial stimulus to agricultural growth from technological change (high yielding varieties of basic staples) has strong

multipliers back to other sectors of agriculture that are highly labor intensive. The effects are precisely as described for the rural and market town non-farm sectors.

When Do Real Wages Rise and Employment Elasticities Decline?

The empirical data show rising real wage rates as a significant factor in declining poverty. In practice, the statistical techniques do not catch employment quantity since there are no measures available. They catch the effect of employment separately only through the increment in real wages.

As long as their is underemployment in rural areas, roughly synonymous with poverty, real wages will not rise. Thus, it is surprising that the data catch real wage increases at such an early stage.

Increased production of basic agricultural commodities that are non-tradable will result in declining real price of that output unless effective demand increases through increased employment.

The statistical studies do catch an effect of declining real prices of basic food staples. That is because much of the change in production is large annual fluctuations due to weather rather than the steady effect of technological change. In the case of the former, employment cannot increase sufficiently rapidly to make effective demand for all the increment in production. But, the steady increase of technology driven output growth can be matched by roughly commensurate increase in demand through increased employment of the poor who spend a high proportion of increased income on basic food.

Thus, the poor benefit from increased basic food staple output either through lower prices or increased employment. The latter is in fact more certain in peasant agriculture because the basic food may in fact be tradable (although trade economists like to exaggerate that for low income countries) eliminating the price decline.

To return to the real wage story. What the data are telling us is that the labor market tightens surprisingly quickly. Why? Because of the immense increase in employment in the local non-farm sector. The poor benefit as employment increases and then again as real wages rise. That is why poverty declines so rapidly with increased agricultural output.

When real wages rise it pays to increase labor productivity. That will happen in both the farm production sector and the rural and market town non-farm sector. In practice, raising labor productivity is low cost in both these sectors. So again, we find that statistical evidence of steadily rising real wages with agricultural growth shows how powerful the employment multipliers

must be. For that to be the case the effect must come substantially from the non-farm sector because the increase in labor productivity is so automatic in food staples production.

Employment Numbers

It is difficult to estimate the actual employment numbers for the indirect effects of agricultural growth because statistics are not kept for the composition of the rural and market town non-farm sectors. What data there are not broken down by sources of effective demand. Hence we have little data on the size of the sector in GDP terms or of the employment context. However a

rough approximation can be made of these numbers. Such estimates are large and fully in keeping with the clearly measured impact of agricultural growth on poverty reduction.

A careful estimate has been made by Mellor and Gavian (1999) for Egypt. The Agricultural Perspective Plan for Nepal makes a set of estimates for Nepal.

Egypt

Estimates have been made for Egypt (Mellor and Gavian, 1999) for the impact on poverty of the structure of growth in a pre-reform period (early 1980's) when agricultural output growth was slower than the labor force growth (-0.2 percent per capita); for an early reform period when the agricultural growth rate significantly exceeded the labor force growth rate (1.0 percent per capita); and a projected future period of full implementation of reforms, providing an agricultural growth rate of 2.7 percent per capita. Calculations were made of the size of the farm income driven non-farm sector, the incremental expenditure on farm driven non-farm production, and the effect on employment.

Table 1 shows the results from those calculations. When agricultural growth was less than the labor force growth rate, the annual increments to employment from agricultural growth were small and total employment growth was far less than the labor force growth. Poverty increased. In the full reform period of high agricultural growth, employment increases far faster than labor force growth so that real wage rates would rise.

Table (5): Annual Increments to Employment, by Sector, 1980/81-2005/6

Sector	Pre-Reform 1980/81-1985/86	Early Reform 1997/98	Mature Reform 2001/2-2005/6
Agriculture	37,950	100,122	146,164

Agri. Driven non-agr.	108,810	340,875	581,175
Autonomous non-agr.	17,707	43,350	45,084
Total Employment	164,467	484,347	772,423
Annual Additions to Labor Force @ 2.7 %	480,060	480,06	549,080

Source: (Mellor and Gavian 1999) See original source for full explanation of derivation of numbers in the table.

In the fast growth period when agriculture and non-agriculture were growing rapidly, agricultures direct and indirect effects accounted 70 percent of employment growth, while the sectors autonomous from agriculture generated 77 percent of GDP growth. Since these are all market price driven forces they are all in economic equilibrium and one cannot in a neo classical context say that one form of growth is better than others; but the agricultural growth contributes most to employment growth. And, the agricultural growth does require government interventions.

In the case of Egypt, those interventions are first to restore market forces to operation thereby freeing agriculture to expand. It also requires direct government action expanding and improving research and extension institutions, rural education, rural infrastructure and all the other elements that rely on public expenditure for creating a favorable environment for private investment in agriculture.

Nepal

The government of Nepal has instituted a long term development plan, termed the Agricultural Perspective Plan (APP)(Nepal, Government of, 1995.) The APP is backed by a Growth Accounting Framework (GA) that incorporates data for the inputs called for in the plan, the calculation of an agricultural growth rate, an overall growth rate that includes the effects of the multipliers of agricultural to non-agricultural growth and transformation of

that growth rate into a decline in poverty. The latter is based on the assumption that the distribution of income will not change. Given the evidence presented above, this provides a very conservative estimate of the employment impact.

The APP accelerates the agricultural growth rate from the 3.1 percent of the 1984/85 to 1993/94 pre APP period to 4.8 percent by the end of the 20 year plan. It should be noted that prior to the APP the proportion of the population under the poverty line was steadily rising as agriculture stagnated. As an indication of the latter, Nepal, in the 1970,s had the highest yields in South Asia for the principle field crops; just prior to the institution of the APP it had the lowest. Nepal had been left out of the dynamic process of agricultural growth that ran through Asia. In that sense it was very like an African country.

The APP GAF shows the percent of the rural population falling under the poverty line declining from 49 percent to 14 percent in the 20 year period of the APP. The absolute number of the rural poor would be reduced from 9.3 million to 3.8 million in that period. That is the absolute number is more than cut in half.

Programs to Reduce Poverty

An important current widely accepted target is to reduce the number of persons under the poverty line by half over the next 15 years. That is an ambitious target but not unprecedented for individual countries. It is clear from the data and the theory that the core of achieving large macro targets of poverty reduction must be major acceleration of the agricultural growth rate and concurrent facilitation of the growth of small scale non-farm enterprises, largely producing non-tradable goods and services in rural and market town areas. Conversely, poverty does not decline, even with large direct action programs without the agricultural growth (Ravallion and Datt 1996.)

In the context of breaking the back of poverty through these large macro efforts, programs targeted directly to the poor can target a reasonable number of people and play an important complementary role. Programs targeted to ensure the participation of the poor in agricultural and non-formal sector growth are also important to achieving the high growth rates.

Thus, the first prong of a poverty reduction program must be to achieve those high agricultural growth rates that will reduced poverty by half in some 15 to 20 years. The direct action programs can then be effective within that context.

Agricultural Growth

It is now feasible to achieve much higher agricultural growth rates than were considered the norm only a few decades ago. Then growth rates of 3.0 to 3.5 percent were considered quite substantial. That only gave 1.0 to 1.5 percent rates of growth per capita. Now fast agricultural growth would be considered more nearly 4.0 to 6.0 percent (Mellor 1992.)

Increased Potential

Three major changes explain this greatly increased potential for agricultural growth - greater knowledge, greater capital availability, and more open global markets for high value agricultural commodities.

Knowledge

First, the knowledge of how to develop agriculture has burgeoned since the 1950's. We not only have a clearer view of the strategic needs but immense detail on how to run credit programs, what works and what doesn't, the appropriate role for government vis a vis the private sector, and of course far greater knowledge of the basic science for bringing about yield increasing technological improvements.

The potentials for biotechnology are immense and just beginning to be tapped, albeit particularly underfunded for the problems of low income countries (Mann, 1999, Science, 1999.). On the social science side the American Agricultural Economics Association review of postwar literature on agricultural development has over 4000 references divided over Asia, Africa, and Latin America (see Eicher and Doyle, Mellor and Mudahar, and Schuh and Brandao respectively in Martin, 1992.) With the slackening of foreign aid interest in agriculture and support for research, the pace of knowledge generation for agricultural and rural development has of course slowed, but there is an

immense backlog of under-utilized knowledge and new knowledge generation has not halted.

Capital

Second, international capital flows are now at levels undreamed of when the Asian countries began their takeoff. Although international capital is not likely to cover a significant portion of the direct needs of the agricultural sector, it can so relieve other financial pressures on low income country governments that much greater resources can be freed for investment in agricultural research and infrastructure than was possible in the early days of the Asian breakthroughs.

Of course, to say that capital need not be limiting is not say that it is not limiting. Governments must recognize the importance of agriculture, follow liberal policies to encourage capital flows, and then invest fully their own funds in agriculture. Foreign aid can do much and may indeed be critical in strengthening the national forces that understand these relationships. It used to do that in Asia, it needs to start doing it in Africa.

Low income countries with large natural resource exports, e.g. oil, diamonds, cannot expect simply the generation of those resources to result in the employment growth rates that reduce poverty, particularly rural poverty. Such resources are valuable for reducing poverty if they are invested in agricultural growth that in turn creates the employment multipliers that reduce poverty. The contrast between Indonesia that used oil revenues at least in part for massive investment in rural roads and education and Nigeria that did not is instructive.

High Value Commodities

Third, and perhaps most important in quantitative terms, production of high value commodities, particularly horticulture and livestock can grow more rapidly than in the past. That is important to agriculture which tends to be land constrained and hence increasing yields through technology and value of output per unit through enlarged markets lessen that constraint.

As domestic growth reaches high levels the high income elasticities for these commodities result in rapid growth in demand. But, now with international trade far more free than in

the past, and promising to become more open, domestic production of high value commodities can grow far more rapidly than domestic demand.

By definition, high value commodities use little land and so abundant labor can result in growth rates of output of 6.0 to 10.00 percent. Since they initially comprise some 20 percent of the value of agricultural output and gradually rise to well over 50 percent that is a cause of major acceleration in the agricultural growth rate.

Tremendous growth in the global economy, in substantial part because of the takeoff in Asia has greatly increased the market and the price responsiveness of demand for traditional high value tropical exports. Hence that potential is also now greater than it used to be. Africa has been the great loser from not exploiting these potentials, while Asian countries, particularly Malaysia and Indonesia have benefitted immensely from rapid growth in exports of these commodities.

Realizing the Potential

The requisites of high agricultural growth rates are three: cost reducing technology; low transaction costs; and an open economy. Foreign aid oriented towards poverty reduction can be important to each.

Technology: Agricultural growth at rates significantly faster than population growth rates is technology driven to a far greater extent than other sectors. That was markedly so for the United States in the slow technological advance period dup to 1990, when agriculture accounted for 80 percent of productivity increase (Ball et.al.)

Agricultural technology must in significant part be driven by domestic research even while it draws very heavily on international research (Evenson and Kislev 1975.) The domestic systems provide the basis for drawing on the international. Of course, education of farmers must move in tandem with the research system and systems of credit are needed to finance the inputs and capital requirements of improved technology.

Foreign aid has an immense contribution to make in this area because of the sophistication in institutional development. High income countries have also in recent years pioneered in setting

narrow sets of priorities for research so that critical mass for effective output can be reached and in collaboration of public and private sector activities. All this needs to be transferred to developing countries. Foreign aid pressure on the necessary facilitating policies will be critical, particularly in Africa.

Infrastructure: Rapid growth in agriculture requires specialization and trade. There is no possibility of a high productivity agriculture producing its own nutrients. Too much is taken off the land. Thus, dependence on purchased plant nutrients is inevitably immense.

The situation for pest control is more complex. Particularly in tropical climates chemical pest control is far too expensive as the sole means of pest management. Biological controls are important but they require some chemical complements. Weed control is even more likely to require some chemical input, particularly if low or no tillage systems are used to improve soil retention.

Even more important than purchased inputs is the specialization in production that allows fine tuning of the production system to the environment. That requires specialization and trade.

If transaction costs are high, due to poor transport and communication systems then specialization and trade cannot occur and agriculture cannot modernize and increase farm incomes to drive anti poverty programs. Thus, large investment in rural infrastructure is crucial to poverty reduction.

Of course, their are immense direct benefits to the poor from improved infrastructure - better access to medical services for example. But, more important practitioners in health, education, and other services important to the poor are only willing to live in rural areas if they become decent places to live. For the rich travel, even for long periods, to these services is a reasonable alternative. It is not an alternative for the poor. They go without.

Sachs (1998) and Krugman (1998) underrate the effect of agricultural specialization making high productivity use of resources that were low productivity in subsistence agriculture. For example, the old tropical soils are of low productivity in annual food crops, but produce a high level of output per unit

area and per worked in tropical tree crops such as oil palm, or cacao.

Broad Participation: Ensuring broad participation in agricultural growth is one of the most effective anti-poverty programs in the context of growth. Such participation has two advantages: it involves the poor directly in increased incomes, and, it results in faster over-all growth. Broadening participation means spending more than pure economics would call for on women's participation, small farmer participation, disadvantaged ethnic groups participation, and possibly in poor areas. Each of these has additional costs beyond including the bulk of middle farmers in the best areas. Those costs can be justified on the basis of poverty alleviation.

Women generally participate fully in most aspects of traditional agriculture. When agriculture modernizes traditional role differentiation tends to deny women access to modern information, inputs, and marketing. Emphasis needs to be given to ensuring their participation not only for increasing agricultural incomes and participation of the poor, but to use modernizing agriculture as a means to bring women into the totality of modern society.

Small Farmers are more costly to reach per unit of output and so may be left out of agricultural growth. That tendency may be reinforced by greater conservatism rooted marginal incomes for subsistence. Ingenuity is needed to bring small farmers into the process.

Disadvantaged ethnic groups may also be left out of the modernization process. The special problems and needs of such groups need to be part of anti-poverty and agricultural growth programs.

Poor areas are a more complex problem. It is sometimes argued that once substantial progress has been made in the favorable areas that the returns to investment are then better in the poor areas. That however is based on a static view of technology. In practice, improved technology is constantly being generated so the issue is not the movement along a static production function but the pace at which the function is being shifted up and to thme right. Areas with favorable soil structure, moisture and sunlight conditions will generally continually respond better to

improved technology and the gap will become larger and larger with the less responsive areas.

Having said that, some technology does reverse the income situation for some conditions. For instance chemical fertilizer greatly reduces the costs of adding nutrients so that conditions that are favorable in all respects except initial nutrient situation may improve their relative position with commercialization. Improved communications may allow specialization in commodities that do have a comparative advantage under new conditions - tree fruit crops in Nepal, tropical perennial exports in Africa.

Thus, the potentials for poor areas must be examined carefully and the changes needed to bring some of them along made. But, given potentials to migrate to burgeoning market towns in prospering agricultural areas a harsh decision not to invest in the agriculture of unresponsive areas needs to be made. Concurrently investment that assists migration (e.g. education) and mitigates the problems of the remaining people are sound anti-poverty programs.

Small Enterprise

The importance of micro enterprise to the poor has been well recognized. What has not been recognized is that the demand for the products of micro enterprise must expand and that the output is largely non-tradable.

Demand

Export markets for the products of micro enterprise exist, e.g. for handicrafts, but the total is a small proportion of what is needed to solve poverty problems through employment growth.

The problem is well exemplified by study of the Grameen Bank in Bangladesh where in areas with little agricultural expansion financing of micro enterprise for the very poor tended to be at the expense of the livelihood of the poor (Hossain,1988 .) However, where agriculture was expanding rapidly, income was rising and demand expanding for such goods and services and so total employment in these enterprises expanded.

Thus, the growth in income from agriculture provides effective demand for service weighted, relatively low quality goods and services that characterize the bulk of micro enterprise. Of course, as such firms multiply some will have the entrepreneurial leadership to expand into urban and foreign markets. Taiwan' current pattern of small scale geographically dispersed industrialization, in such sharp contrast with the entirely different pattern in South Korea, exemplifies the process.

Thus, the first step in ensuring rapid growth of micro enterprise is expanding effective demand through growth in agricultural incomes.

Education

The educational requirements for working in micro-enterprise would seem to be minimal or non-existent. In practice education imparts skills and attitudes that make a major difference to the labor force in micro-enterprise. Thus, expanding education to the poor is important. It is particularly so for poor areas from which migration is essential.

Credit

Credit is important for the poor to participate in micro-enterprise as entrepreneurs. That has been the source of success of the major examples of credit to assist low income persons, e.g. the Grameen Bank in Bangladesh. But, it is even more important to expansion to the next stage of middle sized business with large increase in employment opportunities a la Taiwan (Liedholm and Meade 1987.)

Special Programs Targeted to the Poor

In the context of rapid agricultural growth that will break the back of the poverty problem, there is much to be gained from special programs targeted to the poor. The previous exposition emphasized special programs to ensure the participation of the poor in agricultural growth and in non-formal non-farm enterprises. Here we will comment on programs directly concerned with direct reduction of poverty. These programs cannot in themselves have a significant impact on over-all reduction of

poverty but can have a major effect in reducing fringe poverty in the context of the right structure of growth.

Child Survival

Child survival programs are, of course, an ethically primary objective of the development process. Success in child survival programs must be accompanied by efforts to get the agricultural sector moving in order to provide future jobs for the rapidly expanding labor force that is the concomitant of increased child survival.

Food Security and Safety Nets

The poor and near poor spend a high proportion of their income on food. Food prices will continue to fluctuate significantly from year to year and hence the real incomes and food consumption of the poor will fluctuate. With any given fluctuation in food prices, the poor make eight times as much adjustment in their consumption of food as the rich (bottom 20 percent in the income distribution compared to the top 10 percent)(Mellor, 1978.)

Thus, provision to ensure stable food consumption by the poor is a critical part of any anti poverty program. Historically developing countries have stabilized food prices, usually by taxing farmers in periods of high prices through various under market government procurement plans, associated with subsidies to consumers.

Now more emphasis is given to targeting directly the poor through food stamps and related devices. However data from Jalan and Ravallion (1998) indicate that such targeting is likely to be even less efficient than general subsidies in reaching the poor.

Uncertainty and Fluctuations

The poor are of course highly vulnerable to all sources of uncertainty and fluctuations. Most onerous are fluctuations in food prices, but fluctuations in crop production from weather fall heavily on the poor as farm incomes are reduced and are leveraged in their impact on non-farm employment.

The usual response to this situation is guaranteed employment schemes of the type effectively run by the government of Maharashtra in India. Food aid can also be used to provide such employment guarantees (Singer and Maxwell 1983.)

Unresponsive Areas

The problem of geographic areas that are unresponsive to improved crop technology and ill suited to high value products is currently intractable. Every effort needs to be found for adapting such areas to improved technology and high value commodities, but for those that cannot bc so adapted, the data are clear that the returns to investment are far lower than in the more responsive areas (.) In that circumstance it is better to invest where the returns in increased incomes are higher. Since the job formation from such increased incomes is disproportionately in the market towns the scope to absorb migrants from less advantaged areas is great. Thus, what is needed is increased education in the less responsive areas to facilitate migration. See the work of Ravallion on this issue (1998.)

Skewed Income Distribution

The most intractable poverty problem occurs where incomes are highly skewed to the rich. Agricultural growth does nothing for the poor in such circumstance, nor does any other growth related approach. What is most needed is radical redistribution of assets. Failing that education will assist the poor to leave for other countries, or eventually for increasing job opportunities in their own urban areas. That however, for the poor countries will take a long time. This is the only discouraging feature on the poverty mitigation front.

Foreign Aid

A recent ODI report done for the British foreign assistance program (DFID) notes the general decline and specifically the USAID reduction in assistance to agriculture from $1.2 Billion in 1986 to $240 million in 1997, an astounding 80 percent reduction (ODI 1999.) This is of course a radical turn away from pro-poor growth.

The importance of foreign aid to pro-poor growth derives from the strong urban bias of low income country governments (Lipton 1977.) Given that bias, foreign aid played a major role by steady effort, in Asia, to strengthen nationals in low income countries who saw the important role of agriculture. The result was major progress in agriculture. It has slackened since foreign aid turned away from agriculture. In Africa, foreign aid has given little attention to agricultural growth. Ruttan (1996) has documented why this has happened. If pro-poor growth is to occur, foreign aid must return its attention to agriculture.

Conclusions

Thus, we provide explanation of the conundrums of why growth does not always bring down poverty levels - it is the wrong structure; why the right structure takes time - the effects are indirect they must work their way through the system; why so much of the world is finding its way out of poverty (all of Asia for example) - because agriculture got going in those areas; why poverty reduction is slowing in those same areas - agricultural growth has received much less attention in the last decade and despite considerable institutionalization it has slowed, a slowing reinforced by foreign aid pressures for indiscriminate budget cuts; why Africa has been such a disaster from a poverty reduction point of view - national governments are urban oriented and biased and, in contrast to the record in Asia, foreign aid stopped pressuring for emphasis on agriculture over the past two decades; and, why foreign aid is so important to getting agriculture going - because government actions are critical to agriculture and low income country governments tend to be strongly urban biased.

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