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ECONOMIC GROWTH AND POVERTY REDUCTION: INITIAL CONDITIONS MATTER

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ABSTRACT

The focus of this paper is on analytical examination of how the relation between growth and poverty can change with the initial levels of economic development and inequality. Using the idea of poverty elasticity, measuring the extent to which economic growth reduces poverty, the study offers several propositions to demonstrate that the initial levels of economic development and income inequality can have significant impacts on poverty reduction. It also demonstrates that the tradeoff between growth and inequality can be explained in terms of initial conditions of development and inequality. The theoretical elasticities derived in the paper are then utilized to compute the growth rates in many Asian countries that would be required to achieve the Millennium Development Goal of halving the incidence of poverty between 1990 and 2015.

1 INTRODUCTION

The poverty reduction has become a central goal for development. It can be achieved by economic growth and/or by the distribution of income. Issues related to the benefits of growth accrued to the poor have become a priority of development policy in the 1990s. An emerging consensus is that growth alone is a rather blunt tool for poverty reduction. In conjunction with emphasis on poverty reduction, policies as to the redistribution of income and assets have become increasingly more important. A policy agenda that addresses both distributional concerns and poverty reduction could lead to enhancing both economic growth and equity.

The evidence suggests that rising per capita income in general leads to poverty reduction (Fields 1989, World Bank 1990, Roemer and Gugerty 1997). Taking a step further, some studies have recently attempted to quantify the responsiveness of poverty in relation to economic growth through the idea of the growth elasticity of poverty. The poverty elasticity estimates the percentage change in poverty caused by a 1 percent change in per capita income. In this connection, Ravallion and Chen (1997) carried out a study using cross-country regressions based on a sample of 62 developing countries. They showed that on average, a 1 percent increase in per capita income led to a 3.1 percent reduction in the proportion of people living below the conventional \$1 a day threshold. What is

more, they also found that the growth elasticity was even higher for lower poverty lines, suggesting that while growth overall helps the poor, it helps the extremely poor more than the moderately poor. Using different methodological techniques, a similar conclusion was arrived by other studies – including Deininger and Squire (1996), Roemer and Gugerty (1997), Timmer (1997), and Gallup, Radelet and Warner (1998).

However, the growth-poverty nexus is not as simple as depicted in cross-country regressions. Moreover, the growth elasticity of poverty surely varies across countries and depending on the poverty measures used in the estimation. This may be explained by the fact that different countries have different initial conditions. The countries vary with respect to their initial levels of economic development and income inequality. How do these initial conditions affect the extent of poverty reduction? Bouguignon (2002) has recently attempted to answer this question by linking growth elasticity of poverty with the initial level of economic development and income inequality. His analysis is based on the assumption that the distribution of income or expenditure is log-normal.

This study motivated by Bouguignon's (2002) paper presents several analytical results on poverty elasticity, measuring the extent to which economic growth reduces poverty. It offers several propositions to demonstrate that the initial levels of economic development and income inequality can have significant impacts on poverty reduction. It also demonstrates that the poverty tradeoff between growth and inequality can be explained in terms of initial levels of development and inequality. The theoretical elasticities derived in the paper are then utilized to compute growth rates in several Asian countries that would be required to achieve the Millennium Development Goal of halving the incidence of poverty between 1990 and 2015.

The paper is organized as follows. Section 2 derives various poverty elasticities in relation to the initial levels of economic development and inequality. Section 3 looks into how the growth-inequality tradeoff changes with initial levels of development and inequality. While section 4 presents empirical illustration on section 2, section 5 explains poverty prospects for some selected Asian countries to 2015. The final section summarizes the major findings of the paper.

2 POVERTY ELASTICITY AND INITIAL CONDITIONS

In this paper, our analysis is based on a general class of poverty measures proposed by Foster-Greer-Thorbecke (FGT) (1984):

$$P_a = \int_0^z \left(\frac{z-x}{z} \right)^a f(x) dx \quad (1)$$

where a is the parameter of inequality aversion.¹ Note that x is a measure of individual standard of living and z is the poverty line.

The degree of poverty depends on two factors: average income and income inequality.² While an increase in average income reduces poverty, an increase in inequality increases poverty. The responsiveness of poverty to changes in mean income when inequality remains fixed can be measured by the growth elasticity of poverty. A poverty measure can always be written as

$$P = P(\mathbf{m}, L(p))$$

where \mathbf{m} is the mean income of the society and $L(p)$ is the Lorenz curve measuring the relative income distribution. $L(p)$ is the percentage of income that is enjoyed by the bottom $100 \times p$ percent of the population. The growth elasticity of poverty is defined as

$$h_a = \frac{\partial P_a}{\partial \mathbf{m}} \frac{\mathbf{m}}{P_a} \quad (2)$$

Which is the percentage change in poverty in response to a growth rate 1 percent provided inequality of income measured by Lorenz curve does not change. The growth elasticity h is always negative.

The measurement of growth elasticity of poverty is important because it tells us the extent to which growth reduces poverty when there is no change in inequality. This elasticity varies widely across countries (Lipton and Ravallion 1995). What are the factors that can explain these cross-country differences? One of these factors is the country's initial level of economic development.

Proposition 1: Growth elasticity of poverty for the entire class of poverty measures P_a (except headcount ratio) decreases monotonically with the initial level of economic development.³

The proof of this proposition is given in Appendix. This proposition has an important implication. It tells us that the higher is the initial level of economic development, the larger will be the poverty reduction with a given growth rate provided that the growth process does not change inequality. This also means that it is easier to reduce poverty in a richer country than in a poorer country even if the two countries have the same growth rate of per capita income. More importantly, it tells us that economic growth with no change in inequality can lead to poverty reduction at an increasing rate because of the declining nature of growth elasticity.

Next, we want to see if economic growth affects ultra-poor differently from the poor. The ultra-poor are the poor whose income is far below the poverty line. The Proposition 2, proved in Appendix provides an answer to this question.

Proposition 2: Growth elasticity of poverty h_a decreases monotonically with a .

This proposition implies that the larger is the value of a , the greater will be the percentage poverty reduction with a given growth rate. As the value of a increases, weight given to the most deprived poor whose income is much lower

than the poverty line becomes greater. This leads to a greater proportional reduction in poverty. Therefore, the growth-induced benefits from poverty reduction are larger for the ultra poor than for the poor, suggesting that if growth is good for the poor, it is even better for the ultra-poor.

Proposition 1 highlighted the fact that economic growth is an important determinant of poverty reduction. Economic growth can lead to an increasingly proportional reduction in poverty provided that the inequality of income, measured by the Lorenz curve, does not change with growth. However, economic growth may be accompanied by an increase or decrease in inequality, in which case, changes in inequality play an important role in explaining the interrelation between growth and poverty.

The measurement of the effect of inequality on poverty is a difficult task because inequality in distribution can change in infinite ways. It is not possible to establish a simple formula, relating changes in aggregate measures of inequality such as the Gini index to changes in poverty. To explore the impact of inequality on poverty, we need to specify a more precise shift in the Lorenz curve.

Kakwani (1993) made a simple assumption that the entire Lorenz curve shifts by a constant proportion of the difference between actual share of total income accruing to each income and equal shares. This gives the analytically tractable elasticity of poverty measures P_a with respect to the Gini index, which denoting by e_a may be called the inequality elasticity of poverty.

Proposition 3: Inequality elasticity of poverty e_a is positive only when poverty line is less than the mean income.

Intuitively, if mean income does not change, as inequality increases, poverty should also increase. This requirement, as Proposition 3 implies, is satisfied only when poverty line is less than mean income. If poverty line is greater than mean income, we may confront a situation when an increase in inequality may reduce poverty. An intuitive interpretation of this result is as follows:

When any transfer of income takes place from those whose income is below the mean income to those whose income is above the mean income, inequality increases. Since the poverty line is above the mean income, such income transfers lead to a situation where some people may cross the poverty line resulting in a reduction in poverty.

This result indicates that a poverty line should never exceed the mean income. For most low-income developing countries, \$2 a day poverty line converted to local currency at the 1993 purchasing power parity exceeds per capita mean consumption. Thus, \$2 a day poverty line is not appropriate for a large number of developing countries.

How does the inequality elasticity of poverty change with the initial level of economic development? Proposition 4 provides an answer to this question (the proof of which is given in Appendix).

Proposition 4: Inequality elasticity of poverty e_a increases monotonically with the initial level of economic development.

Proposition 4 implies that the higher is the initial level of mean income, the larger will be the increase in poverty for a given increase in the Gini index. This suggests that economic growth if accompanied by an increase in inequality may not lead to an increasingly proportional increase in poverty, as was the case when growth did not change inequality. Thus, faster growth may lead to a slower reduction or even increase in poverty depending on how much inequality rises.

Growth may be called pro-poor if it reduces inequality so that the poor benefit proportionally more than the non-poor. If we can achieve pro-poor growth, in view of Proposition 4, we can accelerate the rate of poverty reduction even with modest economic growth.

How does the increase in inequality affect the ultra-poor compared to the poor? Proposition 5 answers this question (the proof of which is given in Appendix).

Proposition 5: e_a increases monotonically with a .

This Proposition implies that the larger is the value of a , the greater will be the percentage increase in poverty for a given increase in inequality. This indicates that an increase in inequality hurts the ultra-poor more than the poor. This also means that the pro-poor growth benefits the ultra-poor more than the poor.

Next, we evaluate how important the initial level of inequality is in explaining poverty reduction.

Proposition 6: Growth elasticity of poverty h_a increases monotonically with initial level of inequality.⁴

Proposition 6, the proof of which is given in Appendix, implies that the higher the initial level of inequality, the lower the absolute magnitude of growth elasticity. Thus, the extent of poverty reduction during growth period will be higher in countries where the level of initial inequality is low (as in most Asian countries) than in countries where initial inequality is high (as in most Latin American countries). This conclusion is consistent with a number of studies – including those of Ravallion (1997) and Timmer (1997) – which have shown higher (lower) growth elasticity of poverty reduction in countries with the lower (higher) initial Gini indices. These observations suggest that higher inequality is bad for poverty reduction. This conclusion is based on the assumption that inequality does not change during the growth process. If it does change, the growth-poverty relationship becomes more complex.

Proposition 7: Inequality elasticity of poverty e_a decreases monotonically with the initial level of inequality.

Proposition 7, the proof of which is given in Appendix, tells us that the higher is the initial level of inequality, the smaller (larger) will be the increase (decrease) in

poverty as a consequence of increase in inequality. This is a somewhat surprising result. Its implication is that a country with a high level of initial inequality may not be able to achieve a faster reduction in poverty even with pro-poor growth policies. It also implies that an adverse impact of increase in inequality on poverty will be small when the country's initial level of inequality is high. Thus, the initial level of high inequality as bad as it is may not be too bad under certain circumstances. Generally, the lower initial level of inequality will be more conducive to poverty reduction.

The total poverty elasticity measures the impact of growth on poverty when inequality can also change with growth. It is the total poverty elasticity, which measures the extent to which economic growth reduces poverty. How is the total poverty elasticity related to the growth and inequality elasticity? To answer this question, write the proportional change in poverty as

$$\frac{dP_a}{P_a} = h_a \frac{dm}{m} + e_a \frac{dG}{G} \quad (3)$$

which on dividing by the growth rate of mean income gives the total poverty elasticity as

$$d_a = h_a + e_a I \quad (4)$$

where

$$d_a = \frac{dP_a / P_a}{dm / m}$$

and

$$I = \frac{dG / G}{dm / m}$$

d_a measures the percentage change in poverty when there is a growth rate of 1 percent and I measures the percentage change in the Gini index when there is a growth rate of 1 percent. When I is positive (negative), the growth process is accompanied by an increase (decrease) in inequality. Following Kakwani and Pernia (2000), growth is pro-poor (pro-rich) if I is negative (positive).⁵ Equation 4 suggests that we can define a pro-poor index as

$$z_a = d_a / h_a \quad (5)$$

which is the ratio of total poverty elasticity to the growth elasticity of poverty. It follows that growth is pro-poor when $z_a > 1$, meaning that the poor benefit proportionally more than the non-poor, i.e., growth results in a redistribution in favor of the poor. This would be the first-best outcome. When $0 < z_a < 1$, growth is not strictly pro-poor (i.e., growth results in a redistribution against the poor) even though it still reduces poverty incidence. This situation may be

characterized as 'trickle-down' growth. ⁶If $Z_a < 0$, economic growth actually leads to an increase in poverty. This situation may be characterized as 'immiserizing' growth (Bhagwati 1988).⁷

The Proposition 8 follows immediately from equation (2) and propositions 1 and 4.

Proposition 8: The total poverty elasticity decreases monotonically with the initial level of economic development provided growth is pro-poor.

Proposition 8 implies that the higher is the initial level of economic development, the larger will be the poverty reduction provided that growth is pro-poor, leading to a reduction in inequality. This also indicates that a richer country will have a greater poverty reduction than the poorer country even if the two countries are able to achieve the same growth rate and the same reduction in inequality. If growth is not pro-poor, then there may not exist a monotonic relationship between poverty reduction and the initial level of economic development.

Proposition 9 follows from equation 2 and propositions 6 and 7.

Proposition 9: The total poverty elasticity increases monotonically with the initial level of inequality provided growth is pro-poor.

Proposition 9 implies that the higher is the initial level of inequality, the smaller will be the reduction in poverty provided that growth is pro-poor. The proposition suggests that a country with a high level of initial inequality will have a smaller reduction in poverty than a country with a lower level of initial inequality even if the two countries are able to achieve the same growth rate and the same reduction in inequality. If growth is not pro-poor, then there may not exist a monotonic relationship between poverty reduction and the initial level of inequality. This lemma points out that following pro-poor policies have a short-term as well as a long-term impact on poverty reduction. In the short-term, it has a direct impact on poverty reduction because the absolute magnitude of poverty elasticity is larger when growth is pro-poor. In the long run, it reduces inequality in the country which increases the absolute magnitude of poverty elasticity, resulting in an even greater poverty reduction.

3 GROWTH-INEQUALITY TRADEOFF AND INITIAL CONDITIONS

Section 2 cast lights on the impact of changes in inequality on poverty. We have argued that growth may be classified as not pro-poor if inequality increases during the course of growth. Under this scenario, poverty would increase when mean income is kept constant.

A subsequent question arising is then as to how much growth would be required to offset the adverse effect of the increase in inequality on poverty. This deals with the trade-off between growth and inequality. In this section, we attempt to derive some propositions that relate the growth-inequality tradeoff with initial conditions of economic development and income inequality.

In equation (3), the first term in the right hand side measures the impact of growth on poverty and the second term captures the impact of changes in Gini on poverty. Equating the total proportional change in poverty to zero leads to the growth-inequality tradeoff index (j_a) proposed by Kakwani (1993).⁸

$$j_a = \frac{\partial m G}{\partial G m} = -\frac{e_a}{h_a} \quad (6)$$

The index j_a calculates the percentage of growth in mean income that is required to offset an increase in the Gini index of 1 percent. This suggests that the larger the value of the growth-inequality tradeoff index, the greater will be the benefits of adopting pro-poor policies that reduces inequality.

Proposition 10: j_a increases monotonically with the value of α .

Proposition 10, which is proved in the Appendix, implies that the pro-poor policies benefit the ultra-poor more than the poor because as the value of α increases, the greater weight is given to those whose income is much lower than the poverty line.

Proposition 11: The growth-inequality tradeoff index j_a increases monotonically with the level of economic development.

This proposition, proved in the Appendix, suggests that pro-poor policies that reduce inequality will be more effective for countries with higher initial level of economic development. A rational explanation for this proposition is that as mean income rises, the inequality elasticity rises at a faster rate than the growth elasticity, which indicates that poverty reduction can be facilitated by pro-poor strategies.

Proposition 12: The growth-inequality tradeoff index increases monotonically with the initial level of inequality.

This proposition proved in the Appendix implies that inequality-reducing policies will be more effective in achieving a reduction in poverty when initial level of inequality is high. Lundberg and Squire (2000) find that policies – including openness to trade, well-managed government fiscal policies, and equal distribution of land – are not only good for growth but also good for reducing inequality. If a country has very high initial level of inequality, then pay off from following inequality-reducing policies will be higher.

4 EMPIRICAL ESTIMATES OF POVERTY ELASTICITY

In the previous sections, we discussed various types of poverty elasticities in relation to the initial levels economic development and inequality. In this section, we present the empirical estimates of these elasticities. Our objective is to see how rapidly these elasticities vary with the initial levels of economic development and income inequality. In the calculations of these estimates, we assumed that the income distribution follows a two-parameter lognormal distribution (Aitchison and Brown 1966).

Table 1 presents the estimates of poverty measured by headcount ratio, poverty gap ratio and severity of poverty ratio. These estimates have been produced for alternative values of the Gini index and the mean income (which is expressed as percentage of the poverty line).

As presented in Table1, the smaller is the Gini index, the larger is the rate of poverty reduction with respect to the mean income. Figure 1 shows that an increase in the Gini index from 30 percent to 50 percent can make a substantial difference to the rate of poverty reduction. This suggests that higher initial inequality can vastly reduce the impact of economic growth on poverty reduction. For a given level of mean income, the incidence of poverty generally increases with the Gini index but there is one exception. That is when the mean income is 80 percent of the poverty line, the head count ratio decreases from 78.9 percent to 74.9 percent as the Gini index increases from 20 percent to 40 percent. This result can be thought of as counter-intuitive because, at a given income level, poverty is expected to rise as inequality worsens. Again, as pointed out, this situation can occur when the poverty line exceeds the mean income. Thus, it should be highlighted that the poverty line should never exceed the mean income.

TABLE 1

Poverty measures at different initial levels of mean income and Gini index

Initial Mean income	Initial Gini index				
	20	30	40	50	60
Head count ratio					
80	78.9	75.2	74.9	76.1	78.3
100	57.1	60.7	64.5	68.3	72.4
150	17.0	31.9	43.0	52.1	60.0
200	4.0	15.9	28.6	40.1	50.5
250	0.9	7.9	19.4	31.4	43.1
300	0.2	4.1	13.3	25.0	37.1
Poverty gap ratio					
80	25.2	30.9	37.1	43.8	51.0
100	14.2	21.5	28.9	36.7	44.8
150	2.8	8.7	16.1	24.5	33.8
200	0.5	3.6	9.5	17.3	26.6
250	0.1	1.6	5.8	12.6	21.5
300	0.0	0.7	3.7	9.5	17.8
Severity of poverty					
80	10.3	15.9	22.5	29.9	38.1
100	4.9	10.0	16.4	23.9	32.5
150	0.7	3.4	8.1	14.7	23.2
200	0.1	1.3	4.4	9.8	17.5
250	0.0	0.5	2.5	6.8	13.7
300	0.0	0.2	1.5	4.9	11.0

FIGURE 1

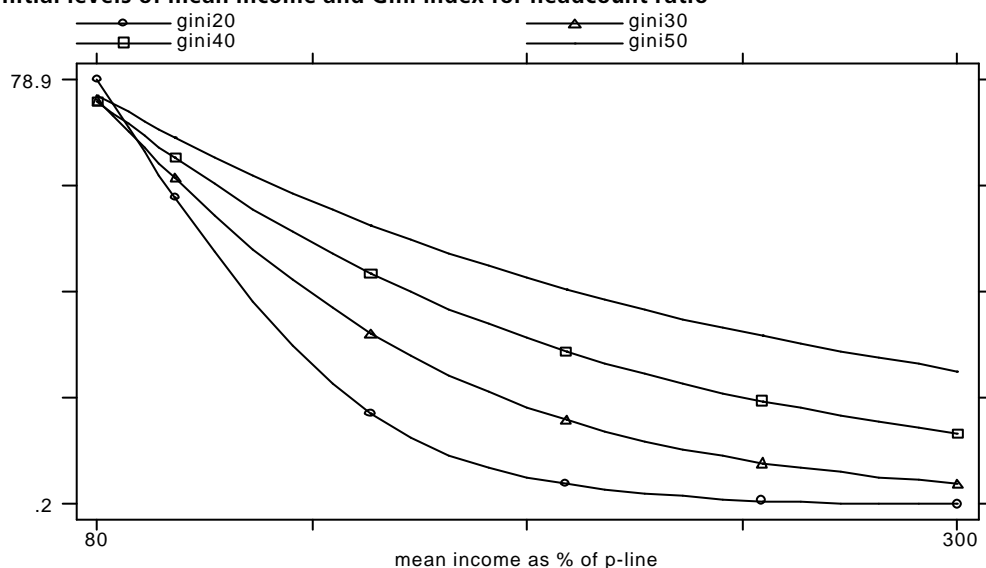
Initial levels of mean income and Gini index for headcount ratio

Table 2 presents the growth elasticity of poverty. The growth elasticity decreases with mean income and increases with inequality. This result suggests that a country with low initial level of mean income is likely to experience a slower poverty reduction. For instance, the growth elasticity of the headcount ratio is – 2.8 when the initial mean income is 200 (when the poverty line is twice the mean income) and the Gini index is 30 percent. When the initial level of mean income rises to 300, the growth elasticity is reduced to –3.9 percent. Thus, we can say that the poorer is the country (with low initial mean income), the harder is to reduce poverty.

A sustainable rapid economic growth increases the country's mean income, which in turn reduces the growth elasticity of poverty and thus results in even more rapid reduction in poverty. Thus, poverty can reduce with economic growth at an accelerated rate provided that the initial level of inequality is low and the growth process is not accompanied by any changes in inequality.

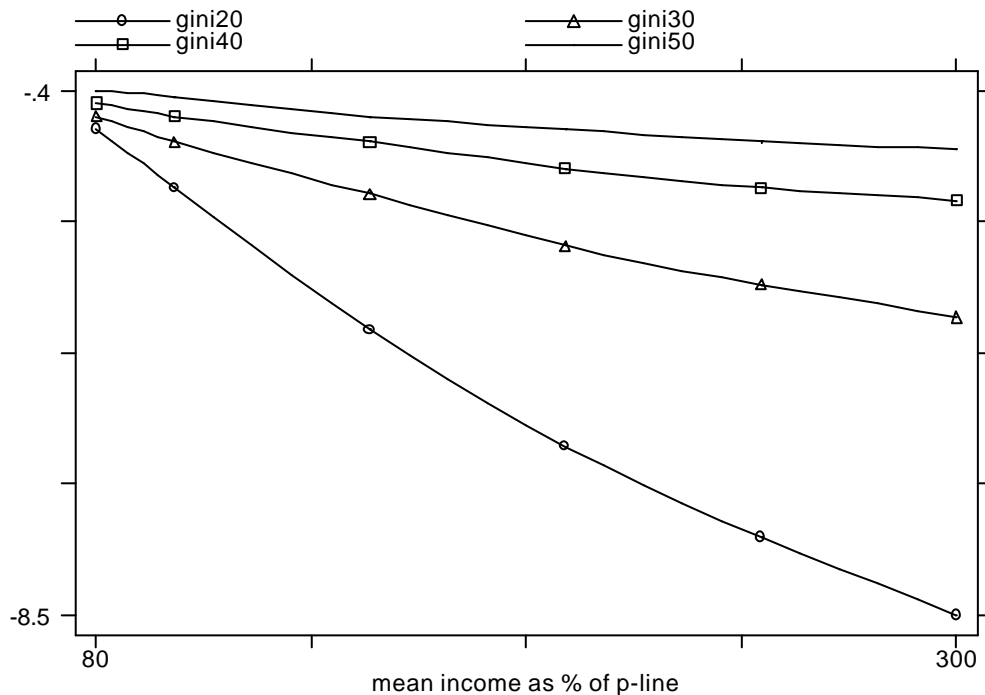
TABLE 2

Growth elasticity of poverty

Initial Mean income	Initial Gini index				
	20	30	40	50	60
	Head count ratio				
80	-1.0	-0.8	-0.6	-0.4	-0.3
100	-1.9	-1.2	-0.8	-0.5	-0.4
150	-4.1	-2.0	-1.2	-0.8	-0.5
200	-5.9	-2.8	-1.6	-1.0	-0.7
250	-7.3	-3.4	-1.9	-1.2	-0.8
300	-8.5	-3.9	-2.1	-1.3	-0.8
	Poverty gap ratio				
80	-2.1	-1.4	-1.0	-0.7	-0.5
100	-3.0	-1.8	-1.2	-0.9	-0.6
150	-5.0	-2.6	-1.7	-1.1	-0.8
200	-6.6	-3.3	-2.0	-1.3	-0.9
250	-7.9	-3.9	-2.3	-1.5	-1.0
300	-9.1	-4.3	-2.5	-1.6	-1.1
	Severity of poverty				
80	-2.8	-1.9	-1.3	-0.9	-0.7
100	-3.7	-2.2	-1.5	-1.1	-0.8
150	-5.6	-3.1	-1.9	-1.3	-0.9
200	-7.2	-3.7	-2.3	-1.5	-1.0
250	-8.5	-4.3	-2.6	-1.7	-1.1
300	-9.6	-4.7	-2.8	-1.8	-1.2

Table 2 also indicates that the growth elasticity of poverty increases rapidly with the initial level of inequality. For instance, as the Gini index increases from 30 to 50 percent, the growth elasticity becomes only -1 percent. Thus the effectiveness of growth in reducing poverty declines very rapidly as the initial inequality increases.

FIGURE 2

Growth elasticity of headcount ratio

The growth elasticity is the partial elasticity, which measures the effect of growth on poverty when the distribution does not change. In order to take account of the distributional change, we need to calculate the inequality elasticity, which measures the percentage change in poverty when inequality changes by 1 percent. The estimates of this elasticity are presented in Table 3.

Table 3 shows that the inequality elasticity increases monotonically with the initial level of mean income: the poorer is the country, the smaller is the inequality elasticity. If economic growth is accompanied by an increase in inequality, richer countries will be more adversely affected than poorer countries. However, if the growth process is pro-poor, indicating that growth is accompanied by the declining inequality, richer countries will enjoy greater poverty reduction than poorer countries.

TABLE 3

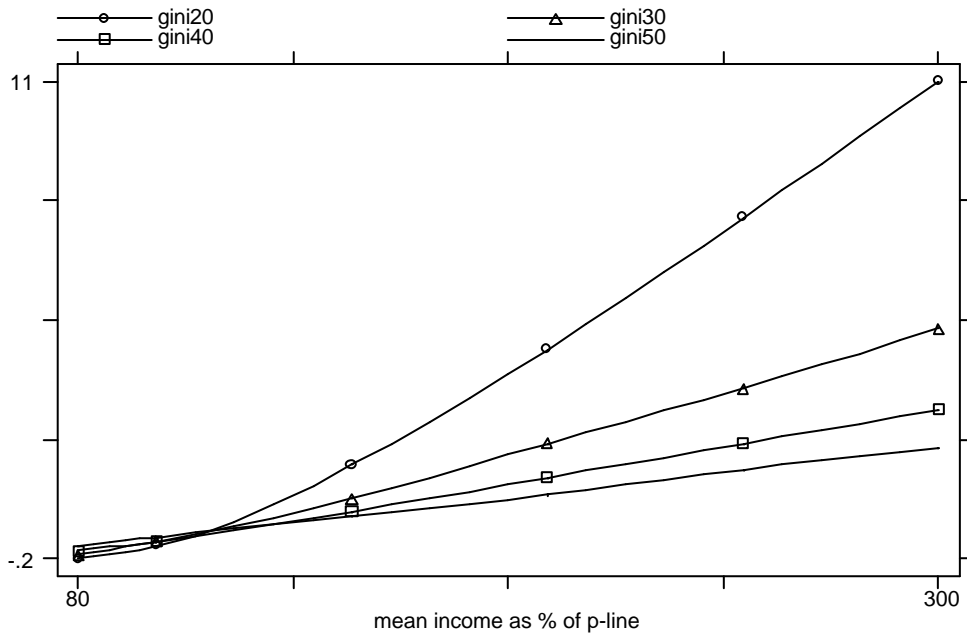
Inequality elasticity of poverty

Initial Mean income	Gini index				
	20	30	40	50	60
	Head count ratio				
80	-0.2	-0.1	0.0	0.1	0.2
100	0.1	0.2	0.2	0.3	0.4
150	2.0	1.2	0.9	0.8	0.8
200	4.7	2.5	1.7	1.3	1.2
250	7.8	3.8	2.5	1.9	1.6
300	11.0	5.2	3.3	2.4	2.0
	Poverty gap ratio				
80	0.4	0.6	0.7	0.8	0.9
100	1.0	1.0	1.0	1.1	1.1
150	3.3	2.4	2.0	1.8	1.7
200	6.3	3.9	2.9	2.5	2.3
250	9.5	5.4	3.9	3.2	2.8
300	12.9	6.8	4.7	3.8	3.2
	Severity of poverty				
80	1.0	1.2	1.2	1.3	1.4
100	1.8	1.7	1.7	1.7	1.7
150	4.5	3.3	2.8	2.6	2.4
200	7.7	5.0	3.9	3.4	3.1
250	11.1	6.6	4.9	4.1	3.6
300	14.6	8.2	5.9	4.8	4.2

Table 3 also shows that the inequality elasticity of the poverty gap ratio is larger than that of the headcount ratio and smaller for the severity of poverty ratio. This implies that the pro-poor growth will benefit the ultra poor more than the poor. It also suggests that the pro-rich growth will hurt the ultra poor more severely than the poor.

The inequality elasticity declines rapidly with the initial level of inequality: the higher is the initial level of inequality, the smaller will be the impact on poverty. When the growth process is accompanied by an increase in inequality, then it is better to have a high level of initial inequality. This suggests that in some circumstances, the higher initial inequality may not be that much harmful. If, however, growth is pro-poor, then with the same level of growth the poverty reduction will be higher when the initial level of inequality is low.

FIGURE 3

Inequality elasticity of headcount ratio

Since the growth and inequality elasticities are affected differently by initial levels economic development and inequality, we have to look at the total poverty elasticity, which measures the total effect of growth on poverty.

As can be seen from (3), to be able to calculate the total poverty elasticity, we need to know the value of I (which is the elasticity of inequality with respect to mean income). We cannot say on a priori ground what the sign and magnitude of I will be. The relation between growth and inequality has been dealt with by a number of studies. The growth-inequality debate can be traced back to the well-known Kuznets hypothesis. In his famous 1955 article, Simon Kuznets found an inverted-U pattern between per capita incomes and inequality based on cross-section of countries: as per capita income rises, inequality first worsens and then improves. The major driving force was presumed to be structural change occurred because of labor shifts from a poor and less productive traditional sector to a more productive and differentiated modern sector. While a number of studies have supported his hypothesis, recent development literature on growth and distribution tends to discard the previous trade-off conclusion.⁹ For instance, Deininger and Squire (1996) conducted a comprehensive test of the hypothesis using higher-quality data containing 682 observations on the Gini index for 108 countries and found that there was no evidence of an inverted-U curve for individual countries.

Studies such as Dollar and Kraay (2000) suggest that growth is generally distribution-neutral and poverty reduction is driven by growth rather than by changes in inequality. It means that growth is accompanied by no change in inequality (I is generally zero). From (3), we can argue that the change in poverty is determined by the magnitude of the growth elasticity of poverty. If this is true,

then growth can reduce poverty at a proportionally increasing rate because, as growth increases the mean income of the country, the growth elasticity of poverty reduces, which in turn reduces poverty at an increasing rate. Thus, even a small growth rate will be able to reduce poverty rapidly in the long run. This has not happened. In many countries, the high incidence of poverty has persisted in spite of having decent growth rates. How can this be explained? A simple answer to this question is that the cross-country analysis is indicative of average trends, while individual country experiences can vary quite significantly. The insignificant growth-inequality relationship does not mean that economic growth is distribution-neutral in all countries.

Equation (3) shows that the impact of inequality on the total poverty is given by the product of I and e_a , indicating that even if I is small, it can have a large impact on poverty depending on the magnitude of e_a . To get a sense of its magnitude, we computed the total poverty elasticity under the assumption that I is 0.5. The results are presented in Table 4.

TABLE 4

Total poverty elasticity when growth is not pro-poor

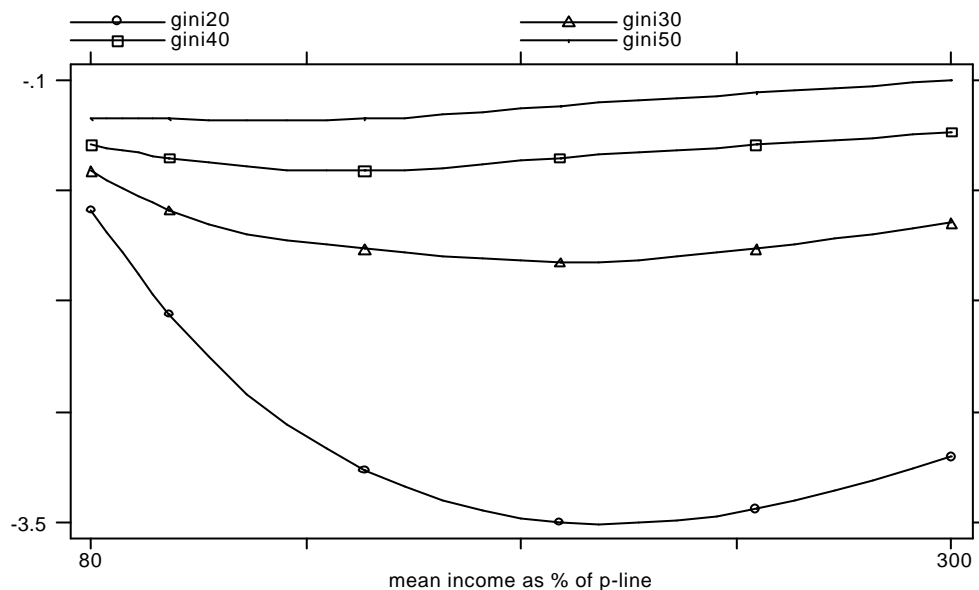
Initial Mean income	Initial Gini index				
	20	30	40	50	60
	Head count ratio				
80	-1.1	-0.8	-0.6	-0.4	-0.2
100	-1.9	-1.1	-0.7	-0.4	-0.2
150	-3.1	-1.4	-0.8	-0.4	-0.2
200	-3.5	-1.5	-0.7	-0.3	-0.1
250	-3.4	-1.4	-0.6	-0.2	0.0
300	-3.0	-1.2	-0.5	-0.1	0.1
	Poverty gap ratio				
80	-1.9	-1.1	-0.7	-0.3	-0.1
100	-2.5	-1.3	-0.7	-0.3	-0.0
150	-3.3	-1.5	-0.7	-0.2	0.1
200	-3.4	-1.4	-0.5	-0.1	0.2
250	-3.2	-1.2	-0.4	0.1	0.4
300	-2.7	-0.9	-0.2	0.3	0.5
	Severity of poverty				
80	-2.3	-1.3	-0.7	-0.3	0.0
100	-2.8	-1.4	-0.7	-0.2	0.1
150	-3.4	-1.4	-0.5	-0.0	0.3
200	-3.3	-1.2	-0.3	0.2	0.5
250	-2.9	-0.9	-0.1	0.4	0.7
300	-2.3	-0.6	0.2	0.6	0.9

It is evident that the effectiveness of growth in reducing poverty is much reduced. The poverty elasticity does not reduce monotonically with the initial level of mean income. It reduces until the mean income is 200 (as a percentage of poverty line) and then starts increasing. Thus, growth does not reduce poverty at an increasing rate. The absolute magnitude of elasticity becomes very small as the initial level of inequality becomes 40 percent or more. The elasticity becomes even positive when the initial Gini index is high.

The results in Table 4 show that the total elasticity of poverty is highly sensitive to the initial levels of income and inequality. It is, therefore, not surprising to find that different countries have vastly different rates of poverty reduction with the same growth rate because they are at different levels of economic development and have different levels of inequality. The cross-country regressions give only the average elasticity that conceals a considerable variation across countries. What is really required is the detailed country case studies that reveal the nature of growth (whether pro-poor or pro-rich) and how growth can be made pro-poor in order to achieve a rapid reduction in poverty.

FIGURE 4

Total poverty elasticity when growth is not pro-poor: headcount ratio



5 POVERTY PROSPECTS TO 2015: SELECTED COUNTRY STUDY IN ASIA

The next question we address is how poverty prospects are likely to evolve in some selected Asian countries over the next 15 years. Halving poverty between 1990 and 2015 is one of the key millennium development goals (MDGs). What is the annual growth rate that would be required to halve the percentage of poor between 1990 and 2015? This growth rate will vary across countries depending on their initial levels of economic development and inequality, which is our prime interest in this section.

Table 5 presents the indicators of expenditure poverty for selected countries in Asia in 1990.¹⁰ The common poverty line used are \$1 per day and \$2 per day lines after local currency expenditures data have been converted into dollars and after the purchasing power parity (PPP) correction. The headcount ratio is used as the poverty measure, which is the proportion of the population below the poverty lines. Since initial conditions in different countries are quite different, their poverty elasticities vary widely. To calculate the growth rates required to achieve the targeted poverty reduction, we need to compute the poverty elasticity for each country. These calculations are done under the assumption that per capita consumption follows a two-parameter lognormal distribution. This assumption is not necessary if we have the unit-record data on per capita consumption of each sample household.

TABLE 5
Poverty indicators in 1990: Selected countries in Asia

Country	Per capita expenditure (at 1993 PPP)	Gini index	% of poor	
			\$1 per day	\$2 per day
China	57.1	33.5	27.5	70.4
Indonesia	61.5	33.2	23.3	66.0
Korea	233.4	33.4	0.2	3.8
Malaysia	139.7	47.9	12.7	35.3
Philippines	86.1	42.8	21.0	52.4
Thailand	110.1	45	15.7	42.5
Bangladesh	45.8	28.6	35.1	83.0
India	41.7	31.2	44.6	86.1
Nepal	48.5	33.4	37.0	78.9
Pakistan	41.7	33.2	46.4	85.4
Sri Lanka	86.8	30.1	6.6	40.7

Source: Selected from Chen and Ravallion (2000).

As we plan to project the required growth rates over the next 15 years, we require the long-term poverty elasticity. It is important to calculate the long-term elasticity because with economic growth, the country's average standard of living increases every year, which decreases the growth elasticity on the one hand and

increases the inequality elasticity on the other. Thus, we need to calculate the total poverty elasticity utilizing the rates of decrease in growth elasticity and increase in inequality elasticity. The estimates of the long-term total poverty elasticity are presented in Table 6.

TABLE 6

Poverty elasticity: Head count ratio

Country	Pro-poor growth	Neutral growth	Pro-rich growth
China	-3.0	-2.2	-1.5
Indonesia	-3.3	-2.4	-1.5
Korea	-9.8	-5.4	-1.3
Malaysia	-3.5	-1.9	-0.5
Philippines	-2.9	-1.8	-0.9
Thailand	-3.3	-1.9	-0.7
Bangladesh	-3.0	-2.3	-1.8
India	-2.2	-1.8	-1.4
Nepal	-2.5	-1.9	-1.4
Pakistan	-2.0	-1.6	-1.2
Sri Lanka	-5.7	-3.8	-2.1
Two dollars a day			
China	-1.1	-1.0	-0.9
Indonesia	-1.3	-1.1	-0.9
Korea	-6.1	-3.8	-1.7
Malaysia	-2.0	-1.3	-0.6
Philippines	-1.4	-1.1	-0.7
Thailand	-1.7	-1.2	-0.7
Bangladesh	-0.8	-0.8	-0.8
India	-0.6	-0.6	-0.6
Nepal	-0.8	-0.7	-0.7
Pakistan	-0.6	-0.6	-0.6
Sri Lanka	-2.5	-2.0	-1.5

We have computed these elasticities using three different scenarios. Our first scenario is that growth is distribution neutral: the growth process does not change inequality so that every individual in the society receives the same proportional benefits from growth. Our pro-poor scenario is that every one percent growth rate is accompanied by a reduction of 0.3 percent in the Gini index. On the other hand, our pro-rich or anti-poor scenario is that every one percent growth rate is accompanied by an increase of 0.3 percent in the Gini index.

It can be seen that the values of poverty elasticity are quite different for different scenarios. The pro-poor scenario gives the largest poverty reduction

elasticity. For instance, the elasticity for Korea is -9.8 in pro-poor growth scenario, which becomes -1.3 in the pro-rich scenario. The richer is a country, the larger the difference in poverty elasticity will be under different scenarios.

Table 7 presents the growth rates that would be required in each country in order to achieve the millennium goal of halving the percentage of poor. As can be seen, these growth rates are not very high, particularly under the pro-poor scenario. It should be emphasized that these are the long-run annual growth rates over a period of 25 years. Many countries may not be able to achieve a long-run sustained growth rates. In the case of India, the average annual growth rate of consumption was only 0.4 percent over the 40 years period. If inequality increases by a larger proportion than growth, then we will require much larger growth rates.

TABLE 7

Growth rates required to halve poverty by 2015

Country	Pro-poor growth	Neutral growth	Pro-rich growth
			One dollar a day
China	0.91	1.24	1.87
Indonesia	0.82	1.14	1.77
Korea	0.28	0.51	2.05
Malaysia	0.79	1.44	5.35
Philippines	0.94	1.48	3.12
Thailand	0.84	1.42	3.77
Bangladesh	0.92	1.17	1.55
India	1.22	1.52	1.96
Nepal	1.10	1.45	2.02
Pakistan	1.34	1.69	2.21
Sri Lanka	0.48	0.72	1.28
Two dollars a day			
China	2.53	2.81	3.17
Indonesia	2.18	2.49	2.89
Korea	0.45	0.73	1.60
Malaysia	1.40	2.18	4.43
Philippines	1.94	2.57	3.69
Thailand	1.59	2.28	3.82
Bangladesh	3.49	3.51	3.55
India	4.68	4.57	4.52
Nepal	3.48	3.65	3.86
Pakistan	4.86	4.78	4.77
Sri Lanka	1.08	1.36	1.78

6 CONCLUSION

In the paper, we have demonstrated analytically that the initial levels of economic development and income inequality matter for the reduction of poverty. We showed that the growth elasticity of poverty decreases monotonically with the initial level of development. That is to say, under the distribution neutral assumption the higher initial level of development leads to a greater reduction in poverty at a given rate of growth. It can be argued, thus, that economic growth with inequality unchanged results in an increasingly proportional reduction in poverty due to the declining nature of growth elasticity of poverty. If growth process were distribution neutral as suggested by several cross-country regression studies, even a small rate of growth would lead to a substantial reduction of poverty in most countries of the world. This has not happened in reality. In many countries, the high incidence of poverty has persisted in spite of having decent growth rates. This suggests that the relationship between growth and poverty reduction is rather complex and in this context, our study has provided explanations as to why some countries have succeeded in achieving a higher reduction in poverty than others with similar growth performances.

The main focus of the paper has been on measuring the impact of changes in inequality on poverty. Intuitively, given other things constant as inequality increases poverty should also increase. The paper shows that this requirement is satisfied only when the poverty line is less than mean income. This result indicates that the poverty line should never exceed mean income. For most of low-income developing countries, \$2 a day poverty line converted to local currency at 1993 PPP exceeds per capita mean consumption. Thus, \$2 a day poverty line is not appropriate for a large number of developing countries.

The paper also shows that for a given increase in the Gini index, the poverty increase will be larger as the initial level of mean income is higher. This suggests that faster growth may lead to a slower reduction or even increase in poverty depending on how much inequality rises. Yet if we can achieve a pro-poor growth (growth that reduces inequality), poverty reduction can be accelerated even with a moderate rate of economic growth. This indicates that even a moderate rate of pro-poor growth can have a greater impact on poverty reduction compared to a higher growth rate but not pro-poor. This is related to the growth-redistribution debate as to poverty reduction, of which its importance has often been overlooked. The methodology presented in the paper helps us to understand insights of the debate in making a policy choice between rapid growth with rising inequality and slower growth with falling inequality.

A surprising result that emerges from the paper is that the higher is the initial level of inequality, the smaller (larger) will be the increase (decrease) in poverty as inequality increases. Its implication is that a country with a high level of initial inequality may not be able to achieve a faster reduction in poverty even with pro-poor growth policies. It also implies that an adverse impact of increase in inequality on poverty will be small when the country's initial level of inequality is high. While in general the lower initial level of inequality will be more conducive to

poverty reduction, the initial level of high inequality may not be too bad under certain circumstances.

Finally, the theoretical elasticities derived in the paper are utilized to compute growth rates in selected countries in Asia, which would be required to achieve the Millennium Development Goal of halving the incidence of poverty between 1990 and 2015. The empirical results show that the required growth rates are not high particularly under the pro-poor scenario. These are long-term annual growth rates over the period of 25 years. Many countries face the problem of achieving a rapid growth over a long period. A better policy option for such countries may be to aim for a long-term sustainable growth rate (even if moderate), which benefits the poor at least as much as the non-poor.

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APPENDIX: PROOF OF PROPOSITIONS

Proposition 1: Growth elasticity of poverty for the entire class of poverty measures P_a (except headcount ratio) decreases monotonically with the initial level of economic development.

The growth elasticity of P_a measures has been derived by Kakwani (1993) and is given by

$$h_a = \frac{\partial P_a}{\partial m} \frac{m}{P_a} = - \frac{a[P_{a-1} - P_a]}{P_a} \quad (A1)$$

for $a > 0$, which is always negative because P_a is a monotonically decreasing function of a : $P_{a-1} > P_a$ for all $a > 0$.

Differentiating h_a in (A1) with respect to m gives

$$\frac{\partial h_a}{\partial m} = - \frac{aP_{a-1}}{mP_a} [h_{a-1} - h_a]$$

which is negative in view of Proposition 2. This proves Proposition 1.

Proposition 2: Growth elasticity of poverty h_a decreases monotonically with a .

It can be easily demonstrated that

$$h_a - h_{a-1} = - \frac{1}{P_a P_{a-1}} [aP_{a-1}(P_{a-1} - P_a) + P_a(P_{a-2} - P_{a-1})]$$

which is always negative because of $P_{a-1} > P_a$ for all $a > 0$, implying that $h_a < h_{a-1}$ for all a . This proves Proposition 2.

Proposition 3: Inequality elasticity of poverty e_a is always positive only when poverty line is less than the mean income.

Following Kakwani (1993), the elasticity of entire class of poverty measures P_a with respect to Gini index is given by

$$\begin{aligned} e_a &= \frac{(m-z)f(z)}{F(z)}, \text{ when } a = 0 \\ &= \frac{a}{zP_a} [(m-z)P_{a-1} + zP_a], a \geq 1 \end{aligned} \quad (A2)$$

which will be always positive only when $m > z$. This proves Proposition 3.

Proposition 4: Inequality elasticity of poverty e_a (for $a \geq 1$) increases monotonically with the initial level of economic development.

Differentiating e_a in (A2) with respect to m gives

$$\frac{\partial e_a}{\partial m} = \frac{aP_{a-1}}{zP_a^2} [m + (m-z)(h_{a-1} - h_a)]$$

which, in view of Proposition 2, is always positive when $m \geq z$. This proves Proposition 4.

Proposition 5: e_a increases monotonically with a .

From equation (A2), we can write

$$e_a - e_{a-1} = \frac{1}{zP_a P_{a-1}} [a(m-z)P_{a-1}(P_{a-1} - P_a) + P_a(P_{a-1} - P_{a-2}) + mP_{a-2}P_a + zP_a(P_{a-1} - P_{a-2})]$$

which is positive based on the fact that $P_{a-1} - P_a > 0$ for all $a \geq 1$. This leads to Proposition 5.

Proposition 6: Growth elasticity of poverty h_a ($a \geq 1$) increases monotonically with initial level of inequality.

Differentiating h_a in (A1) with respect to G gives

$$\frac{\partial h_a}{\partial G} = -\frac{aP_a P_{a-1}}{GP_a^2} [e_{a-1} - e_a]$$

which is positive in view of Proposition 5. This proves Proposition 6.

Proposition 7: Inequality elasticity of poverty e_a decreases monotonically with the initial level of inequality.

Similarly, differentiating e_a in (A2) with respect to G gives

$$\frac{\partial e_a}{\partial G} = -\frac{aP_{a-1}(e_a - e_{a-1})(m-z)}{GP_a z}$$

which is negative based on Proposition 5. This proves Proposition 7.

Proposition 10: Φ_α increases monotonically with the value of α .

Using A1 and A2 in (6) gives the tradeoff index j_a for the FGT class of poverty measures as:

$$\Phi_\alpha = \frac{zP_\alpha + (\mu - z)P_{\alpha-1}}{z(P_{\alpha-1} - P_\alpha)} \quad (A3)$$

which can be written as

$$\varphi_{\alpha} - \varphi_{\alpha-1} = \frac{\mu(P_{\alpha-2}P_{\alpha} - P_{\alpha-2}^2)}{z(P_{\alpha-1} - P_{\alpha})(P_{\alpha-2} - P_{\alpha-1})}$$

which will be always positive. This proves Proposition 10.

Proposition 11: The growth-inequality tradeoff index φ_{α} increases monotonically with the level of economic development.

Differentiating (A3) with respect to μ gives

$$\frac{\partial \varphi_{\alpha}}{\partial \mu} = \frac{(\alpha-1)(P_{\alpha}P_{\alpha-2} - P_{\alpha-1}^2)}{zP_{\alpha}P_{\alpha-1}(P_{\alpha-1} - P_{\alpha})^2}$$

which can be proved to be always positive. This proves Proposition 11.

Proposition 12: The growth-inequality tradeoff index increases monotonically with the initial level of inequality.

Finally, Differentiate φ_{α} in (A3) with respect to Gini gives

$$\frac{\partial \varphi_{\alpha}}{\partial G} = \frac{\mu P_{\alpha} P_{\alpha-1} (\varepsilon_{\alpha} - \varepsilon_{\alpha-1})}{zG(P_{\alpha-1} - P_{\alpha})^2}$$

which in view of Proposition 5 is always positive for all $\alpha \geq 1$. This proves Proposition 12.

NOTES

1. When $\alpha = 0, 1$, and 2, poverty measure becomes the headcount ratio, poverty gap ratio and the severity of poverty, respectively.
2. Instead of income, one can use consumption to measure poverty. Consumption is more widely used than income. The methodology presented in this section does not change when we replace income by consumption.
3. Bourguignon (2002) has proved this proposition for $\alpha = 0$ and 1 under the assumption that the distribution of income is lognormal. The proof of this proposition given in Appendix does not make any such assumption. This result does not hold when income distribution is not lognormal
4. Bourguignon (2002) has also proved this proposition for 0 and 1 under the assumption that the distribution of income is lognormal. He shows that the growth elasticity increases monotonically with, the standard deviation of logarithm of income. Our proof is based on the Gini index.
5. The World Bank defines growth as pro-poor if it reduces poverty, howsoever small (Ravallion 2004). This is a very weak requirement. It implies that growth can be pro-poor even if the poor receive a very small share of the total benefits of growth and rich receiving a very large share. The word pro-poor implies that the poor should receive more not less benefits of growth. According to the World bank's definition, inequality can increase as long as poverty does not increase. Our definition of pro-poor growth requires that both inequality and poverty should reduce.
6. When $z_a = 1$, it means that economic growth is distributionally neutral, ie., it has no impact on inequality.
7. When $z_a = 0$, it means that economic growth has no impact on poverty.
8. For an empirical application of this trade off index, see Kakwani(2000).
9. Studies that supported the Kuznets hypothesis include Kravis (1960), Oshima (1962), Adelman and Morris (1971), Paukert (1973), Ahluwalia (1974, 1976), Robinson (1976), and Ram (1988). Studies that challenged the hypothesis were Anand and Kanbur (1984), Fields (1989), Oshima (1994), and Deininger and Squire (1996). In fact, recent consensus is that there exists no solid evidence of increase in inequality with economic growth. Ravallion and Chen (1997) have provided an evidence of declining inequality with economic growth, using a sample of 64 changes in inequality and growth during 1981-1994.
10. These data come from Chen and Ravallion (2000), which can be referred to for details of the data.