A Review of the Relation between Economic Growth, Inequality and Poverty

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Abstract

The objective of the present paper is to review the theoretical framework of poverty and its relations with economic growth and inequality. It includes six sections. The first section introduce the aim of the paper. The second section presents an overview of theories of economic growth. The third section discusses the definition and measurement of poverty. Next, the relationship between economic growth and poverty under the influence of inequality will be discussed in the fourth section. The fifth section is concerned with the concept and policy implications for pro-poor growth. The sixth section concludes.

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1. Introduction

Never in the history of mankind has there been an era of economic development like the 20th century. Between 1900 and 2000 world output at constant price increased about 19-fold, corresponding to an average annual growth rate of 3 percent. Rapid technical progress was made in food production and medical science, which led to a massive decline in infant mortality and a remarkable rise in life expectancy. The number of infant deaths among a thousand live births decreased significantly from more than 200 at the beginning to about 60 at the end of the century. The world life expectancy is estimated to have increased from 46 years in the 1950s to 66 years in 1998 (McDevitt, 1999). Despite a substantial rise in world population from 1.6 to 6.3 billion people, world output per capita increased almost fivefold over the 20th century (IMF, 2000).

Yet, the world still has deep poverty amid plenty. Of the world's 6.3 billion people, 2.8 billion people – almost half – live on less than $2 a day and 1.2 billion – a fifth – are struggling to survive on less than $1 a day, with 44 percent of these living in South Asia, 23 percent in East Asia and Pacific, 24 percent in Sub-Saharan Africa, and 9 percent in the rest of the world (World Bank, 2001b). In rich countries, less than 1 child in 100 does not reach its fifth birthday, while in the poorest countries as many as 20 children out of 100 do not reach that age. And while in rich countries fewer than 5 percent of all children under five are malnourished, in poor countries as many as 50 percent are. Poverty is an unacceptable human condition. It is surely undeniable that poverty alleviation is what economic development is all about.

To reduce poverty, economic growth constitutes a prerequisite. The positive effects of economic growth on poverty reduction are at the basis of the so-called trickle-down theory which emerged in the 1950s. It hypothesizes that the benefits of economic growth will automatically trickle-down to the poor through increased domestic activities, higher tax revenues, and government expenditures including transfers; hence there is no need for any specific instruments or complementary efforts to facilitate or secure the goal of poverty reduction. Numerous empirical studies justify a very strong relation between economic growth and poverty reduction. A recent study at the World Bank by Dollar and Kraay (2000) concludes that changes in mean income consistently play the main role in securing reduction in poverty. This positive relationship between poverty reduction and income growth holds in a sample of 80 countries over four decades. This empirical observation is not the end of the story, however. It raises the questions about what causes

economic growth and why countries with similar rates of economic growth can have very different rates of poverty reduction.

Economic growth depends to a significant extent on the resources that a country possesses. Improvements in resources such as capital, population, natural resources, and technology will result in an increase in national output. Sound economic management also plays a very crucial role in sustaining economic growth. Appropriate economic policies such as openness to international trade, sound monetary and fiscal policies (reflected in moderate budget deficits and absence of high inflation), a well-developed financial system, and a suitably sized government are strongly conducive to economic growth (World Bank, 2001b).

The positive role of economic growth in poverty reduction is now beyond dispute. However, the extent to which economic growth affects poverty depends on how income distribution changes within a country. The World Development Report 2000/2001 published by the World Bank shows that there can be a large variation in poverty reduction between countries which have experienced the same growth in per capita consumption. For a given rate of economic growth, poverty will fall faster in countries where the income distribution becomes more equal than in countries where it becomes less equal. It is clear that if economic growth leads to an income distribution biased in favour of rich regions within a country, the impact of such economic growth on poverty reduction will be very limited. In contrast, high economic growth in regions where the poor are concentrated will have large effects on poverty reduction.

In cases where inequality increases so much that its adverse impacts on the poor exceed the benefits they gain from economic growth, an absolute belief in trickle-down theory is not advisable for a strategy of poverty reduction. Instead, a strategy of pro-poor growth should be promoted. A policy of pro-poor growth not only focuses on economic growth, but also affects the pattern of income distribution so that the poor can benefit proportionally more than the rich from economic growth, which will reduce the welfare gap between the poor and the rich, and finally eliminate poverty.

This paper's objective is to review the literature of the relation between economic growth, inequality and poverty. It also introduces the measurement of poverty and inequality.

2. Economic Growth: An Overview

2.1. Concept of Economic Growth and Development

Economic growth refers to an increase in a country's capacity to produce goods and services over a period. This growth results from all economic activities in the national economy. Thus economic growth is usually measured as an increase in real GDP or real GDP per capita. Economic growth can be calculated as an annual percentage rate, or annual absolutes, or an average periodic rate of increase in real GDP per capita. A major benefit of economic growth is that an increase in real GDP allows more goods and services for consumption.

Development not only calls for economic growth, but involves much more. Economic development, in addition to a rise in real GDP per capita, implies fundamental changes in the structure of the economy. Two of the most important of these structural changes are the rising share of industry, along with the falling share of agriculture in GDP, and the increasing percentage of people who live in cities rather than the countryside. Consumption patterns also change as people no longer have to spend all their income on necessities but instead move on to consumer durables and eventually to leisure-time products and services. A fundamental condition for economic development is that all people of the country must participate in the process that brought about these changes in structure (Perkin et al., 2001).

World Bank (2000a) stresses the physiological and social changes due to development for people. According to that study, development is about improving the quality of people's lives, expanding their ability to shape their own futures. It results in more equitable education, and job opportunities, greater gender equality, better health and nutrition, a cleaner, more sustainable natural environment, a more impartial judicial and legal system, broader civil rights and freedoms, and a rich cultural life. Measurement of development requires multidimensional indices of welfare such as indices of human development, indices of economic growth and environmental sustainability, etc.

Finally, it should be kept in mind that, while economic development involves much more than a rise in per capita income or product, economic development cannot occur without economic growth.

2.2. Causes of Economic Growth

Economic growth depends to a significant extent on the resources a country has. Improvements in the input factors such as capital, population, natural resources, and technology will result in an increase in national output, and hence in economic growth. Other non-economic factors such as government administration, history, culture, and political institutions also play important roles in boosting economic growth. However, it is not easy to answer the questions "what leads to increases in those factors which affect economic growth?" and "what actually causes economic growth?". It is difficult to say much about economic growth without a theory of growth. Thus to answer these questions, one should examine development in the theory of economic growth over the years.

Classical Theory

The classical economists considered the extension of the free market as a key element in economic growth, and opposed the government's intervention in economic activities. In 1776, Adam Smith published his famous book "*An Enquiry into the Nature and Causes of the Wealth of Nations"*, arguing for a system of "natural liberty" based on the free division of labour and a market largely unimpeded by government interference. Adam Smith postulated the idea that increasing division of labour would increase the productivity of labour through specialization, which in turn could lead to higher incomes, and higher incomes led to increased demand and a larger market size. The larger market could create opportunities for a further increase in the division of labour and specialization. Therefore, economic growth could be accelerated in such a vicious circle. He also stressed the important role of trade in raising economic prosperity.

Meanwhile David Ricardo proposed a two-sector model in which agriculture was said to be the key sector for growth. He argued that economic growth resulted from capital accumulation, which was dependent on profits. In turn profits depended on costs of agricultural production, which was influenced by land. Thus land was said to impose a limitation on growth. He emphasized that agricultural protection, which raised agricultural rent and reduced the accumulation of capital, was a major impediment to growth and needed to be removed.

Marxian Theory

Karl Marx, a German philosopher and revolutionary in the nineteenth century, shared the view of the classical economists that the extension of the market is important for economic development. He believed that social, political, cultural, and spiritual aspects of life are conditioned by the mode of production. The mode of production is the sum of the material, productive forces of society. These productive forces are greatly affected by the technology, climate as well as geography. As productive forces change, new social relationships, upon which the superstructure of political and legal institutions is built, will develop to a new level more appropriate to the altered production relationship. That is the way through which history had moved and was moving.

Keynesian Growth Model

At the time of the Great Depression in the 1930s, John Keynes wrote a well-known book with the title "*General Theory of Employment, Interest & Money",* in which, in contrast to the classical economists he argued that relying on markets to obtain full employment is not a good idea. He believed that the economy could settle at any equilibrium not at full employment and that there would not be automatic changes in markets to correct this situation. To promote economic growth the government has to implement demand-oriented strategies to increase aggregate demand. Any increase in aggregate demand in the economy will result, according to Keynes, in an even bigger increase in national income. This process comes about because any increase in demand will lead to more people being employed. If more people are employed, then they will spend the extra earnings. This in turn leads to even more spending, more employment, and even more income.

Harrod-Domar Model

In the 1940s, Roy Harrod and Evsey Domar proposed a very famous model known as the "*Harrod-Domar Growth Model*" to examine the relationship between the rate of economic growth and the growth of capital. In their model the actual rate of growth of output equals the total increase in capital stock, which is given by the savings ratio,

divided by the amount of capacity required to produce an extra unit of output, which is given by capital-output ratio. So, an increase in savings and productivity of investment will lead to a rise in economic growth.

Neo-classical Theory

In the mid-1950s, Robert Solow introduced a new model of economic growth that represented an important step forward from the Harrod-Domar framework. Instead of using a fixed-coefficient production function in the Harrod-Domar model, which assumed that capital and labour always were used in a fixed proportion to produce different levels of output, he used the neo-classical production function to allow substitution between capital and labour in producing output. Thus in addition to savings, the population also plays an important role in the growth process. In his model output per worker can rise only if the ratio of capital to labour increases, or total productivity increases.

Neo-classical economists consider technological changes as key elements allowing output per worker to continue to growth. Technological changes can be improvements in technology in the mechanical sense such as new computers or machines, or in terms of human capital, such as improvements in the health, education, or skills of the workforce.

Theory of Stages of Growth

In 1960 Walt Rostow , the best known growth stage theorist, divided the process of economic development into five stages through which all economies are considered to pass from fairly poor agricultural societies to highly industrialized mass-consumption economies. These five stages were defined and analyzed by Rostow in his book *"The Stages of Economic Growth"*, namely: (a) The traditional society, in which adherence to long-lived economic and social systems and customs means that output per head is low and tends not to rise. (b) The stage of the establishment of the pre-conditions for the following stage *"take-off"*. This stage is a period of transition, in which the traditional systems are overcome, and the economy is made capable of exploiting the fruits of modern science and technology. (c) The *"take-off"* stage represents the point at which

the "old blocks and the resistance to steady growth are finally overcome", and growth becomes the normal condition of the economy. The economy begins to generate its own investment and technological improvement at sufficiently high rates so as to make growth virtually self-sustaining. (d) The *"drive to maturity",* which is the stage of increasing sophistication of the economy. Against the background of steady growth, new industries are developed, there is less reliance on imports and more export activity, and the economy "demonstrates" its capacity to move beyond the original industries which powered its take-off, and to absorb and to apply efficiently the most advanced fruits of modern technology. (e) The fourth stage ends in the attainment of the fifth stage, which is the age of high mass consumption, where there is an affluent population and durable and sophisticated consumer goods and services are the leading sectors of production.

Dualistic Model

In the dualistic model proposed by Arthur Lewis in 1955, the economy is divided into two sectors called traditional and modern. In the traditional sector, no net saving or capital accumulation occurs. Capitalists in the modern sector are assumed to use capital and labour to produce output. At first, they can gain profits and reinvest in the production. The model supposes the existence of a surplus amount of labour in the traditional sector, which is gradually absorbed into the modern sector. The process of production expansion continues until the surplus labour ceases to exist and the wage rate starts to rise. This increasing wage rate will reduce the profit rate and slow down the rate of economic growth. In addition the increase in the size of the modern sector relative to the traditional sector may turn the terms of trade against the former, which would decrease the growth of the modern sector. To ensure economic growth, more savings and investment in the modern sector are needed. These savings and investment are implemented by the capitalists. Thus anything that alters the distribution of income in favour of these capitalists would increase saving and investment, hence economic growth.

Gustav Ranis and John Fei, in their paper *"A Theory of Economic Development"* published in 1961, proposed the idea that investment needed to be directed to the traditional sector to increase productivity there and cheapen the agricultural commodities which were assumed to be the main products of the traditional sector. The decrease in the agricultural commodities will mitigate the deterioration in the terms of trade against the

modern sector due to its rapid expansion as mentioned above. As a result economic growth of the modern sector can be restored.

The New Growth Economics

In the middle of the twentieth century, the new growth or endogenous growth theory appeared and has attempted to explain technological change, which is usually assumed exogenous by traditional growth models. In the new growth theory, investment is regarded as a source of technological changes (Grabowski and Shields, 1996). Investment may represent innovation if firms invest to solve problems they face. If the investment is successful, other firms will seek to adapt the successful investment to their own needs. Thus investing may represent a sequence of innovations with each innovation built upon previous innovations. This type of technical progress has been called "*learning by watching*". Externalities, resulting from learning by watching, are seen as a key to development.

Furthermore Uzawa (1965) and Lucas (1988) proposed that investment in human capital, research and development were the sources of such externalities, causing technical progress. Human capital, accumulated by the individual worker, would both make that worker more productive and increase the productivity of capital and other workers in the economy. Arrow (1962) and Romer (1986) have considered an approach where the size of the capital stock generated externalities. Arrow introduced the concept of *"learning by doing"*. It seems that the more practice people have in doing a particular job, the better they get at the job, and labour productivity increases as a result. Romer developed a model where the size of the capital stock and research and development played crucial roles. In general, these models have supported the conclusion that it would be sensible to subsidize education and research and development.

In short, all growth theories explain the source of economic growth differently, but reasonably under their own assumptions. Which economic theory should be applied depends on the situation in each economy. In practice, a strategy of economic growth is a flexible combination of various policies from some economic theories, and it is hard to specify which theory of economic growth should be given greatest priority.

3. Poverty: Definition and Measurement

3.1. Definition of Poverty

World Bank (2000b) defines poverty as an unacceptable deprivation in human well-being that can comprise both physiological and social deprivation. Physiological deprivation involves the non-fulfillment of basic material or biological needs, including inadequate nutrition, health, education, and shelter. A person can be considered poor if he or she is unable to secure the goods and services to meet these basic material needs. The concept of physiological deprivation thus is closely related to low income and consumption levels. Social deprivation widens the concept of deprivation to include risk, vulnerability, lack of autonomy, powerlessness, and lack of self-respect.

The definition of social deprivation depends not only on the economic problem but also on social, political, and cultural problems. It varies from one country to another, and from one period to another. Thus it is very difficult to find a consistent measurement of poverty connoting both physiological and social deprivation.

In practice, the definition of poverty is based on the physiological aspect. Poverty can be said to exist in a given society when one or more persons do not attain a level of material well-being or welfare deemed to constitute a reasonable minimum by the standard of that society (Ravallion, 1992). Given a particular indicator of welfare, a certain reasonable minimum is drawn, which is a basis for classifying an individual or household into the poor and the non-poor.

In order to measure poverty it is necessary to provide answers to the three following questions:

(1) What indicator of welfare should be selected?

(2) At what level of the selected indicator do we say that a person is poor?

(3) How can we aggregate individual indicators of welfare into a measure of poverty?

The first two questions will be discussed below, and the third question in section (2.3.2).

Welfare Indicator

There are many welfare indicators such as household consumption, per capita consumption, per capita income, per capita food consumption, food share, calorie intake, basic needs, and so on.[2] Consumption indicators are strongly favoured for measuring welfare in developing countries (Deaton, 1997). In comparison with other indicators, consumption is relatively easy to measure and compare. This variable summarizes many things that improve the quality of life, such as food consumption, payments for schooling, and purchases of medicines and medical services. In addition, the consumption measure can also include estimates of the annual "use value" of consumer durable goods as well as of owner-occupied housing. However, there is a drawback in using expenditure data to measure welfare. Expenditure data does not take into account saving and changes in assets. Thus, to some extent, it can overestimate or underestimate people's welfare.

An alternative to using consumption expenditure data would be to use income data. Yet there are three reasons to prefer expenditure data. First, income only raises living standards when it is used for consumption purposes, as opposed to being saved or used to pay debts. This implies that household consumption expenditures are more closely related to the quality of life of households than household income. Second, income data tends to be inaccurate, especially in developing countries where the vast majority of workers are self-employed. Finally income, especially agricultural income, can be extremely variable, and a farmer's income in any month is a poor indicator of living standard in that month. A better case can be made for annual income. But this makes the collection of data much more expensive. An income-based measure requires multiple visits or the use of recall data, whereas a consumption measure can rely on consumption over the previous few weeks.

In measuring poverty, one should be clear on whether one wants to estimate poverty among households or poverty among individuals. The fact that poverty is experienced by individuals and not households per se suggests that poverty among persons needs to be measured. This requires data on consumption per capita, not on total consumption for households. However, the most common survey uses the household as the unit of observation to collect data on consumption, because there are some goods

[2] For detailed information, see Glewwe (1989), Ravallion (1992).

commonly used in the household, and the consumption of these goods cannot be assigned to specific individuals (Ravallion, 1992). In order to measure poverty among individuals one can use some rule to divide household total consumption between members, equally or in proportion to some measure of needs, then treat each individual as the unit in poverty and welfare calculations.

A common practice is to assume that there is a uniform distribution within the household, and everyone is the same and has the same needs. This also neglects economies of scale that arise out of living together, which implies that family members can benefit from each other's consumption, and there are public goods, for example water or electricity, that can be used by all family members at no additional cost. Thus the use of consumption per capita may understate the true dispersion of consumption among individuals, thereby understating poverty incidence. A solution to this problem is to use some form of normalization such as "consumption per equivalent adult", whereby children count as some fraction of an adult, with the fraction dependent on age, so that effective household size is the sum of these fractions, and is measured not in numbers of persons, but in the number of adult equivalents. Economies scale can be allowed for by transforming the number of adult equivalents into "effective" adult equivalents so that if two cannot live as cheaply as one, four adult equivalents can perhaps live as cheaply as three adults. However how much equivalence scales should be assigned to each member in the household, and how these "effective" adult equivalents are calculated, and whether it even makes sense to try have been controversial issues for more than a century. As a result the use of per capita consumption is still best practice in measuring poverty (Deaton, 1997).

Poverty Lines

The second question refers to the establishment of a poverty line which separates population into the poor and the non-poor. Traditionally, there are three ways to specify a poverty line: the absolute, relative and subjective methods. The absolute method sets the poverty line as a minimum level of income or consumption expenditure necessary for a minimum living standard in a society at a point of time, and this line needs to be updated as prices change over time. The relative method specifies the poverty line as a point in the distribution of income or expenditure, hence the line can be updated automatically over time for changes in living standards. The subjective method derives the poverty line based on public opinion on minimum income or expenditure levels that can "get long"

and "make ends meet" . Compared with the first two poverty lines this line is relatively less popular and has been rarely used. For the analysis of poverty in the developing countries and in most government statistics the absolute poverty line is most widely used.

3.2. Poverty Measures

There exists a large amount of literature on aggregate measures of poverty.[3] In this study the focus is placed on the three most popular additive measures, and on Sen's measure which is also widely used.

3.2.1. Additive Poverty Measures

Once a poverty line has been set, a number of summary statistics describing the incidence, depth and severity of poverty can be calculated. These include the headcount index H which measures the incidence of poverty, the poverty gap PG which measures the depth of poverty, and the squared poverty gap P_2 which measures the severity of poverty. Foster, Greer and Thorbecke (1984) show that these three additive or FGT (Foster-Greer-Thorbecke) poverty measures can all be calculated using the following formula:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{z - x_i}{z}\right]^\alpha \qquad (1)$$

where x_i is the welfare indicator such as income or consumption per capita, for poor person i, z is the poverty line, n is the number of people in the sample population, q is the number of poor people, and α can be interpreted as a measure of inequality aversion.

The Headcount Index H

When $\alpha = 0$, the above equation reduces to q/n, the number of poor people in the population divided by the number of people in the sample population. This very commonly and simply used measure of the incidence of poverty is called the headcount

[3] For reviews see Kakwani (1980), Atkinson (1987), Ravallion (1992).

ratio H or, when turned into a percentage, the headcount index H. The ratio H varies from 0 when there are no poor in a society to 1 when a whole society is poor.

Two main disadvantages of the headcount ratio H, however, are that it is not sensitive to changes in income of the poor below the poverty line, or to transfers of income among the poor, as well as to transfers from the poor to the non-poor. For example, suppose that a poor person suddenly becomes very much poorer, the headcount index remains unchanged. Thus it is absolutely insensitive to differences in the depth of poverty. To counter these shortcomings, Sen (1976) proposed the following two axioms, which a suitable measure of poverty must satisfy.

Monotonicity Axiom: Given other things, a reduction in income of a person below the poverty line must increase the poverty measure.

Transfer Axiom: Given other things, a pure transfer of income from a person below the poverty line to anyone who is richer must increase the poverty measure.

It is clear that the headcount ratio H violates both axioms.

The Poverty Gap Index PG

When $\alpha = 1$, the poverty gap index is produced, which shows the shortfall of the poor's income from the poverty line expressed as an average of all people in the population. This index can be written as:

$$PG = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{z - x_i}{z}\right] = I.H \qquad (2)$$

H is the above mentioned headcount index, while I is often referred to as the *"income gap ratio"* and defined as:

$$I = \frac{z - \mu^*}{z} \qquad (3)$$

where μ^* denotes the mean income of the poor. This index shows the ratio of mean depth of poverty to the poverty line.

The range of the poverty gap index is from 0 to the value of H. If everyone gets rid of poverty, no one is poor, and the PG index equals 0. If there are poor, and the poor

have no income at all, the poverty gap PG equals the headcount ratio H. The income gap ratio I also reaches its maximum of 1. In practice, of course, PG never reaches H because there are subsistence requirements which implies for each i: $x_i > 0$. Given the headcount ratio, the higher the poverty gap PG the deeper the poverty is.

The poverty gap index PG can be used to calculate the minimum cost of eliminating poverty using perfectly targeted transfers. This cost is equal to the sum of all the poverty gaps in the population, and can be expressed as:

$$C = \sum_{i=1}^{q} [z - x_i] = n.z.PG \qquad (4)$$

The targeting of transfers, however, usually involves leakage and administration costs so that it is not unusual for the actual cost of eliminating poverty to be a multiple of the poverty gap.

The poverty gap index PG takes into account changes in income of the poor. A reduction in income of a poor person below the poverty line will increase the income gap ratio, thereby increasing the poverty index PG. However the PG index is still insensitive to transfers of income among the poor. Thus it violates the transfer axiom.

Squared Poverty Gap Index P_2

When $\alpha = 2$, the squared poverty gap index which is also called the FGT (Foster-Greer-Thorbecke) index P_2 is produced. Like the poverty gap index PG, this index measures the severity (or intensity) of poverty, and ranges from 0, when there are no poor in a society, to the value of the headcount ratio H, when all of the poor have no income. This index gives more weight to poorer individuals. The poorer the person, the greater the weight given to his or her shortfall from the poverty line. Thus it takes into account income distribution among the poor, and satisfies both the monotonicity and transfer axioms.

Unlike some other poverty measures, these three poverty measures have a useful property of being additively decomposable, e.g. the national poverty index is equal to the weighted average of indices in rural and urban areas or different regions.

3.2.2. The Sen Index P_s

A widely used poverty index is that of Sen (1976) which takes into account not only the number of poor and their aggregate income gap but also the inequality of income among the poor. Sen's approach to measuring poverty is based on an ordinal welfare concept. He proposed a poverty index P_S of the population as the weighted aggregate income gap of the poor in that population:

$$P_S = \sum_{i=1}^{q} g_i v_i(z,x) \qquad (5)$$

where $g_i = z - x_i$ is the income gap or income short-fall of the i-th poor and $v_i(z,x)$ is the weight attached to his or her income gap given the income distribution x. It should be noted that $v_i(z,x)$ has been defined as a function of the whole income distribution vector x and not of x_i alone, which implies a more general welfare function than the one that is additive separable. The weights are determined on the basis of ranking of poor individuals. In this connection he raised the following axioms:

Axiom N (Normalized Poverty Value): If all the poor have the same income then $P_S = I.H$

Axiom E (Relative Equity): For any pair i, j:

if $W_i(x) < W_j(x)$ then $v_i(z,x) > v_j(z,x)$

where $W_i(x)$ and $W_j(x)$ are the welfare level of i and j under the income distribution x.

Axiom M (Monotonic Welfare): For any pair i, j:

if $x_i > x_j$ then $W_i(x) > W_j(x)$

Axiom R (Ordinal Rank Weights): The weight $v_i(z,x)$ of the income gap of person i is proportional to the rank of i in the interpersonal welfare order of the poor.

Axiom N shows that if all the poor have the same income, then all the poor receive the same weight $v_i(z,x)$, and $P_S = I.H$. Axiom E implies that the intensely poor receive higher weight than the less intensely poor, provided that there is general agreement as to who is poorer than who. Axiom M gives the relationship between income and welfare, implying that a richer person receives higher welfare than a poorer person. Axioms E and M together imply that the larger the income gap, the greater the weight should be attached to it. Axiom R is the most demanding. Sen justifies it by viewing deprivation as an essentially relative concept. The lower a person is on the welfare scale, the greater his

sense of poverty. Moreover, his welfare rank with respect to others may represent the weight to be placed on his income gap.

Sen (1976) proved that the poverty index P_S, which satisfies not only the two axioms of monotonocity and transfer but also the four above axioms N, E, M, and R, can be expressed as:[4]

$$P_s = H[I + (1 - I)G^*] \tag{6}$$

where G^* is the Gini coefficient of the income distribution of the poor:

$$G^* = \frac{1}{2n(n-1)\mu} \sum_{i=1}^{n} \sum_{j=1}^{n} \left| x_i^* - x_j^* \right| \tag{7}$$

It should be noted that x_i^* here is the income of poor i. So the Gini coefficient is calculated for the poor population only.

The major disadvantage of the Sen index is that it has no obvious meaning. However it is possible to give some explanations about this index. The value of P_S lies in the closed interval [0, 1], with $P_S = 0$ if everyone has an income greater than z, and P_S = 1 if everyone has zero income. When all the poor have the same income, that is $G^* = 0$, the Sen index equals the poverty gap PG (Axiom N). Then, the lower the income of the poor, the closer P_S will approach the headcount H, and the larger the proportion of the poor, the closer P_S will approach the income-gap measure I.

3.3. Measurement of Poverty: a Lorenz-Curve Based Approach

It is possible to calculate the three additive poverty indices and the Sen index without individual income if the specification of Lorenz curve, the mean income, and the poverty line are known.

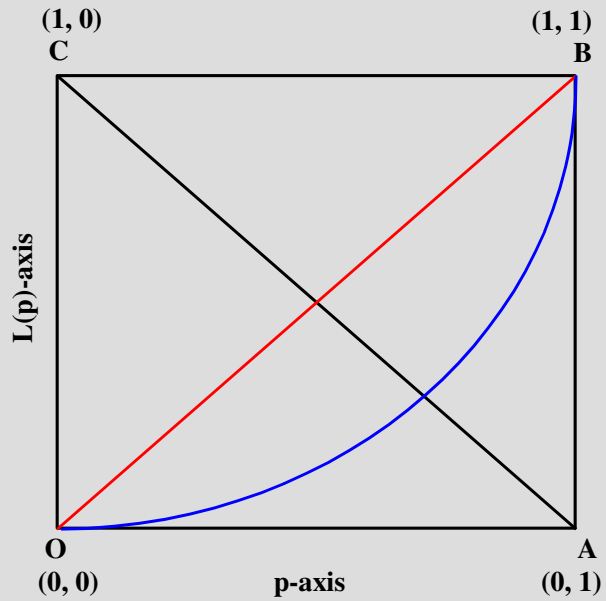
3.3.1. The Lorenz Curve

[4] For proof see Sen (1976).

The Lorenz curve proposed by Lorenz in 1905 is widely used to represent and analyze the size distribution of income and wealth. Let's denote p as the cumulative proportion of income units, and $L(p)$ as the cumulative proportion of income received by p when income units are arranged in ascending order of their income or consumption. The value of $L(p)$ and p range from 0 to 1, and the value of $L(p)$ is always less than or equal to the value of p. The Lorenz curve is defined as the relationship between the variables $L(p)$ and p. It is depicted in figure 1.

In this figure the egalitarian line, the straight line $L(p) = p$, is the diagonal OB through the origin of the unit square. The Lorenz curve falls below this line. If the curve coincides with the egalitarian line, it implies that each person has the same income. This is the case of absolute equality of income. In contrast, if the Lorenz curve coincides with OA and OB, implying that all income is gained by only one person in the population, inequality is at its maximum.

Figure 1: The Lorenz Curve



Finally, it should be noted that the Lorenz curve $L(p)$ is monotonically increasing in p and convex to the p-axis (Kakwani, 1980). This implies that the fraction of income $L(p)$ increases as the lowest fraction of the population p rises, and $L(p)$ rises slower than p at first, but later it rises faster than p.

3.3.2. Poverty Measures Obtained from the Lorenz Curve Function

Three Additive Poverty Indices

The three poverty indices discussed in (2.3.2.1) can be calculated based on the equation of the Lorenz curve, when the values of the mean income and the poverty line are known.

Firstly, the headcount ratio H can be found as a solution to the following equation (Kakwani, 1980):

$$L'(H) = \frac{z}{\mu} \tag{8}$$

where μ and z are the mean income and the poverty line, respectively. L'(H) is the first derivative of $L(p)$ with respect to p at the H value.

Secondly, the poverty gap index is calculated as follows:

$$PG = I.H = \left(1 - \frac{\mu^*}{z}\right)H \tag{9}$$

where $\mu^* = \mu\frac{L(H)}{H}$ denotes the mean income of the poor.

Finally, the squared poverty gap index P_2 is obtained as the integral of $\left[1 - \left(\frac{\mu}{z}\right)L'(p)\right]^2$ over the interval (0, H), that is:

$$P_2 = \int_0^H \left[1 - \left(\frac{\mu}{z}\right)L'(p)\right]^2 dp \tag{10}$$

The Sen Poverty Index

The Sen poverty index can be obtained from the Lorenz curve as follows:

$$\begin{aligned} P_s &= H[I + (1 - I)G^*] \\ &= HI + (H - HI)G^* \\ &= PG + (H - PG)G^* \end{aligned} \tag{11}$$

Where

$$G^* = 1 - 2\int_0^1 L(p^*)dp^* \quad (12)$$

and $L(p^*)$ is the Lorenz curve for the poor population.

In summary, the above poverty measures can be fully characterized in term of the poverty line, the mean income and the Lorenz curve representing the structure of relative income inequalities:

$$P = P[z, \mu, L(p)] \quad (13)$$

This equation indicates that the level of poverty is directly determined by two key factors. Firstly, the level of poverty depends on the level of the mean income. It is reasoned that economic growth can change the mean income, thereby altering poverty. Secondly, given the factor of the mean income, the Lorenz curve, which presents the pattern of income distribution, also determines what level the incidence and severity of poverty stands at. Thus, there is an inherent relationship between poverty, growth and inequality. This will be discussed in the below section.

4. Relationship between Economic Growth, Inequality and Poverty

4.1. Impact of Economic Growth on Poverty

Adverse Impact of Poverty on Growth

There is a broad consensus that poverty can impede economic growth. The poor have very low productivity due to ill-heath and insufficient skills, which erodes the productive capacity of the economy. Furthermore, a severe constraint on collateral also prevents the poor from taking up loans in credit markets. Naturally the poor are less able to exploit opportunities for physical and human capital accumulation. This lowers the income growth rates, which in turn may increase the poverty. Reducing the number of the poor would reduce the number of typically credit-constrained people, and ceteris paribus lead to greater economic growth.

Trickle-down Development

The positive effects of the economic growth on poverty reduction have usually been motivated by the trickle-down theory which emerged in the 1950s. It implies that a vertical flow from the rich to the poor happens of its own accord. The benefits of economic growth go to the rich first, and then in the second round the poor begin to benefit when the rich start spending their gains. Thus the benefits of economic growth would automatically trickle-down to the poor through increased domestic activities, higher tax revenues, and government expenditure including transfers. There is no need for any specific instruments or complementary efforts to facilitate or secure the goal of poverty reduction.

Numerous empirical studies justify a very strong relation between economic growth and poverty reduction. Studies by Ahluwalia (1979), Fields (1980), Fields (1989), Demery and Squire (1995), Ravallion and Chen (1997) show that changes in the mean income consistently play the main role in securing changes in poverty. A recent study at the World Bank by Dollar and Kraay (2000) concludes that the income of the poor rises one-for-one with overall growth. This general relationship between the income of the poor and per capita GDP growth holds in a sample of 80 countries over four decades.

In short, there is no doubt that economic growth constitutes a prerequisite for poverty reduction in the long term. In turn, poverty reduction can create favourable conditions for economic growth. Without an increase in income per capita, poverty will persist in poor countries.

4.2. The Role of Inequality

Although economic growth is said to be the engine of poverty reduction, it works more effectively in some situations than in others. The key factor that affects the impact of growth on poverty is the pattern of income distribution.

Gini Index as Inequality Measure

To measure the level of inequality, one can use various indices such as Gini index, Theil indices, the coefficient of variation, the relative mean deviation, and the standard deviation of logarithms of income.[5] Related to the approach of Lorenz curve, the Gini index is most widely used. Graphically, it can be calculated by dividing the area between the diagonal line and the Lorenz curve by the area under the diagonal line of equality (see figure 2.1). Thus the further the Lorenz curve is from the line of equality, the higher the Gini coefficient.

Note that, because the value of the area under the diagonal is equal to 0.5, the value of the Gini index can be obtained by subtracting twice the area under the Lorenz curve from 1. That is:

$$G = 1 - 2\int_0^1 L(p)dp \qquad (14)$$

The Gini index can be calculated from the individual incomes in the population as follows:

$$G = \frac{1}{2n(n-1)\mu}\sum_{i=1}^{n}\sum_{j=1}^{n}\left|x_i - x_j\right| \qquad (15)$$

where x_i is the income of the i^{th} person, and n is the total number of people in the population. The double sum in (2.15) can be hard to calculate if n is relatively large, and an equivalent but computationally more convenient form is:

$$G = \frac{n+1}{n-1} - \frac{2}{n(n-1)\mu}\sum_{i=1}^{n}\rho_i x_i \qquad (16)$$

where ρ_i is the rank of individual i in the x-distribution, counting from the top so that the richest has the rank of 1.

The value of the Gini coefficient varies from 0 when everyone has the same income to 1 when one person has everything. The closer a Gini coefficient is to one, the more unequal the income distribution is. For most developing countries, Gini coefficients for expenditures or incomes range between 0.3 and 0.6.

Direct Effects of Inequality on Poverty

[5] For example see Kakwani (1980)

It is obvious that an increase in inequality will lead to an increase in poverty. Let's take the headcount ratio H as a simple measure of poverty incidence. Recall the formula (8) to calculate H from the Lorenz curve as follows:

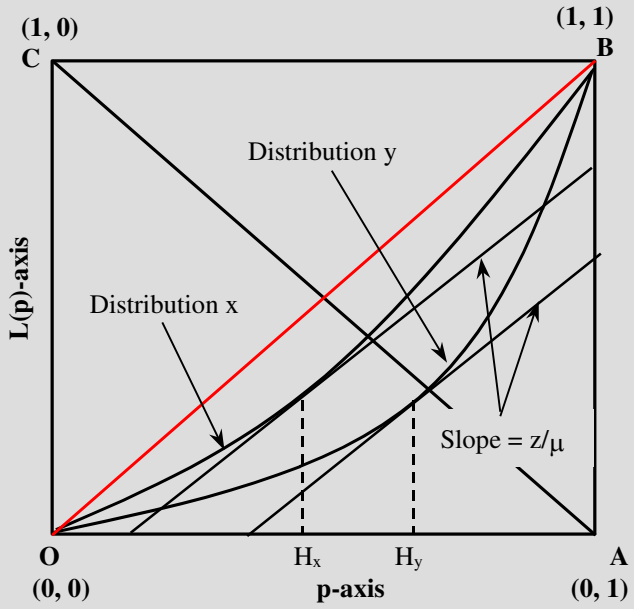
$$L'(H) = \frac{z}{\mu}$$

where μ is the mean income, and z is the poverty line. Assume that μ is larger than z.

The H value can be determined in the graph by portraying a tangent having a slope of z/μ with the Lorenz curve. For simplicity, assume that this Lorenz curve is symmetric, that is, the curve is skewed neither toward (0,0) nor toward (1,1).[6] Suppose there are two income distributions x and y. Greater inequality in y than in x is represented by the larger gap between the Lorenz curve of y and the egalitarian line. Figure 2 makes it clear that for any two distributions x and y sharing the same mean μ, the headcount ratio for x will be lower than for y, for a given poverty line z.

At the same time, for two distributions x and y sharing the same Lorenz curve, which means that x and y have the same level of inequality, if the income mean of x is larger than that of y, then the headcount ratio for x will be smaller than headcount ratio for y. That is, poverty inherent in x is higher than poverty inherent in y.

Figure 2: Inequality and Poverty



[6] For discussion on symmetry of Lorenz curve, see appendix 1.

Inequality Affects Poverty-Reducing Impacts of Growth

Inequality also has adverse impacts on poverty through the main channels as follows:

Firstly, high inequality can make economic growth less effective in reducing poverty. Intuitively, in an economy where inequality is persistently low, the poor will tend to obtain a higher share of the gains from economic growth than in an economy where inequality is higher. This can be illustrated from picture 2.2. Suppose there is the same increase in income mean of distribution x and y so that the two tangents with slope of z/μ move along the two Lorenz curves to the left and remain parallel to each other. Because of the convexity characteristic of the Lorenz curve, the earlier the stage of the Lorenz curve, the faster the lowest faction of people p declines than $L(p)$. It is reasoned that the rate of poverty reduction of distribution x will higher than that of distribution y. In empirical studies, Ravallion (1997) and Timmer (1997) found supportive evidence from cross-country distributional data that higher initial income inequality entailed a lower absolute elasticity of poverty to growth in average incomes. For example, a country with a Gini index of 0.25 can expect a growth elasticity of the headcount index of around –3.3, while for a country with a Gini index of 0.6, the elasticity is –1.8 (Ravallion, 1997).

Secondly, inequality can be a factor detrimental to economic growth, thereby impeding poverty reduction. In contrast to the Harrod-Domar model which predicted that greater inequality would lead to higher growth rates, the weight of theory in the 1990s has been in support of the negative relationship between inequality and economic growth. Some key arguments lie in the fact that inequality gives rise to social conflicts and political instability, and less investment in human capital, which tend to reduce efficiency and investment level, hence economic growth.[7]

4.3. The Composition of Economic Growth

Besides the inequality component, the sectoral and regional composition of growth can influence the impacts that economic growth places on poverty. There is no dispute that growth in sectors of the economy or regions of the country where the poor are

[7] For more arguments see Levin and Bigsten (2000), Goudie and Ladd (1999).

concentrated will have greater effects on poverty reduction than in other sectors or regions. For example, it is often argued that in developing countries where most of the poor live in rural areas and are involved in agriculture, high economic growth in agriculture will reduce poverty significantly, because it generates incomes for poor farmers, thereby increasing their demand for goods and services that can be easily produced by the poor. It is also supposed that if economic growth results in the expansion of blue-collar or low-skilled employment, the poor are more likely to benefit from the growth. Fallon and Hon (1999) in a cross-country study found that the more labour-intensive the growth pattern, the faster the decline in the incidence of poverty. Various country-specific and cross-country studies show that economic growth in the agricultural and tertiary sectors has a major effect on mitigating poverty, while economic growth in manufacturing sectors has a limited effect on poverty reduction.[8] Ames et al. (2001) also argues that although manufacturing growth is more important for overall growth, agricultural growth is more crucial for employment and poverty reduction.

However the link between sectoral growth and poverty reduction may be more complicated in the long-run. While faster growth in the agricultural sector or labour-intensive sectors may address the poverty problem in the short-run, reliance on agricultural activity may also intensify output variability, which in turn would contribute to increasing rather than decreasing poverty. A more diversified economy with vibrant industrial sectors might offer the best chance for sustainable economic growth, and hence consistent reduction in poverty.

In addition to the impact of different sectors on poverty, it is worth considering that the population distribution between regions and sectors also matters for the elasticity of poverty with respect to economic growth. In general, a change in the population distribution will shift the Lorenz curve. Urbanization is widely viewed as an effective factor in promoting rural non-farm economic growth by expanding the market size, which makes a considerable contribution to reducing poverty in rural areas as well as to decreasing inequality between rural and urban areas.

5. Pro-poor Growth and Policy Implications

5.1. Distrust in "Trickle-down"

[8] See Thorbecke and Hong-Sang (1996), Timmer (1997), and Bourguignon and Christian (1998).

So far it is clear that economic growth is a necessary but not sufficient condition for poverty reduction. How strong a poverty-reducing effect economic growth has, depends on what happens to income distribution. The "trickle-down" development may not hold in some cases in which inequality increases so much to the extent that its adverse impacts on the poor exceed the benefits they gain from economic growth. This argument is partly based on a famous hypothesis proposed by Simon Kuznets in the 1950s that the distribution of income in a society follows an inverted U-shaped transformation in the process of economic growth. Inequality increases in the early stage of growth, and then decreases in the later stages as the per capita income increases.[9]

Support for the Kuznets hypothesis led Adelman and Moriss (1973) to conclude that: "There is no automatic, or even likely, trickling-down of the benefits of economic growth to the poorest segments of the population in low-income countries. On the contrary, the absolute position of the poor tends to deteriorate as a consequence of the growth".

Bhagwati (1968) proposed a theory of immiserizing growth, in which the economic growth can bypass or even harm the poor. This model establishes some conditions which allow a possibility: growth can immiserize itself. The precise demonstration concerns an economy where increased productivity led to a sufficiently large deterioration in the terms of trade whose adverse effects outweigh the primary gain from growth. Bhagwati (1988) showed the anti-poor impact of immiserizing growth by sketching a scenario in which the more affluent farmers adopt new seeds and raise grain production that results in lower prices. In contrast, the marginal farmers, who are not able to adopt the new technology, find their stagnant output yielding even less income. Thus the green revolution which leads to agricultural economic growth may hurt the poor, thereby increasing poverty.

Even if the trickle-down development can bring about some benefits for the poor, there is no guarantee that such benefits are enough to reduce poverty significantly. The trickle-down development itself does not ensure an effective degree of poverty reduction due to economic growth. Economic growth that results from market forces generally benefits the rich proportionally more than the poor, because the rich have inherent advantages, for example, human and material capital, in a market economy. In addition, there is a time-lag from when the rich benefit until when the poor can raise their incomes owing to the increased spending of the rich. As a result, the poor may benefit less and later than the rich from economic growth, and poverty declines very slightly.

[9] See Kuznets (1955).

5.2. Concept of Pro-poor Growth

For maximizing positive effects on poverty reduction, instead of relying on "trickle-down" development, patterns of pro-growth should be promoted. A strategy of pro-poor growth does not only focus on economic growth, but also affects the pattern of income distribution so that the poor can benefit from economic growth proportionally more than the rich, which will reduce the welfare gap between the poor and the rich, and finally eliminate poverty.

Generally speaking, pro-poor growth can be considered as growth patterns that encourage greater participation of the poor, allowing them to benefit considerably from the process of economic growth. ADB (1999) indicates that growth is pro-poor when it is labour-absorbing and accompanied by policies and programs that mitigate inequalities and facilitate income and employment generation for the poor, particularly women and other traditionally excluded groups. Kakwani (2000) regarded pro-poor growth as a major departure from the "trickle down" development concept. It includes both indirect pro-poor policies, which make economic growth more favourable for the poor, and direct pro-poor policies such as the public provision of clean water, sanitation, health services, education, etc. Its outcome should be that no person in society is deprived of the minimum basic capacities.

5.3. Policy Implications for a Pro-poor Strategy

Sustainable reduction of poverty entails pro-poor policies in many socioeconomic aspects, because poverty is an outcome of multidimensional processes, beyond the economic domain. With the amelioration of poverty as a target, the policies designed to achieve that target can be divided in two main classes (Bhagwati, 1988):

(1) The indirect route, i.e., the use of resources to accelerate growth and thereby impact on the incomes and improvements in the living standards of the poor.

(2) The direct route, i.e., the public provision of minimum-needs-oriented staple foods, water and sanitation, education, housing, nutritional supplements and health, and transfers to finance private expenditures on these and other components of the living standards of the poor.

The primary distinction between the two approaches is between creating favourable conditions for the poor to increase their incomes and providing human and capital assets directly in kind or through cash to the poor.

In practice, a comprehensive pro-poor strategy involves multidimensional policies in both the direct and indirect routes, and the domination of an approach depends on each concrete situation. In addition to emphasis on generating a stable socioeconomic environment for economic growth and poverty reduction, various studies have stressed different pro-poor policies. Bhagwati (1988) raises great support for the New Economic Policy that aims at an export-promoting strategy and a regime of *laissez faire* as a pillar for economic growth in developing countries. He emphasizes the role of the removal of political economy constraints such as bureaucracy and corruption on both the direct and indirect route's ability to reach the poor more effectively. McKay (1996) suggests that pro-poor policies are "more likely to be labour-rather than capital-intensive and place emphasis on raising education and skill levels among the poor". Deininger and Squire (1997) recommend that it be a more equal distribution of assets, rather than income, that is important to raise the poor's incomes, reducing the incidence of poverty. Thus policies aiming at facilitating accumulation of productive assets by the poor should be encouraged.

World Bank (1996) gives support to emphasis on boosting growth in agriculture, remote poor regions, or urban slums where the poor tend to concentrate. Road construction and other projects in rural areas should be given preference over urban investments, and investments in primary education and health services should be stressed rather than universities and hospitals. Besides these direct policies, World Bank (2001b) puts forward an idea of an administrative and institutional reform, whereby access of the poor to market opportunities and to public services is improved by making public administration, legal institutions, and public service delivery more efficient and accountable to all citizens, and by strengthening the participation of the poor in political processes and local decision-making. The pro-poor strategy proposed by the World Bank (2001b) is also concerned with reducing vulnerability of the poor to economic shocks, natural disasters, ill health, and personal violence. This requires effective national action to manage the risk of economy-wide shocks and effective mechanisms to reduce the social and natural risks faced by the poor.

The pro-poor growth strategy proposed by Kakwani (2000) recommends the removal of institutional and policy-induced biases against the poor, as well as the adoption of direct pro-poor policies. Macro policies that tend to constrain pro-poor

growth include such policies as overvalued exchange rates, big city-oriented industrial location policies, and public spending biases toward urban areas and against rural areas. Similarly, there are micro policies which are unfavourable for the welfare of the poor. For example, monopoly powers enjoyed by some firms may result in high prices that hurt the poor heavily. Subsidized public services such as state universities may benefit primarily the non-poor. Improvement in access of the poor to credit, and promotion of small and medium enterprises are usually suggested as plausible micro pro-poor policies. A well-administered progressive tax system is also beneficial to the poor. Direct policies include adequate public spending on basic education, health and family planning services.

One highly pro-poor strategy can be described as *"redistribution before growth"* which carries out radical redistribution of assets between the rich and the poor (Perkins et al., 2001). The strategy begins with asset redistribution through confiscating properties of the rich, then assigning them to the poor. This model was successfully implemented in Taiwan and South Korea where large rural landholdings were broken shortly after World War II and development has proceeded rapidly and comparatively equally. However if the radical redistribution is repeated many times, it may cause political instability and fail to create efficient incentive for economic growth in the long term, because no one tries to work to be rich for the fear of repeated expropriation.

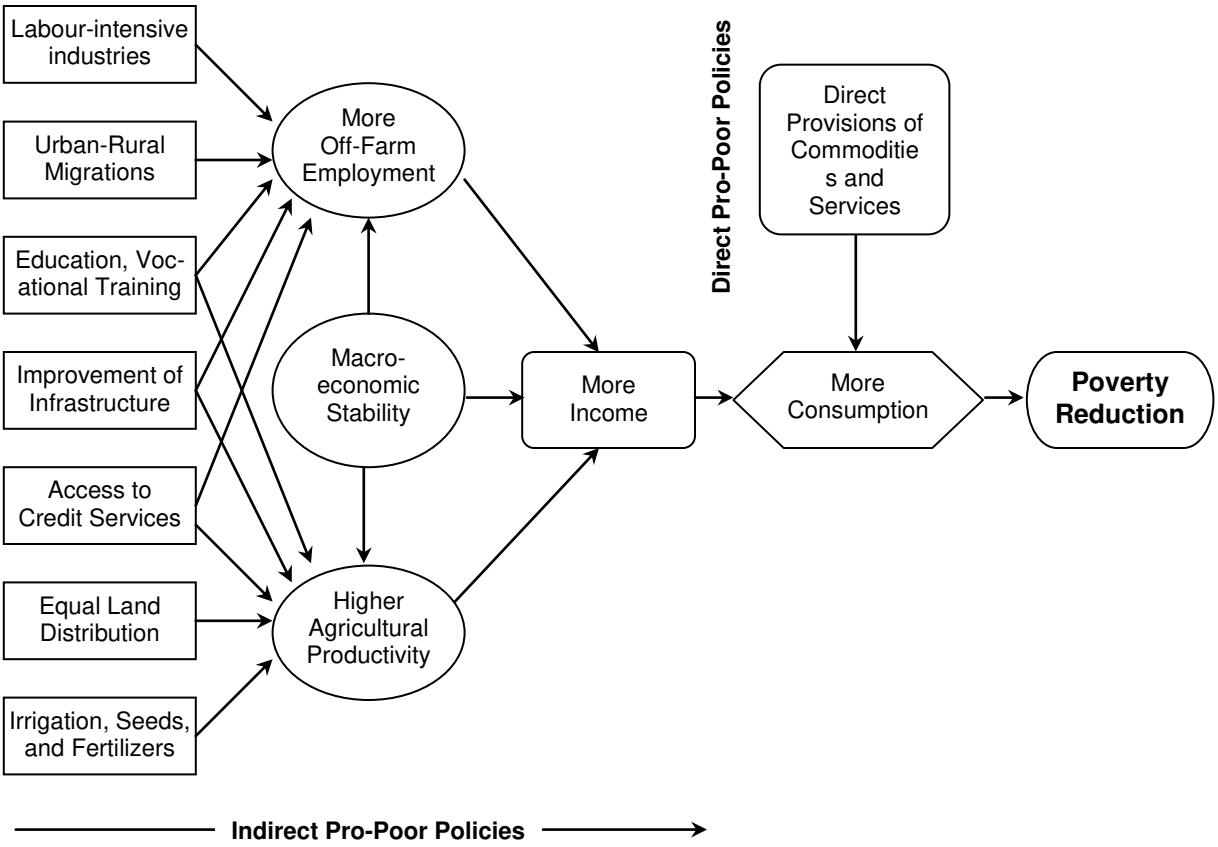
To avoid the unexpected outcomes of the *"redistribution before growth"* approach, the *"redistribution with growth"* strategy, which is combination of the indirect and direct approaches, has emerged as a tolerable solution. This strategy should try to shape the pattern of development so that low-income producer see improved earning opportunities and simultaneously receive the resources necessary to take advantage of them. Besides, attention is also paid to direct policies such as the provision of public services to help the poor get rid of poverty.

Pessimism about how fast economic growth, even when it is focused on poverty reduction, can improve the well-being of the poor leads to concern about *"basic human needs"* approach, which emphasizes direct pro-poor policies. The strategy requires two important elements for success. First, financing must be adequate to ensure that the commodities and services can be provided at costs affordable to the poor. Second, service networks are needed to distribute the public services in forms appropriate for consumption by the poor, especially in areas where the poor live.

Diagram 1 summarizes some general implications for pro-poor policies. The fact that most of the poor in developing countries are relying on agricultural production

suggests that to reduce poverty, it is necessary to increase the income of the poor by generating more employment and raising agricultural productivity. This requires measures promoting a macroeconomic environment conducive to economic growth such as low inflation, realistic exchange and interest rates, and a sustainable budget (Groudie and Ladd, 1999). In addition, the provision of physical and human capital for the poor also plays a crucial role in increasing the poor's income and reducing poverty.

Diagram 1: Pro-Poor Policies



6. Conclusions

Economic growth refers to an increase in a country's capacity to produce goods and services over a period. It is usually measured as an increase in the real GDP or real GDP per capita. In general, economic growth depends to a significant extent on the resources a country has. Improvements in the input factors such as capital, population, natural resources, and technology will result in an increase in national output. Other non-

economic factors such as government administration, history, culture, and political institutions also play important roles in boosting economic growth.

Poverty can be said to exist in a given society when one or more persons do not attain a level of material well-being or welfare deemed to constitute a reasonable minimum by the standard of that society. Given a particular indicator of welfare, a poverty line is drawn, which is a basis for classifying an individual or household into the poor and the non-poor. To measure poverty, this study uses the three additive indices, namely the headcount index H which measures the incidence of poverty, the poverty gap PG which measures the depth of poverty, and the squared poverty gap P_2 which measures the severity of poverty, and the Sen index which takes into account not only the incidence and depth of poverty but also income inequality among the poor.

To reduce poverty, there is a precondition to ensure high economic growth. However, the extent to which economic growth decreases poverty is still a matter of controversy. In the 1950s and 1960s, the "trickle-down" theory dominated development thinking with the argument that economic growth automatically benefited the poor, thereby reducing poverty irrespective of the nature of economic growth. This theory became increasingly discredited as the issue of inequality was taken into account. In some cases, economic growth can lead to high inequality in income distribution to the extent that the adverse impacts of inequality on the poor exceed the benefits they gain from economic growth. Thus, it is not advisable to believe that economic growth always benefits the poor proportionally and leads to great reduction in poverty. If poverty reduction is a major policy goal to be achieved, a so-called pro-poor strategy that allows more than proportional benefits for the poor should be adopted.

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