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Measuring Changes in Poverty: A Methodological Case Study of Indonesia during an Adjustment Period

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Analysis of the effects of policy changes on the poor is often hindered by the difficulties inherent in measuring poverty and comparing levels of poverty before and after policy changes. This article outlines two techniques which can overcome many of these measurement problems: stochastic dominance conditions, which can facilitate a robust poverty ranking of distributions of living standards; and a decomposable poverty index, which allows measured changes in aggregate poverty to be disaggregated into their various components, such as the changes among population subgroups, and growth and redistributive components. These techniques can be applied to a wide range of indicators of economic well-being and poverty lines, and to assumptions about the poor. The approaches are illustrated using household survey data from Indonesia before and after external shocks and the subsequent structural adjustment program in the mid-1980s. The study finds that favorable initial conditions and a pro-poor pattern of growth enabled Indonesia to maintain its momentum in poverty alleviation during the period.

Comparisons of the magnitude and severity of poverty can provide direct evidence of an economy's progress in raising living standards of the poor and throw light on how the poor are affected by specific macroeconomic changes and public policies. Several difficult methodological issues cloud such comparisons, however. The chosen indicator of a household's economic well-being must be readily quantified, it must reflect the range of factors that contribute to well-being, and it must be comparable across sectors, regions, and periods. Having

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chosen an indicator of individual well-being, an equally contentious issue is the selection of a minimal acceptable level of that indicator beyond which a person is not deemed to be poor: the poverty line. Finally, there is the choice of a summary statistic with which to aggregate information on poverty across individuals or households.

Several measures have been proposed. The most commonly used, the head-count index, measures poverty simply as the fraction of the population who are poor. Other indexes account for the severity of poverty, by weighing extremes of poverty more heavily. These measurement issues can make poverty assessment controversial. If, for example, conditions for the poorest have deteriorated without other changes, the head-count measure will not reveal this fact but other measures may. Furthermore, the magnitude of poverty measured by any index will depend on the chosen indicator of well-being and the level of the poverty line. Thus when evaluating how poverty has changed, different methods of measurement may produce different conclusions.

Though many of these issues remain unresolved, substantial progress in the theory of welfare and poverty measurement has been made in recent years. Using data from Indonesia, we will illustrate how some of these advances in methodology can help resolve the empirical uncertainties surrounding poverty comparisons over time.

The proportion of Indonesians who attained minimal nutritional and other consumption needs rose significantly in the 1970s (Rao 1984; CBS [Central Bureau of Statistics] 1984). Several writers have expressed concern, however, that this success in poverty alleviation has not been sustained through the difficult 1980s (see, for example, Jayasuriya and Manning 1988, Sundrum 1988, Booth and Sundrum 1988, and Papanek 1988). The major external shock of the 1980s was the 63 percent fall between 1981 and 1986 in the price of Indonesia's main export and source of public revenue, oil. During 1986 alone, this resulted in a drop of about a third in the country's external terms of trade. The government responded quickly with cuts in real public spending, sweeping tax reforms, and in September of 1986, a 31 percent currency devaluation. It is now widely agreed that these policies were effective in stabilizing the main macroeconomic aggregates. How did the external shocks, and the government's policy response, affect Indonesia's poor in the short term?

The effect on the poor of reduction in government spending will typically depend on the allocation of the cuts across different expenditure categories. Much of the immediate burden of adjustment fell on domestic savings and investment rather than private consumption. Government saving was cut by more than 50 percent and public investment fell by more than 15 percent in 1986 alone, whereas private consumption actually grew modestly over the 1984-87 period. When average household consumption is maintained, poverty will not increase provided that (and it is an important proviso) the poor do not lose from changes in the *distribution* of consumption. It appears that the government did try to prevent its expenditure cuts from falling too heavily on current

expenditures and investments for programs which disproportionately benefit the poor: transfers to the provinces were maintained, as were labor-intensive rural infrastructure projects, and the shares of social services and agriculture in total government development expenditures rose (World Bank data; Ahmed and Peters 1990). The efficacy of these measures in protecting the poor is less obvious, however (Keuning and Thorbecke 1989).

The effects on the poor of the changes in relative prices associated with structural adjustment are also unclear. Devaluation will increase prices of traded goods and thus draw producers, employment, and income out of nontradables into the traded goods sector. The currency devaluations and the boom in nonoil exports undoubtedly helped the rural sector: agriculture accounted for more than half of the rise in nonoil exports between 1986 and 1987 (Bank of Indonesia 1988). The rural poor would only have gained, however, if they were net producers of tradable goods. There are likely to be many poor households in both rural and urban areas which are not. There has also been some indication of a decrease in real agricultural wage rates in Java during the 1980s (Papanek 1988), though conflicting evidence also exists (Collier and others 1988).

Another issue is whether the poor can buffer their consumption from the adverse *income* effects of short-run macroeconomic shocks and policy responses. It is not implausible that many of the poor do have strategies for coping with short-run income declines. To the extent that they can increase their hours of work, take second jobs, draw on savings, or obtain assistance from a network of friends and relatives, the poor may be able to maintain consumption through an adjustment period (for evidence on informal social insurance arrangements in Java, Indonesia, see Ravallion and Dearden 1988). We do not know the extent to which these coping strategies will be effective in a recessionary period, and to what extent they will be available to the poorest of the poor.

Thus neither theory nor evidence are conclusive in predicting the effects of the external shocks and domestic adjustments on Indonesia's poor. Fortunately we have access to two large and comparable household surveys for 1984 and 1987, spanning the adjustment period. The twin objectives of this article are: (i) to describe several recent theoretical advances in poverty analysis, and (ii) to illustrate their use through an evaluation of the change in poverty and undernutrition in Indonesia over the 1984–87 period. Section I informally discusses the methodological issues related to the measurement of poverty and undernutrition. Section II proposes two simple decomposition formulas which can throw light on the contributions of sectoral gains and population shifts (on the one hand), and economic growth and changes in inequality (on the other) to aggregate changes in poverty. Our main empirical results are presented in section III, in which we give poverty assessments for various indicators of the standard of living of the poor. Section IV uses the decomposition formulas given in section II to try to better understand the sources of the measured change in aggregate poverty. The importance of the country's favorable distributional parameters at the beginning of the period is also discussed. The sensitivity of these results to

measurement errors in rates of rural inflation and growth rates of consumption are assessed in section V. In the light of our findings, section VI discusses Indonesia's prospects for future poverty alleviation, and section VII offers conclusions.

I. MEASURING POVERTY

Two fundamental questions arise when measuring poverty. The first is how an individual's "standard of living" should be quantified, and relatedly, how a minimum acceptable standard, the poverty line, is to be determined. The second is how the degree of poverty relative to a particular poverty line is measured and how this is aggregated across those who are deemed to be poor. Measurement will always be constrained by data availability. Individuals and their environments will differ in many ways which might be deemed relevant in principle but are not readily quantifiable. Similarly, variability in nutrient requirements between people is important, but difficult to quantify.

We shall discuss some of these problems in section III, but we begin here by assuming that an acceptable indicator is available for an individual's living standard. If the indicator values are arranged in ascending order from poorest to richest, we have a distribution of that indicator within the population. We then face the second problem: how to compare distributions of that indicator which, in the application here, are the observed survey distributions at two dates.

A large theoretical literature has established several desirable properties for poverty measures (for an excellent survey, see Foster 1984). The measure of poverty should increase when the income of a poor household decreases (the monotonicity axiom) or when income is transferred from a poor to a less poor household (the transfer axiom). These criteria imply that one wishes the measure to take account of the distribution of living standards among the poor, not simply to indicate how many people are poor. It is also desirable that the poverty measure be additively decomposable by population subgroup so that aggregate poverty can be represented as an appropriately weighted sum of poverty levels in the component subgroups of a population. This property facilitates the construction of poverty profiles—showing how poverty varies across subgroups of a population—and it also ensures that when poverty increases in one subgroup without any other changes, aggregate poverty will also increase.

A class of additively decomposable measures is that proposed by Foster, Greer, and Thorbecke (1984; hereafter FGT), and it is this which we will employ here. The FGT class contains a number of other commonly used poverty measures as special cases. The most commonly used poverty measure has been the head-count index, which gives the proportion of the population with a standard of living below the poverty line. But it does not indicate *how* poor the poor are: it is unchanged if a poor individual becomes poorer. One index that does reflect changes in the degree of poverty among the poor is the poverty gap index. This is the average, over all households, of the gaps between poor households' stan-

dards of living and the poverty line, as a ratio of the poverty line. This gives a good indication of the *depth* of poverty. But the poverty gap index is not sensitive to the distribution of the standard of living indicator among the poor, and so it does not capture the *severity* of poverty. The FGT class of measures subsumes these two measures, *and* provides a distributionally sensitive measure, through the choice of a parameter, α : the larger is α , the greater the weight given by the index to the severity of poverty.

The FGT class of measures treats poverty as dependent on the poverty gap ratio, the parameter α entering as a power of that ratio. Let y_j denote consumption per capita for the j th person's household when households are ranked in ascending order of consumption (taking consumption per capita as the indicator). The poverty line is z and the poverty gap for individual j is $g_j = z - y_j$. Total population size is denoted as n , and q is the number of poor people. The FGT class of measures may then be written as:

$$(1) \quad P_\alpha = \frac{1}{n} \sum_{j=1}^q \left(\frac{g_j}{z} \right)^\alpha$$

where g_j/z is the poverty gap ratio. Three members of the FGT class are considered here:

- The FGT poverty measure for $\alpha = 0$. This is simply the head-count index, given by the proportion of the population with a standard of living below the poverty line: $P_0 = q/n$. For example, if 40 percent of the population are deemed to be poor, then $P_0 = 0.4$.
- The measure for $\alpha = 1$. This is the average poverty gap in the population, expressed as a proportion of the poverty line:

$$P_1 = \frac{1}{n} \sum_{j=1}^q \frac{g_j}{z}$$

Thus a value of $P_1 = 0.1$ means that the aggregate deficit of the poor relative to the poverty line, when averaged over all households (whether poor or not), represents 10 percent of the poverty line. (P_1/P_0 is the mean poverty gap of the poor as a proportion of the poverty line:

$$\frac{P_1}{P_0} = \frac{1}{q} \sum_{j=1}^q \frac{g_j}{z} .$$

- The measure for $\alpha = 2$. Unlike the other two, this measure is sensitive to the distribution of income among the poor. It satisfies the main axioms for a desirable poverty measure in the literature, including Sen's (1976) "transfer axiom," which requires that when a transfer is made from a poor person to someone who is poorer, the measure indicates a decrease in aggregate poverty. Its desirable properties make it our preferred measure.

We can now demonstrate the decomposable property of P_α . We consider the population split into m subgroups with populations n_i ($i = 1, \dots, m$; notice that

$$n = \sum_{i=1}^m n_i).$$

The FGT class of measures can then be written as:

$$(2) \quad P_\alpha = \sum_{i=1}^m \frac{P_{\alpha i} n_i}{n}$$

which is simply the population-weighted mean of the subgroup poverty index, $P_{\alpha i}$. The index $P_{\alpha i}$ gives, for each subgroup i containing n_i persons, the measure described in equation 1:

$$(3) \quad P_{\alpha i} = \frac{1}{n_i} \sum_{j=1}^{q_i} \left(\frac{g_{ij}}{z} \right)^\alpha$$

where $g_{ij} = z - y_{ij}$, the poverty gap for the j th household in subgroup i . Thus, by an appropriate choice of α , the measures continue to satisfy the desired axioms when aggregate poverty is decomposed by subgroups. We will exploit this property throughout the analysis.

Although major advances have been made in the search for better *cardinal* measures of poverty and undernutrition, there is still widespread concern over arbitrariness in the choice of a poverty line, or nutrition cutoff point, and in the choice of a specific functional form for the poverty measure. For example, the popular FGT measure P_2 uses only one of a number of possible functional forms, all satisfying the main axioms for a desirable poverty measure (Atkinson 1987 surveys other examples).

Fortunately, for many (though not all) applications, all that one is really concerned about is the *ordinal* ranking of distributions. For example, the main question of interest may be: did poverty increase as a result of, say, structural adjustment? As a rule, the answer to this question requires only that we know the direction of poverty change (the ordinal comparison), not how *much* poverty has changed (the cardinal comparison).

When ordinal comparisons suffice, we need not confine ourselves to a particular poverty line and poverty measure but can draw on recent results on the use of dominance conditions in ordering indicator distributions using a variety of lines and measures (important contributions are Atkinson 1987 and Foster and Shorrocks 1988). If the class of poverty measures satisfies certain rather mild conditions (notably that the measures are continuous, separable, symmetric, and weakly monotonic), we can apply the first-order dominance test. Suppose that the cumulative proportion of the population below each value of the standard of living indicator is graphed on the vertical axis and the indicator value is on the horizontal axis. If the curve of one distribution, A , lies entirely below that

of another, B, then A first order dominates B. Regardless of the poverty line or poverty measure, we then know that poverty is lower for A than B. First-order dominance over the whole range of incomes also implies an unambiguous ranking in terms of the head-count index when the poverty line varies across the population in some unknown way, such as would arise because of errors in measuring individual living standards, or because of unknown differences in nutrient requirements. Nonintersecting distribution functions can thus be a powerful test for establishing poverty rankings.

If the distribution functions intersect at one or more points, then we know that different poverty lines or poverty measures will rank the distributions differently; some will indicate a decrease in poverty and others will not. We need more information. Here the stronger second-order dominance test can be useful. The test says that if the area under one distribution function, A, is less than that under another, B, over the entire range of admissible poverty lines, then A exhibits less poverty than does B for all distributionally sensitive measures, such as all FGT measures for which $\alpha > 1$. Thus, by adding this mild restriction to the set of admissible poverty measures, we may be able to achieve an unambiguous ranking of distributions, despite the fact that first-order dominance does not hold.

II. DECOMPOSING MEASURED CHANGES IN AGGREGATE POVERTY

Given measurements of poverty at two dates, it may also be of interest to explore the factors underlying the observed changes. For this purpose, we have devised two simple formulas which allow one to decompose a measured change in aggregate poverty into its constituent parts. These indicate how the aggregate change reflects intrasectoral gains versus intersectoral shifts in population, and changes in average income as compared with changes in the distribution of income.

The first formula aims to assess the relative gains to the poor within specific sectors and the contribution of changes in the distribution of the population across those sectors. Suppose that we have P_α poverty measures for each of two dates, t ($t = 1984$ and 1987), and two sectors, i ($i = u$ and r for urban and rural). The change in aggregate poverty between the two dates can be decomposed into intrasectoral effects, population shifts, and interaction effects, as follows:

$$\begin{aligned}
 (4) \quad P_\alpha^{87} - P_\alpha^{84} = & (P_{\alpha u}^{87} - P_{\alpha u}^{84})n_u^{84} + (P_{\alpha r}^{87} - P_{\alpha r}^{84})n_r^{84} \\
 & \text{Intrasectoral effects:} \\
 & \text{Change in urban poverty at} \qquad \qquad \text{Change in rural poverty at} \\
 & \text{the 1984 population share} \qquad \qquad \text{the 1984 population share} \\
 & + \sum_{i=u}^r (n_i^{87} - n_i^{84})P_{\alpha i}^{84} + \sum_{i=u}^r (P_{\alpha i}^{87} - P_{\alpha i}^{84})(n_i^{87} - n_i^{84}) \\
 & \text{Change in poverty arising} \qquad \qquad \text{Interaction between sectoral} \\
 & \text{from population shifts} \qquad \qquad \text{changes and population shifts}
 \end{aligned}$$

where $P_{\alpha i}^t$ denotes measured poverty in sector i at date t with corresponding population share n_i^t . Intuitively, the intrasectoral effects are the contribution of gains to the poor within each sector to the change in aggregate poverty. The population shift effect shows how changes in the distribution of the population across sectors contributed to the change in aggregate poverty. The interaction effect can be interpreted as a measure of the correlation between population shifts and intrasectoral changes in poverty. We shall call equation 4 the sectoral decomposition of a change in poverty.

The second formula decomposes the change in poverty into a change in the mean consumption level of a given distribution, and a change in the distribution of consumption around the mean. The qualitative effect on measured poverty of a reduction in inequality at a given mean is not obvious a priori. For example, although a transfer of income from someone at the poverty line (or only slightly above it) to someone well below it will reduce inequality, it will also increase the head-count index of poverty. The usual measures of inequality, such as the Gini coefficient, can be a poor indicator of how changes in distribution have affected aggregate poverty (Datt and Ravallion 1990). We need other tools of analysis to decompose changes in poverty measures into growth and distributional effects.

To derive the second decomposition formula, let P_{α}^{87*} denote the measure of poverty in 1987 if only mean consumption changed since 1984 without any change in relative consumption levels; that is, P_{α}^{87*} is obtained by applying the 1987 mean to the 1984 Lorenz curve. Similarly, let P_{α}^{87**} denote the poverty level in 1987 if only the Lorenz curve had shifted since 1984, leaving the mean unchanged. The observed change in poverty between two dates can then be decomposed into growth and distributional effects as follows:

$$(5) \quad P_{\alpha}^{87} - P_{\alpha}^{84} = \underbrace{(P_{\alpha}^{87*} - P_{\alpha}^{84})}_{\substack{\text{Growth effect:} \\ \text{change in poverty given} \\ \text{change in mean con-} \\ \text{sumption holding 1984} \\ \text{Lorenz curve constant}}} + \underbrace{(P_{\alpha}^{87**} - P_{\alpha}^{84})}_{\substack{\text{Distributional effect:} \\ \text{change in poverty given} \\ \text{shift in the Lorenz curve} \\ \text{holding 1984 mean} \\ \text{consumption constant}}} + \underbrace{\text{residual}}_{\substack{\text{Interaction between} \\ \text{effects of growth} \\ \text{and changes in} \\ \text{distribution}}}$$

We shall call this the growth-equity decomposition of a change in poverty. The two simulated poverty measures, P_{α}^{87*} and P_{α}^{87**} , are calculated by econometrically estimating parametric specifications of the Lorenz curves and deriving the poverty measures as functions of those parameters and of the mean income and the poverty line. (Datt and Ravallion 1990 outline the methodology in greater detail.) Note that this decomposition is not exact; the residual is the difference between the distributionally neutral growth effect given the 1987 Lorenz curve and that evaluated at the 1984 Lorenz curve. The residual will only vanish if the distributionally neutral growth effect on poverty is independent of the Lorenz curve (or, equivalently, if the distributional effect is independent of the mean). That does not hold for the poverty measures and Lorenz curve parameter estimates considered in this study, nor does it appear likely to ever hold for any plausible Lorenz curve (Datt and Ravallion 1990).

One should be cautious in drawing policy implications from the growth-equity decomposition. Distributionally neutral growth is not the same thing as growth with distributionally neutral policies. The laissez-faire growth path of an economy need not be distributionally neutral, and policy interventions aimed at reducing relevant inequalities may well be essential to attaining even distributionally neutral growth. The growth-equity decomposition is a simple descriptive device intended to throw light on the proximate causes of poverty alleviation; a deeper analysis of those causes would be needed to draw sound policy implications.

III. THE DATA AND RESULTS

Following past practice for Indonesia, we shall base our poverty assessments mainly on distributions of household consumption per person. We draw on Indonesia's National Socioeconomic Surveys (SUSENAS) data on consumption from both market expenditures and own production for 50,000 randomly sampled households comprising 250,000 persons at each date. The data are available on magnetic tapes supplied by the Central Bureau of Statistics, Indonesia. We adjusted the data to February 1984 urban prices using a modified version of Indonesia's consumer price index (CPI). The ordinary CPI is far from ideal for our purposes because it is constructed only for urban areas and its goods composition is inappropriate for the poor. We have reweighted the CPI so as to better reflect the consumption pattern of the poor. Price deflation was done at the province level before aggregation. The SUSENAS survey almost certainly underreports consumption, but because such underreporting is likely to be more serious at high incomes, the poverty assessments are still likely to be reasonably accurate.

For the purpose of assessing poverty during macroeconomic adjustment, there are two problems with these data. The first and most worrying is that the SUSENAS surveys imply a higher growth rate of real private consumption per capita over 1984-87 than that implied by the national accounts. We shall return to this point in section V. Second, the methodology we use may be quite insensitive to changes in the supply of publicly provided goods, because such changes are unlikely to be properly reflected in household consumption expenditures.

We have assumed a rural poverty line of Rp10,000 per month (in 1984 prices), equivalent to about \$31 per month, at 1985 purchasing power parity (Summers and Heston 1988). This closely approximates the poverty line used in past World Bank studies, after adjusting for inflation (Rao 1984, 1986). We have assumed that urban prices were 10 percent higher than rural prices; this is consistent with Rao (1984, 1986) and with estimates of cost-of-living differentials in Java by Ravallion and Van De Walle (forthcoming, b). The urban poverty line is thus Rp11,000. All further consumption and income variables will be expressed in 1984 urban prices, assuming this 10 percent cost-of-living differential.

We shall also present estimates of urban poverty on the basis of an alternative urban poverty line set 50 percent higher than the rural poverty line. Although this is far more than cost-of-living differences would appear to warrant, it may be defended by “relative poverty considerations”—the assumption that the urban lifestyle may require a more diversified consumption pattern. A 50 percent differential in urban-rural poverty lines is consistent with the practice of some past research on poverty in Indonesia (CBS 1984; Sayogyo and Wiradi 1985).

Table 1 gives our cardinal estimates of poverty in Indonesia for various poverty measures and for both urban poverty lines. All three measures, including the preferred “distributionally sensitive” measure, and both urban poverty lines indicate a significant decrease in poverty over the 1984–87 period.

We find that the head-count index of poverty decreased from approximately 33 percent at the beginning of the period to slightly more than 20 percent by 1987; this is a substantial contraction over just three years. The poverty gap measure implies that the aggregate consumption shortfall of the poor declined from about Rp937 per month per head of Indonesia’s population (representing about 5.5 percent of national mean consumption) to Rp464 in 1987 (about 2.3 percent of the national mean).

Are the qualitative results robust to the choice of poverty line and measure? Figure 1 gives the cumulative frequency distributions of consumption in 1984 urban prices for 1984 and 1987. The 1984 distribution lies entirely above the 1987 distribution. Thus the first-order dominance condition holds, and so one can conclude that all well-behaved poverty measures and all possible poverty lines will show an unambiguous decrease in aggregate poverty between the two dates. This was found to hold for both urban and rural areas.

From figure 1 we can also assess the sensitivity of this conclusion to possible underestimation of price increases facing the poor. The 1987 poverty line (in 1984 urban prices), which would be needed for the 1987 national head-count index of poverty to equal that of 1984 (Rp11,000), is Rp12,818. Thus an additional inflation rate over three years of at least 16.5 percentage points (on top of the CPI-based estimate of about 20 percent) would have been needed to reverse the conclusion that poverty has decreased by this measure. Similarly, the true annual inflation rate would need to be about 4.5 points higher (or 14.1 points higher over the three years) to equalize the head-count indexes for the two dates at the higher poverty line. Thus the conclusion that poverty has decreased would be robust to even quite substantial measurement error in the CPI; the inflation rate would need to have been underestimated by at least 50 percent to reverse our conclusion.

A potentially important observation about the results in figure 1 is that the poverty lines are found on a steep segment of the consumption distribution. This is illustrated more clearly by the density function of consumption shown in figure 2, which, for any given level of consumption, shows the slope of the cumulative distribution function at that level. The poverty line is very close to the mode, where the slope of the distribution function reaches its maximum.

Table 1. Aggregate Poverty Measures, Indonesia, 1984 and 1987

Poverty measure (P_α) and sector	Poverty, 1984	Poverty, 1987	<i>t</i> -statistic for 1984–87 difference ^a	Decline, 1984–87 (percent)
<i>Head-count index</i> ($\alpha = 0$) (percent)				
Urban 10 percent ^b	12.08 (0.26)	7.32 (0.21)	14.35	39.40
Urban 50 percent ^c	28.04 (0.36)	21.17 (0.33)	14.21	24.50
Rural	39.43 (0.26)	26.80 (0.23)	35.77	32.03
Total ^d	33.02 (0.21)	21.65 (0.18)	40.86	34.39
<i>Poverty gap index</i> ($\alpha = 1$) (percent)				
Urban 10 percent ^b	2.68 (0.07)	1.25 (0.05)	17.70	53.36
Urban 50 percent ^c	7.31 (0.12)	4.67 (0.09)	14.21	36.11
Rural	10.32 (0.09)	5.29 (0.06)	46.37	48.74
Total ^d	8.52 (0.07)	4.22 (0.05)	51.63	50.47
<i>Distributionally sensitive index</i> ($\alpha = 2$) ^e				
Urban 10 percent ^b	0.92 (0.03)	0.33 (0.02)	15.61	64.13
Urban 50 percent ^c	2.78 (0.06)	1.50 (0.04)	17.84	46.04
Rural	3.86 (0.05)	1.57 (0.02)	44.50	59.33
Total ^d	3.17 (0.03)	1.24 (0.02)	49.38	60.88

Note: The poverty index for the total population is $P_\alpha = \sum_{i=1}^m P_{\alpha i} \frac{n_i}{n}$; and for each sector i as

$P_{\alpha i} = \frac{1}{n} \sum_{j=1}^{q_i} \left(\frac{g_{ij}}{z} \right)^\alpha$, where n_i = the population of sector i , q_i = the number of poor individuals in sector i ; z = the poverty line; $g_{ij} = z - y_{ij}$, the poverty gap, where y_{ij} is the consumption per capita of the j th household in sector i . A higher α indicates that the measure is more sensitive to lower consumption among the poor. See equations 2 and 3 in the text. Numbers in parentheses are standard errors (s.e.).

a. $t = (P_\alpha^{87} - P_\alpha^{84}) / \text{standard error of } (P_\alpha^{87} - P_\alpha^{84})$. All differences are statistically significant at the 1 percent level.

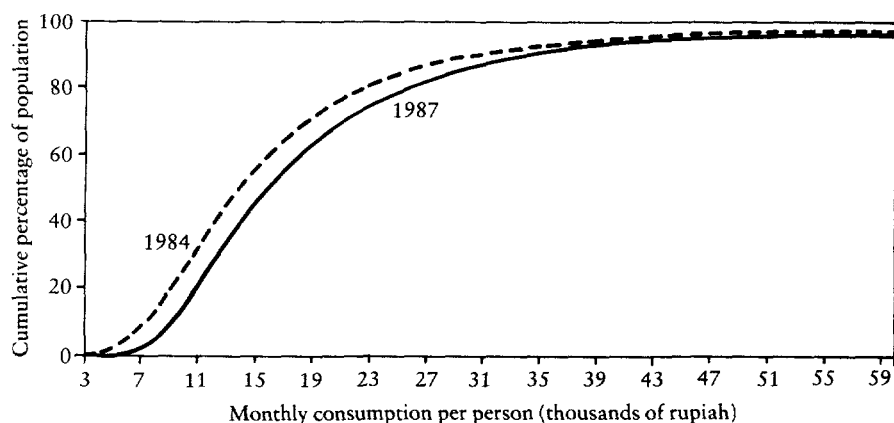
b. Assumes that the cost of living, and hence the poverty line, in urban areas is 10 percent higher than in rural areas.

c. Assumes that the poverty line in urban areas is 50 percent higher than in rural areas.

d. Using the 10 percent higher poverty line for urban areas.

e. The calculated values of P_2 have been multiplied by 100.

Source: Authors' calculations based on data tapes from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia. Calculations for the t -statistics are based on Kakwani's (1990a) standard errors.

Figure 1. *Distribution of Consumption, Indonesia, 1984 and 1987*

Note: Each point on the curve shows the percentage of people living in households consuming less than the amount on the horizontal axis. Consumption is given in 1984 urban prices.

Source: Authors' calculations based on data from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia.

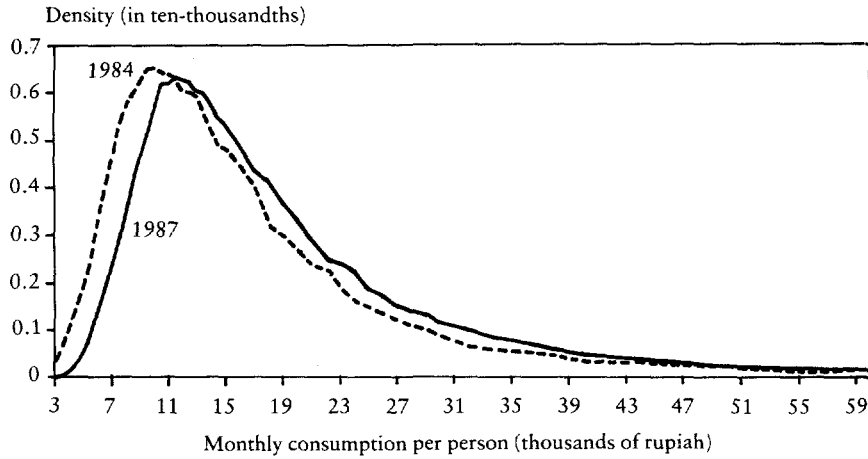
This has two implications of interest here. First, estimates of the head-count index of poverty will be particularly sensitive to the exact location of the poverty line, as our comparison of the urban poverty lines at 10 and 50 percent cost-of-living differentials in table 1 has suggested. Second, measured levels of poverty will be very responsive to horizontal shifts in the distribution of consumption. If the poverty line is at the mode of per capita consumption, the response of the head-count index to an additive gain or loss at all consumption levels will be at its maximum. As the results of the following section will demonstrate, the response of poverty in Indonesia to shifts in consumption in the form of distributionally neutral changes in the mean was also high in the mid-1980s. This is a factor in understanding how recent economic growth has affected poverty.

Is our qualitative result on the change in poverty over this period robust to the choice of an indicator of the standard of living? Three alternative standards will be considered: income, food expenditure share, and caloric intake.

Figure 3 gives the distributions of household income per person, again in 1984 urban prices. A comparison of the entire frequency distribution again reveals that the first-order dominance condition holds. No matter where one draws the poverty line, or what poverty measure one uses (within a broad class), aggregate poverty (measured in terms of income) unambiguously fell between 1984 and 1987. This conclusion is also robust to substantial measurement error in the CPI.

In view of the problems of comparing surveyed consumption and income levels over time, we consider the share of total household consumption expendi-

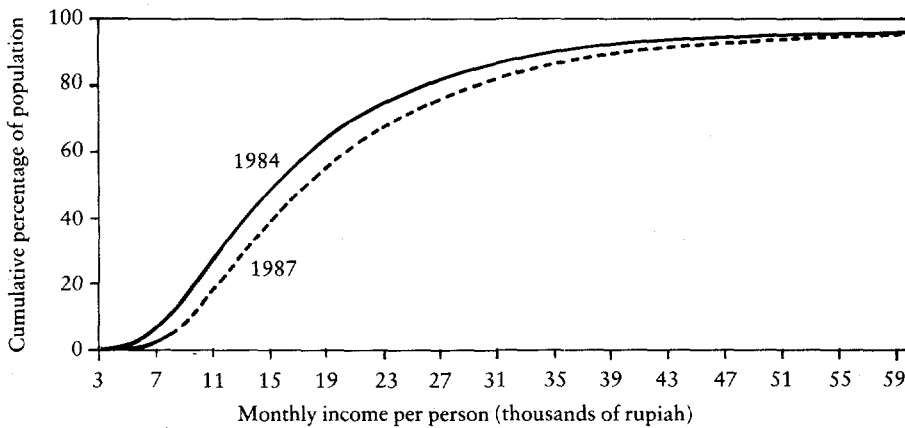
Figure 2. *Densities of Consumption, Indonesia, 1984 and 1987*



Note: The curve shows the slope of the corresponding distribution function in figure 1 at each consumption level.

Source: Authors' calculations based on data from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia.

Figure 3. *Distribution of Income, Indonesia, 1984 and 1987*



Note: Each point on the curve shows the percentage of people with household income per person less than the amount on the horizontal axis. Income is given in 1984 urban prices.

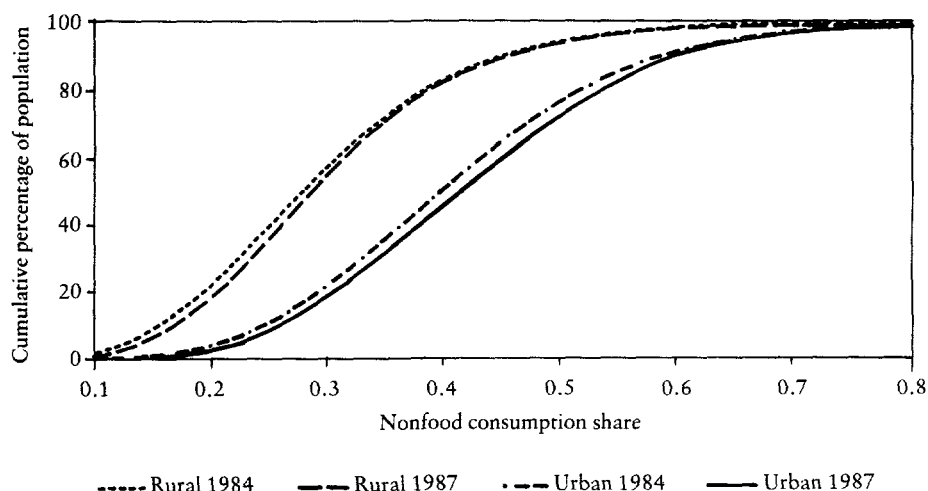
Source: Authors' calculations based on data from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia.

tures devoted to nonfood goods. This is generally found to be a monotonically increasing function of real consumption and is thus a good indicator of real consumption levels. That function will only be the same, however, for households which are homogeneous in relevant respects—the real consumption level corresponding to a given food share will generally vary according to relative prices, demographic factors, and tastes. Differences in relative prices and (possibly) tastes between urban and rural areas could well be the most important factor influencing measured differences in food shares across households in Indonesia. For this reason we will consider urban and rural areas separately.

Figure 4 gives the cumulative frequency distributions of the share of nonfood goods in total consumption for urban and rural areas in 1984 and 1987. First-order dominance still holds up to high levels of nonfood shares, so a wide range of poverty lines and measures will continue to indicate a decrease in poverty in both sectors over this period. The proportion of the rural population with a food share in excess of 75 percent fell from 39.2 percent in 1984 to 35.8 percent in 1987, whereas for the urban sector it fell from 10.5 to 8.5 percent. The decline in poverty is not nearly as dramatic as that suggested by the CPI adjusted consumption and income data, but it is still evident in the decline in food shares.

Did undernutrition also diminish? The SUSENAS tapes provide estimates of household calorie intakes, obtained by applying caloric unit values to the quantities consumed of 170 foods and beverages. The survey probably underestimates calorie intakes, because it does not survey the quantities of foods eaten

Figure 4. *Share of Nonfood Consumption in Total Consumption Expenditure for Rural and Urban Households, Indonesia, 1984 and 1987*



Note: Each point on the curve shows the percentage of people with a nonfood consumption share less than the amount on the horizontal axis.

Source: Authors' calculations based on data from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia.

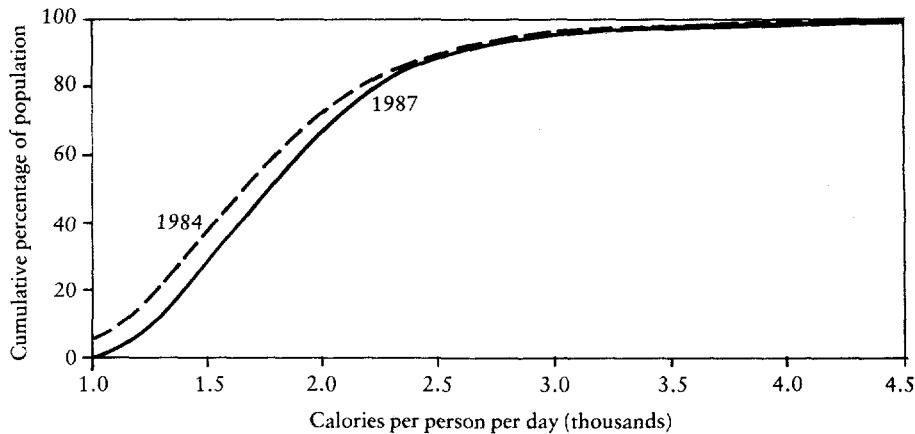
away from home (Van De Walle 1988). This need not invalidate use of the SUSENAS for comparing calorie intake distributions over time. For example, if a constant proportion of calorie intake is obtained away from home, then first-order dominance of one distribution of measured intakes over another would also imply dominance for the (unobserved) true distributions. Furthermore, because real food expenditures at all levels rose over this period, it seems likely that calorie intakes from food eaten away from home would also have increased for the undernourished (Ravallion 1990). An improvement in the distribution of calorie intakes in the SUSENAS data would then imply an improvement in the underlying true distribution.

The distribution of measured caloric intake per person for 1987 lies below that for 1984 up to a high intake level (see figure 5). Only among the upper 9 percent of the population was intake higher in 1984. First-order dominance thus holds up to high caloric norms. The second-order dominance condition discussed in section I holds over the entire distribution. Thus a broad class of undernutrition measures would show an improvement whatever the underlying distribution of caloric requirements. These results also hold in both urban and rural areas.

IV. DECOMPOSITIONS OF INDONESIA'S PROGRESS IN ALLEVIATING POVERTY

We now examine some of the factors which contributed to the measured decline in poverty. The relative sectoral shares in poverty and the relative

Figure 5. *Distribution of Caloric Intake, Indonesia, 1984 and 1987*



Note: Each point on the curve shows the percentage of people living in households with calorie intakes per person less than the amount on the horizontal axis (excluding foods not prepared at home).

Source: Authors' calculations based on data from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia.

changes in the mean and distribution of consumption expenditure are analyzed using the decomposition formulas developed in section II. We also consider the influence of initial poverty conditions on the potential for alleviation.

The results of section III indicate significant poverty alleviation between 1984 and 1987 in both urban and rural sectors. There was also a shift in population over the period, with a declining share of the population residing in the poorer rural sector (down from 76.5 percent in 1984 to 73.6 percent in 1987). What was the relative contribution of these factors to the reduction in poverty?

Table 2 gives the urban-rural sectoral decomposition of the change in aggregate poverty derived from equation 4. For all measures, both population shifts and gains to the urban and rural sectors alleviated aggregate poverty, and these improvements were dampened only slightly by the negative interaction effect. The gains to the rural sector accounted for the vast majority of aggregate poverty alleviation. For the P_2 poverty measure, which attaches greater weight to the poverty gap of the poorest of the poor, the gains to the rural sector represented more than 90 percent of the aggregate gain.

In light of this result we investigated further the distribution of gains within that sector. For this purpose, all households were classified by their principal source of income among twenty-one distinct sources for each sector. The poorest rural groups—farm laborers and self-employed farm households—which accounted for only 11 and 57 percent of all rural persons, respectively, accounted for 17 and 61 percent of the aggregate drop in poverty according to the P_2 measure (Huppi and Ravallion 1990).

Turning to the growth-equity decomposition (equation 5), we find that the

Table 2. *Decomposition of Change in Poverty into Intrasectoral Effects, Intersectoral Population Shifts, and Their Interaction between 1984 and 1987, Indonesia*
(percentage of total poverty reduction)

Poverty measure	Components of Poverty Alleviation			
	Intrasectoral Effects		Intersectoral population shifts	Interaction effect
	Urban ^a	Rural		
Head-count index ($\alpha = 0$)	9.83	84.99	7.05	-2.02
Poverty gap index ($\alpha = 1$)	7.81	89.50	5.21	-2.45
Distributionally sensitive index ($\alpha = 2$)	7.18	90.78	4.46	-2.58

Note: The poverty measures are calculated for the total population as $P_\alpha = \sum_{i=1}^m P_{\alpha i} \frac{n_i}{n}$ $i = u, r$; and for each sector i as $P_{\alpha i} = \frac{1}{n} \sum_{j=1}^{q_i} \left(\frac{g_{ij}}{z} \right)^\alpha$, where n_i = the population of sector i , q_i = the number of poor individuals in sector i ; z = the poverty line; $g_{ij} = z - y_{ij}$, the poverty gap, where y_{ij} is the consumption per capita of the j th household in sector i . A higher α indicates that the measure is more sensitive to lower consumption among the poor.

a. The urban population as a share of the total was 0.235 in 1984 and 0.264 in 1987 (see equation 4 in the text).

Source: Authors' calculations based on data tapes from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia.

period 1984–87 saw a simultaneous increase in mean consumption and a reduction in the overall inequality of consumption, in both urban and rural sectors. The three-year growth rate in urban consumption implied by the SUSENAS data was 12.1 percent, whereas the rural rate was 14.6 percent. Table 3 gives cumulative shares of consumption by decile for each year. The 1987 Lorenz curves unambiguously dominate those for 1984 in both sectors and nationally. Thus all well-behaved inequality measures will indicate a reduction in inequality over the period. The aggregate Gini index dropped from 0.331 in 1984 to 0.321 in 1987.

Table 4 gives our estimates of the relative contributions of growth and greater equity to poverty alleviation using the decomposition formula in equation 5.¹ In all cases considered in table 4, most of the reduction in poverty can be attributed to higher mean consumption at a given distribution of consumption. The contribution of greater equity (the upward shifts in the Lorenz curve) increases with α , the value of which rises with the weight given to the poorest of the poor.

Because increases in mean consumption are so important in poverty alleviation, the point elasticity of poverty with respect to distributionally neutral growth is also of interest. For the head-count index, this elasticity is simply the elasticity of the cumulative distribution function when evaluated at the poverty line. Following Kanbur (1987) and Kakwani (1990a), we can derive the elasticity with respect to the mean of the entire P_α class of poverty measures; that elasticity is given by:

$$(6) \quad \begin{aligned} \eta_\alpha &= \frac{-zf(z)}{P_0} < 0 \quad (\text{for } \alpha = 0) \\ &= \alpha \left(1 - \frac{P_{\alpha-1}}{P_\alpha} \right) < 0 \quad (\text{for } \alpha \geq 1) \end{aligned}$$

where $f(z)$ denotes the probability density of consumption at the poverty line z . This also has to be estimated; nonparametric methods were used, details of which are given in Ravallion and Huppi (1989).

All poverty measures are found to respond elastically to higher mean consumption, holding the Lorenz curve constant (table 4). For a given poverty line and sector, the growth elasticity is highest for the distributionally sensitive measure of poverty and lowest for the head-count index.

The growth elasticity of poverty is a function of the parameters of the underlying consumption distribution. Consider first mean consumption. By differentiating equation 6 with respect to the mean μ , we obtain:

$$(7) \quad \begin{aligned} \frac{\partial \eta_\alpha}{\partial \mu} &= -\frac{\eta_\alpha^2}{\mu} < 0 \quad (\text{for } \alpha = 0) \\ &= \frac{(\eta_\alpha - \eta_{\alpha-1})\alpha P_{\alpha-1}}{\mu P_\alpha} \quad (\text{for } \alpha \geq 1) \end{aligned}$$

1. Three Lorenz curve specifications were tested (Kakwani-Podder, Kakwani, and elliptical). The Kakwani model gave the best fit in the lower half of the distribution and so was preferred (see Ravallion and Huppi 1989).

Table 3. *Distribution of Household Consumption Expenditure: Lorenz Curve Values, Indonesia, 1984 and 1987*
(cumulative percentage shares)

Population decile	Urban		Rural		Total	
	1984	1987	1984	1987	1984	1987
10	3.23	3.46	3.77	4.26	3.40	3.78
20	7.88	8.15	8.99	9.81	8.14	8.77
30	13.54	13.84	15.18	16.21	13.82	14.59
40	20.15	20.54	22.25	23.42	20.42	21.20
50	27.76	28.05	30.28	31.46	27.97	28.73
60	36.46	36.74	39.35	40.44	36.62	37.27
70	46.51	46.81	49.65	50.59	46.57	47.10
80	58.38	58.69	61.50	62.25	58.40	58.76
90	73.47	73.58	76.06	76.42	73.31	73.48
Gini index	0.333	0.329	0.293	0.277	0.331	0.321

Source: Authors' calculations based on data tapes from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia.

Table 4. *Decomposition of Changes in Poverty Measures into Consumption Growth and Redistribution Effects, Indonesia, 1984-87*
(percentage of total poverty reduction)

Poverty measure and sector	Higher mean consumption ^a	Change in distribution ^b	Residual	1984 consumption point elasticity of P_α ^c
<i>Head-count index</i> ($\alpha = 0$)				
Urban	78.25	18.29	3.46	-3.27
Rural	82.97	7.72	9.31	-2.00
Total	86.12	6.43	7.44	-2.05
<i>Poverty gap index</i> ($\alpha = 1$)				
Urban	65.81	38.43	-4.24	-3.51
Rural	69.82	30.23	-0.05	-2.82
Total	72.82	26.93	0.25	-2.88
<i>Distributionally sensitive index</i> ($\alpha = 2$)				
Urban	56.07	53.63	-9.71	-3.83
Rural	64.11	43.14	-7.25	-3.35
Total	66.81	39.93	-6.74	-3.38

Note: The poverty measures are calculated for the total population as $P_\alpha = \sum_{i=1}^m P_{\alpha i} \frac{n_i}{n}$, $i = u, r$; and for each sector i as $P_{\alpha i} = \frac{1}{n_i} \sum_{j=1}^{q_i} \left(\frac{g_{ij}}{z}\right)^\alpha$, where n_i = the population share of sector i ; q_i = the number

of poor individuals in sector i ; z = the poverty line; $g_{ij} = z - y_{ij}$, the poverty gap, where y_{ij} is the consumption per capita of the j th household in sector i . A higher α indicates that the measure is more sensitive to lower income among the poor.

a. $(P_{\alpha}^{87*} - P_{\alpha}^{84}) / (P_{\alpha}^{87} - P_{\alpha}^{84})$.

b. $(P_{\alpha}^{87**} - P_{\alpha}^{84}) / (P_{\alpha}^{87} - P_{\alpha}^{84})$.

c. $\eta_\alpha = -zf(z)/P_0 < 0$ (for $\alpha = 0$), or, for $\alpha \geq 1$, $\eta_\alpha = \alpha(1 - P_{\alpha-1}/P_\alpha) < 0$.

Source: Authors' calculations based on data tapes from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia; estimates of Lorenz curves and consumption density from Ravallion and Huppi (1989).

The last derivative is not necessarily negative for all $\alpha \geq 1$, though it is found to be so for $\alpha = 1, 2$ (table 4). This result can be interpreted as an acceleration effect of growth on poverty; a higher level of mean consumption implies a more elastic response of poverty (in absolute value) to further growth. And, conversely, at low average consumption, higher growth rates will be needed to achieve the same proportionate poverty alleviation impact.

Under plausible assumptions about how distribution has shifted over time, it can also be shown, for these data, that the (absolute) elasticity of the FGT class of poverty measures with respect to the mean (again holding the Lorenz curve constant) is a monotonically *decreasing* function of the initial Gini measure of inequality.² Differentiating equation 6 with respect to the Gini coefficient, G , it can be shown, analogously to equation 7 that:

$$\begin{aligned} \frac{\partial \eta_\alpha}{\partial G} &= -\frac{\eta_0 \epsilon_0}{G} > 0 \quad (\text{for } \alpha = 0) \\ &= \frac{(\epsilon_\alpha - \epsilon_{\alpha-1}) \alpha P_{\alpha-1}}{GP_\alpha} > 0 \quad (\text{for } \alpha \geq 1) \end{aligned}$$

where ϵ_α denotes the elasticity of the P_α poverty measure to the Gini coefficient.

Indonesia had experienced sustained growth and reductions in overall inequality for many years before the adjustment period. Our results suggest that both growth in mean consumption and the reduction in inequality *before* the adjustment period would have increased the elasticity of aggregate poverty to further growth. It can thus be argued that a history of fairly equitable growth allowed the pace of poverty alleviation to be maintained with lower growth rates during the adjustment period.

V. ALTERNATIVE ASSESSMENTS

If growth rates in mean real consumption have been overestimated, the methods we have used so far will have overestimated poverty alleviation in Indonesia. Here we consider two alternative assumptions.

The first assumes a rural rate of inflation above the CPI (which is constructed for urban areas). We know from the dominance analysis in section III that the conclusion that poverty declined would be robust to substantial measurement error in the price deflator. But it may be illuminating to examine the quantitative effect on the estimated measure of poverty of assuming a rural inflation rate of, say, 5 percentage points (over three years) above the CPI (table 5). Under this

2. This assumes that the Lorenz curve shifts such that $L^{87}(p) - L^{84}(p)$ is directly proportional to $p - L^{84}(p)$, where $L^t(p)$ denotes the Lorenz curve for date t (Kakwani 1990a). If so, a decrease in the Gini coefficient will reduce the measure of poverty for a broad class of additive measures if the poverty line is less than the mean. Ravallion and Huppi (1989) show that this assumption holds well for these data. Then the elasticities $\epsilon_0 = \eta_0(z - \mu)/z$ and $\epsilon_\alpha = \eta_\alpha + \alpha\mu P_{\alpha-1}/(zP_\alpha)$ for $\alpha \geq 1$, and it is readily verified that the elasticity of poverty with respect to the Gini coefficient is positive: $\partial \eta_\alpha / \partial G > 0$ (all α) for these data.

Table 5. *Measured Poverty Levels under Alternate Rates of Inflation and Consumption Growth*
(percent)

Poverty measure and sector	1987			
	1984 estimate, SUSENAS data	SUSENAS data	Rural inflation 5 percent higher	National accounts growth rates with SUSENAS Lorenz curves
<i>Head-count index</i> ($\alpha = 0$)				
Urban	12.08	7.32	7.32	9.56
Rural	39.43	26.80	31.01	34.28
Total	33.02	21.65	24.75	29.07
<i>Poverty gap index</i> ($\alpha = 1$)				
Urban	2.68	1.25	2.68	1.67
Rural	10.32	5.29	6.46	7.45
Total	8.52	4.22	5.46	6.29
<i>Distributionally sensitive index</i> ($\alpha = 2$)				
Urban	0.92	0.33	0.92	0.48
Rural	3.86	1.57	1.98	2.35
Total	3.17	1.24	1.70	1.92

Note: The poverty measures are calculated for the total population as $P_\alpha = \sum_{i=1}^m P_{\alpha i} \frac{n_i}{n}$ $i = u, r$; and for

each sector i as $P_{\alpha i} = \frac{1}{n} \sum_{j=1}^{q_i} \left(\frac{g_{ij}}{z} \right)^\alpha$, where n_i = the population of sector i , q_i = the number of poor individuals in sector i ; z = the poverty line; $g_{ij} = z - y_{ij}$, the poverty gap, where y_{ij} is the consumption per capita of the j th household in sector i . A higher α indicates that the measure is more sensitive to lower income among the poor.

Source: Authors' calculations based on data tapes from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia; national accounts consumption growth rates are from World Bank estimates; estimates of Lorenz curves from Ravallion and Huppi (1989).

higher assumed rate of inflation, measured levels of poverty in 1987 were 9 percent higher for the head-count index and about 15 percent higher for the poverty gap and distributionally sensitive indexes (though the 1987 levels were still between 25 and 45 percent lower than the estimated levels for 1984).

The second case is based on the slower real growth rate implied by the national accounts. We simulated the consumption distribution that would have held in 1987 if mean consumption grew from its 1984 level at a rate indicated by the national accounts (5 percent over the three years according to World Bank estimates) while the Lorenz curve implied by the 1987 SUSENAS was maintained. Thus the SUSENAS data is only used to assess how relative inequalities changed over the period. Under this assumption of lower consumption growth, poverty in 1987 as measured by the three indexes was 21 to 51 percent higher than estimated using the SUSENAS growth rate (table 5). But once again, the estimates still showed a 12, 26, and 39 percent decline in poverty from 1984 to 1987 for the head-count, poverty gap, and distributionally sensitive measures, respectively.

Note that these last calculations assume that the higher growth rate implied by the SUSENAS data is not the outcome of sampling bias in the 1987 survey; undersampling of the poor in 1987 (relative to 1984) would clearly lead to overestimation of the growth rate. The effect of any undersampling on the Lorenz curve is ambiguous, but it is probable that such sampling bias would result in an underestimation of poverty in 1987. We have no basis for systematically assessing this possibility, though with such a large sample size and a well-established and sound sampling methodology, a significant bias in the aggregate Lorenz curve seems unlikely.

VI. IMPLICATIONS FOR FUTURE POVERTY ALLEVIATION PROSPECTS

Some aspects of the methodology used here can throw light on the potential for future reductions in poverty in Indonesia. We can use our 1987 results to estimate the elasticities of poverty to any future distributionally neutral growth in mean consumption. We find that the 1987 growth elasticities are even higher than those for 1984. For example, our estimate for the 1987 elasticity of the poverty gap measure is -4.1 , as compared with -2.9 for 1984 (table 4); and for the distributionally sensitive measure it is -4.8 for 1987, versus -3.4 for 1984. Furthermore, recent national accounts data suggest that growth rates of real consumption per capita have increased since the 1984–87 period. Both the higher growth elasticities of poverty and the higher consumption growth rates imply increasing poverty alleviation through any distributionally neutral growth after 1987.

In the 1984–87 adjustment period, Indonesia's consumption growth was maintained at the expense of investment. Sustainable future consumption growth will clearly require that investment be revived. Furthermore, the potential reduction in poverty from even substantial consumption growth may not materialize if it is accompanied by a deterioration in overall equity. The deterioration in equity needed to reverse the gains from growth may be quite modest. To illustrate, we have estimated the poverty measures resulting from 5 and 10 percent increases in mean consumption after 1987, assuming first that the 1987 Lorenz curve holds, and second, that inequality increases to its 1984 level (the national Gini index would rise from 0.321 to 0.331—table 3).

We find that the aggregate head-count index would fall from 21.7 percent to 19.3 percent as a result of a distributionally neutral 5 percent increase in real consumption per capita after 1987 (see table 6). If, however, the same increase in the mean were associated with a return to the less equitable 1984 Lorenz curve, the resulting head-count index would be 21.1 percent, only slightly lower than its 1987 level. Furthermore, the same comparison using the distributionally sensitive poverty measure indicates that poverty would *increase*. Given a 10 percent increase in the mean, the head-count and poverty gap measures would generally be lower even if inequality increases to its 1984 level, although this is not true for the distributionally sensitive poverty measure.

Table 6. *Projected Levels of Poverty Given Increased Mean Consumption under Alternate Assumed Distributions, Indonesia, post-1987*
(percent)

Poverty measure and sector	1987	5 percent increase in mean real consumption		10 percent increase in mean real consumption	
		No change in distribution ^a	Increased inequality ^b	No change in distribution ^a	Increased inequality ^b
<i>Head-count index</i> ($\alpha = 0$)					
Urban	7.32	5.83	6.99	4.65	5.82
Rural	26.80	23.24	25.73	19.84	22.65
Total	21.65	19.29	21.07	16.48	18.49
<i>Poverty gap index</i> ($\alpha = 1$)					
Urban	1.25	0.95	1.40	0.74	1.16
Rural	5.29	4.34	5.82	3.52	4.94
Total	4.22	3.48	4.63	2.79	3.90
<i>Distributionally sensitive index</i> ($\alpha = 2$)					
Urban	0.33	0.27	0.50	0.22	0.42
Rural	1.57	1.27	2.00	0.98	1.67
Total	1.24	0.93	1.53	0.72	1.26

Note: The poverty measures are calculated for the total population as $P_\alpha = \sum_{i=1}^m P_{\alpha i} \frac{n_i}{n}$ $i = u, r$; and for

each sector i as $P_{\alpha i} = \frac{1}{n} \sum_{j=1}^{q_i} \left(\frac{g_{ij}}{z} \right)^\alpha$, where n_i = the population share of sector i ; q_i = the number

of poor individuals in sector i ; z = the poverty line; $g_{ij} = z - y_{ij}$, the poverty gap, where y_{ij} is the consumption per capita of the j th household in sector i . A higher α indicates that the measure is more sensitive to lower income among the poor.

a. Assumes 1987 Lorenz curve.

b. Assumes 1984 Lorenz curve.

Source: Authors' calculations based on data tapes from the National Socioeconomic Surveys, Central Bureau of Statistics, government of Indonesia; estimates of the Lorenz curves from Ravallion and Huppi (1989).

Is inequality likely to have deteriorated since 1987? The sharp increase in rice prices during 1987 and 1988 (associated with poor harvests and a reluctance by the government to import rice) is probably the main recent event which could have threatened continued poverty alleviation, although its effect on aggregate poverty is not obvious. Even if rice price increases were fully passed on to the incomes of rice producers, evidence from Java for 1981 (Ravallion and Van De Walle, forthcoming, a) suggests that all distributionally sensitive measurements of poverty would show an increase with higher rice prices. The effects are ambiguous for measures of poverty which are not sensitive to the welfare of the poorest of the poor. It remains to be seen whether adverse effects on the poor of changing relative prices have been sufficiently large or persistent to seriously jeopardize continued poverty alleviation through growth in Indonesia.

VII. CONCLUSIONS

The measurement of poverty at one point in time is fraught with difficulty, and the comparison of poverty levels at two points in time adds even further problems. We have described a number of tools for empirical analysis which allow researchers to test the sensitivity of poverty assessments to measurement assumptions, and to decompose observed changes in aggregate poverty, so as to assess their sectoral, demographic, and distributional composition, and their possible future evolution. We have based poverty measures on distributions of household consumption per person, adjusting for inflation using the consumer price index, though modifying the underlying expenditure weights to accord more closely with the spending patterns of the poor. We have drawn on the recent literature on poverty analysis to analyze a range of poverty measures, using dominance conditions to rank the distributions of living standards.

We conclude that aggregate poverty in Indonesia decreased over the 1984–87 period for both urban and rural areas according to comparisons of both income and consumption distributions. For a range of commonly assumed poverty lines for Indonesia, the magnitude of the decline in poverty over the period is impressive. For the most widely used poverty measure, the head-count index, the percentage of the population identified as poor fell from 34 percent in 1984 to 22 percent in 1987. Such estimates can be quite sensitive to how poverty is measured, however, and particularly to the choice of a poverty line. In the Indonesian case, for example, where the commonly used poverty line lies near the mode of consumption distribution, slight shifts of the distribution, or slight errors in measuring the poverty line, will produce large changes in measured levels of poverty when using the head-count index. The quantitative result is similarly sensitive to possible errors in the estimated rate of growth of real mean consumption or the relevant rate of inflation for the rural poor. Using the lower growth rate of private consumption derived from national accounts data, measured poverty fell by 12 percent from 1984 to 1987, rather than the 25 percent reflected in the SUSENAS data.

We also find that poverty declined over the period for a very broad class of poverty measures and a wide range of poverty lines. Indeed, in the Indonesian case this conclusion would hold even if one allowed the poverty line to be anywhere between the lowest and highest consumption levels! The assumed rate of inflation would have to be implausibly high or the growth rate in mean consumption implausibly low, in our view, to alter the conclusion that poverty decreased.

Although the caloric intake data is less than ideal (with underestimation being likely at both dates), there is strong evidence that the extent of undernutrition also fell significantly. This holds for both urban and rural sectors over a very wide range of alternative measures of undernutrition, and it holds for any (unknown) interpersonal distribution of nutritional requirements, provided that

this did not also change over the period. The improvement was particularly marked at low calorie intakes.

In summary, although legitimate doubts can be raised about the *size* of the changes involved, the analytical techniques adopted allow us to reach the unambiguous conclusion that poverty and undernutrition in Indonesia continued to decline during the difficult period of the 1980s.

We also presented and applied techniques that allow one to quantify some of the factors underlying the changes in aggregate poverty using two methods of decomposition, one according to sectors, the other according to distributional parameters. The sectoral decomposition of the change in aggregate poverty indicates that gains to the rural sector were very important, particularly for the poorest of the poor. Gains to the urban sector and population shifts from the rural to urban sector contributed to poverty alleviation, but were quantitatively less important than the direct gains to the rural poor. We also found that both increases in average real consumption (holding relative inequalities constant) and a modest improvement in overall equity contributed to poverty alleviation. The growth in average consumption was quantitatively more important than improvements in equity, although less so for the preferred, distributionally sensitive poverty measure.

Further research is required to uncover the causes of Indonesia's success in poverty alleviation during an adjustment period that could have worsened the lot of the poor. Some possible clues can be identified here. Continued growth in average real private consumption despite the cuts in government expenditure during the period appears to have been possible, at least in part, because government investment spending bore the brunt of the cuts. And where government consumption was cut, programs which were of greatest benefit to the poor were protected. Because of the predominance of poverty in the rural areas, the gains to the rural farm sector were crucial, and so policy adjustments favoring that sector, such as the devaluations of the exchange rate, probably were important. Indonesia's recent economic history also played a role. By the mid-1980s, past growth with relatively low and decreasing inequality allowed seemingly small improvements in the distribution of consumption to generate a relatively large decline in aggregate poverty. Thus Indonesia's recent economic history created favorable conditions for maintaining the country's success in reducing poverty during an adjustment period, provided that at least modest and equitable growth in private per capita consumption could be maintained.

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