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Income Distribution and Growth's Ability to Reduce Poverty

Evidence from Rural and Urban African Economies

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Abstract

The present study examines the degree to which income distribution affects the ability of economic growth to reduce poverty, based on 1990s data for a sample of rural and urban sectors of African economies. Using the basic needs approach, an analysis-of-covariance model is derived and estimated, with the headcount, gap and squared gap poverty ratios serving as the respective dependent variables and the Gini coefficient and PPP-adjusted incomes as explanatory variables. The study finds that the responsiveness of poverty to income growth is a decreasing function of inequality, albeit at varying rates for the three poverty measures: lowest for the headcount, followed by the gap and fastest for the squared gap. The ranges for the income elasticity in the sample are estimated at: 0.02-0.68, 0.11-1.05 and 0.10-1.35, respectively, for these poverty …./

Keywords: Income distribution, income growth, poverty, rural and urban African economies

JEL classification: D31, I32, O49

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measures. Furthermore while, *on average*, the responsiveness of poverty to income growth appears to be the same between the rural and urban sectors, there are substantial sectoral differences across countries. The results suggest the need for country-specific emphases on growth relative to inequality, with special attention accorded the possible rural-urban dichotomy.

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1 Introduction

Poverty has increasingly become a subject of global interest. Goal 1 of the Millennium Development Goals (MDGs) of halving poverty by 2015 enjoys a major emphasis in the international discourse. Since the 1980s, the poverty rate has been trending considerably downward in all regions of the world except in sub-Saharan Africa (SSA), where Goal 1 seems unlikely to be attained. Indeed, the poverty headcount ratio in SSA, measured as the proportion of the population living on less that US$1 per day, rose from 42 per cent in 1981 to 46 per cent in 2000, the same year that the MDGs were initiated (World Bank 2006). The SSA poverty rate appears to have fallen more recently, however. For example, in 2004 the rate was 41 per cent (World Bank 2007), which is nearly the same as the poverty level in 1981, despite the substantial progress in other regions of the world. Given this challenge, it seems appropriate to focus the poverty debate on this region of the world, as the current paper does.

Attention on the importance of income distribution in poverty reduction has also been growing. A number of studies decompose the effects of inequality and income on poverty (e.g. Ali and Thorbecke 2000; Datt and Ravallion 1992; Kakwani 1993). Both Datt and Ravallion (1992) and Kakwani (1993) estimate substantial contributions by distributional factors as well as by growth for single countries. Based on cross-country African data, Ali and Thorbecke (2000) find that poverty is more sensitive to income inequality than it is to income.

Several papers, furthermore, emphasize the importance of inequality in determining the responsiveness of poverty to growth (e.g. Adams 2000; Easterly 2000; Ravallion 1997). These particular studies do so by analysing specific issues. For example, Ravallion (1997) econometrically tested the 'growth-elasticity argument' that while low inequality helps the poor share in the benefits of growth it also exposes them to the costs of contraction. Similarly, Easterly (2000) evaluated the impact of the Bretton Woods Institutions' programmes by specifying growth interactively with the level of inequality in the poverty-growth equation and found that the effect of the programmes was enhanced by lower inequality. Moreover, emphasizing the importance of the definition of growth, Adams (2004) nonetheless provides elasticity estimates showing that the growth elasticity of poverty is larger for the group with the smaller Gini coefficient (less inequality).[1] More recently, Fosu (2009) finds that inequality adversely affects the income elasticity of poverty in SSA. However, the data did not permit any rural-urban delineation.

The present paper, first, employs the basic needs approach to derive an analysis-of-covariance model of the poverty-growth relationship, where the level of inequality enters both independently and interactively with income. Second, it estimates the fully specified and constrained models using a 1990s cross-sectional sample of rural and urban sectors of SSA countries. The paper finds that income inequality reduces the efficacy of income growth in reducing poverty, at a rate that rises with the order of the poverty measure, that is, it is largest for the severity of poverty (squared gap), followed

1 We adopt the convention of an *absolute-valued* elasticity.

by poverty depth (gap), and least for the spread of poverty (headcount). The paper uncovers a wide range of growth effectiveness across countries and between the rural and urban sectors in certain countries, based on the disparities in inequality. For efficient poverty reduction, therefore, the current results imply that the degree of emphasis required for growth relative to inequality should differ considerably across African economies, and even within a given country with considerable rural and urban inequality profiles.

2 Derivation of the estimating model

Deriving the model for estimating the inequality–growth–poverty relationship,[2] an individual is said to be 'poor' if his/her income falls short of 'basic needs' in a given locality.[3] Furthermore, the lower the level of income is the more likely that it will fall below basic needs and put the individual into poverty. Assuming a Cobb-Douglas relationship, the poverty function may be presented as:[4]

$$P = P(Y) = AY^{\beta} \qquad (1)$$

where P is the level of poverty and Y is income, the parameters *A* and β are expected to be positive and negative, respectively. A linearized version of equation (1) is of the form:

$$p = \alpha + \beta y \qquad (2)$$

where p, y and α are the respective logarithmic transformations of P, Y and *A*. Thus, the rate at which a logarithmic increase in income (growth) is transformed to a reduction in poverty is β, while α is the intercept.

Suppose, however, that the socioeconomic environment, such as the nature of income distribution, influences both α and β. For instance, a more equally distributed income would likely raise the rate at which income growth was transformed to poverty reduction. Similarly, in a country where income is quite low, redistribution toward greater equality could actually make more individuals poor, for the incomes of those

2 The model specification follows closely that in Fosu (2008), which provides evidence bearing only on the headcount measure, however, the current paper extends the analysis to include all the three poverty measures and provides more in-depth analysis, including rural–urban comparisons.

3 For proponents of the basic needs approach, see for example Hicks and Streeten (1979), Streeten (1977) and Adelman (1975). However, Goldstein (1985) and Ram (1985) suggest a 'trickle-down' approach to growth. Being qualitatively below basic needs would be defined by the headcount ratio, P_0, how far below by the poverty gap P, and severely below by the squared gap P_2 (see Foster, Greer and Thorbecke (1984), hereafter FGT).

4 The assumption may be justified by the special properties of the Cobb-Douglas function (CDF) that increasing income would reduce poverty at a decreasing rate, since the farther below that an income is from the poverty line the greater the effort that is required to raise such income above the poverty line. Of course, many other functions would satisfy this condition as well, however, the CDF is currently adopted to simplify the analytical exposition, while the FGT poverty measures will be used in the empirical analysis.

above the poverty line would be reduced, possibly putting them also below the line. Hence, α and β may, respectively, be expressed parametrically in linear form as:[5]

$$\alpha = c_1 + c_4 g \tag{3}$$

$$\beta = c_2 + c_3 g \tag{4}$$

where g is the logarithm of the Gini coefficient measuring the level of inequality, and c_j (j=1.2,…,4) are constant coefficients showing the respective effects of inequality on the parameters of the poverty function. Incorporating equations (3) and (4) into equation (2) yields:

$$p = c_1 + c_2 y + c_3 gy + c_4 g \tag{5}$$

where c_1 is the intercept, c_2 is the independent impact of y on p when g=0, c_3 is the effect of y interactively with g and c_4 is the impact of g when y=0.

With reference to equation (5), the intercept c_1 is expected to be positive, for at zero values of y and g there would surely be some poverty. The sign of c_2, which is the independent impact of y (with g=0), is anticipated to be negative, since growth reduces poverty when there is a near perfectly equal distribution of income. However, c_3 is expected to be positive. This is because c_3 represents the effect of g on the impact of y, so that as g rises and income distribution becomes less equal, the poverty-reduction effect of growth is abated. Finally, the sign of c_4 is anticipated to be negative, that is, an increase in inequality would decrease poverty when y is zero. The rationale is that in the case where nearly everyone is poor, redistribution from the non-poor to the poor is likely to render more people poor.

According to equation (2), income growth should reduce poverty proportionately. This is the case of the Dollar and Kraay (2002) proposition that all income groups benefit proportionately from growth, implying a uniform distribution of growth with no special role for income distribution with respect to the growth effect. In contrast, according to equation (5), not only does inequality affect poverty independently, but also the transformation of growth to poverty reduction would depend on the level of inequality.

From equation (5), the income impact on poverty is:

$$y_{imp} = c_2 + c_3 g \tag{6}$$

Similarly, the effect of inequality on poverty is obtained as:

$$g_{imp} = c_4 + c_3 y \tag{7}$$

we discuss first equation (6). Since c_2 is negative and c_3 positive, the sign of y_{imp} is negative at low levels of inequality. However, at a sufficiently large value of g, it would be positive. This latter effect is possible, since as income increases the poverty line realistically also rises, though less than proportionately.[6] Thus, if g is sufficiently large

5 For similar frameworks, see Fosu (2001, 2004).

6 As will be elaborated later, this is a more realistic characterization of the poverty line, for basic needs tend to increase with income, though not necessarily in a proportionate fashion.

so that increases in income mainly accrue to upper income individuals, then the level of poverty rises.[7] Consequently, not only is the poverty function with respect to income growth non-linear, but also it could be non-monotonic. Based on equation (6), the threshold value of g is given as:

$$g_{tr} = -c_2/c \qquad (8)$$

Below g_{tr} the impact of y on p is negative, and is positive above it. In effect, as long as inequality is not too high, growth would reduce poverty.

Similarly, according to equation (7), g_{imp} is negative initially at low levels of y, since c_4 is negative. The sign of c_3 is positive, however, so that as y becomes larger, g_{imp} tends toward being positive. Hence, the poverty–inequality function is also non-linear and possibly non-monotonic. From equation (7), the threshold value of y is:

$$y_{tr} = -c_4/c_3 \qquad (9)$$

Below y_{tr} the impact of g on p is negative, and is positive above it. That is, reducing inequality would normally decrease poverty, provided income is not too low.

3 Data, estimation and results

3.1 The data

The data consist of 32 observations on rural and urban sectors in 16 SSA countries for the 1990s.[8] This dataset is unique in the sense that it provides data for both rural and urban sectors based on comprehensive household surveys (World Bank 1997).[9] The use of cross-section, rather than panel data for African countries is defensible mainly because usable panel data on poverty are unavailable for most African economies, especially for rural and urban sectors. Furthermore, as we are interested in cross-country comparisons in the poverty elasticity rather than intertemporal elasticities per se, the lack of panel data may not pose major difficulties.

Actually, the country-specific factors not controlled for in such a cross-section study, are precisely the variables that may give rise to the differences in the cross-country variance of the poverty elasticity. It is these factors that are to be explored in subsequent research in order to design appropriate country-specific policies to reduce poverty. In addition, as Adams (2004) demonstrates, income distributions are relatively stable over time, suggesting that it is the cross-country variance that really matters. Finally, a

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7 This effect is possible given that the poverty line is not fixed and rises with mean income, as is adopted in the present study. As income accrues mainly to the rich, mean income rises and so does the poverty line, so that more individuals will likely fall below the poverty line and become poor. Theoretically, such a variable poverty line is plausible under the ‘relative income hypothesis’ that an individual’s welfare position depends on the individual’s relative rather than absolute income position.

8 The countries represented are: Burkina Faso, Central African Republic, Côte d’Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Madagascar, Niger, Nigeria, Senegal, Sierra Leone, Tanzania, Uganda and Zambia.

9 The limited number of household surveys explains the rather small sample size. This is also the dataset employed in Ali and Thorbecke (2000).

unique characteristic of the data is that it covers both rural and urban sectors, thus providing the potential advantage of accounting for any rural-urban difference in the income elasticity of poverty across sectors in a given country.[10]

3.2 The poverty line

Employed here is a 'quasi-relative' poverty line from Ali and Thorbecke (2000);[11] this concept is a compromise between the absolute poverty line, which is fixed, and relative poverty, where the line rises proportionately with income. These two extreme measures have been used extensively in the literature and in practice, but they are both problematic (Foster 1998). In reality, 'basic needs' are likely to increase with income over time and space across countries.[12] Even in a given country, basic needs may differ between urban and rural areas, as well as over time.

It seems reasonable, therefore, to expect that the poverty line will increase with the standard of living. The only real question is, by how much? If basic needs rise proportionately with average income, as the relative poverty approach implies, then growth will have no impact on poverty, unless it happens to disproportionately raise the incomes of the poor, a generally rare phenomenon. Thus using such a poverty line is likely to underestimate the reduction in poverty levels due to growth. Conversely, to the extent that the poverty line rises with the standard of living that in turn increases with income, using a fixed poverty line would likely result in an overestimation of the reduction in poverty emanating from growth. Thus, the quasi-relative poverty line represents a reasonable compromise between these two extremes. One way to capture this concept, as adopted here, is by the use of a poverty line that is quadratic with respect to income.[13]

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10 Ali and Thorbecke (2000) find, for example, that poverty in SSA is primarily a rural phenomenon. As will also be reported in a later section, a given country can have a considerable disparity in poverty responsiveness to income between the rural and urban sectors.

11 While the 'quasi-relative' poverty terminology is introduced here, the approach itself was initiated by Ali (1998), and further elaborated by Ali and Thorbecke (2000).

12 As an illustration of this reality, colour television is today a 'basic need' in the developed countries, though it was a luxury in the past in these countries and is a luxury today in many developing countries. Even in a given country, rural–urban income differences are likely to result in sectoral disparities in 'basic needs'. More generally, the variable poverty line may be justified on the basis of the 'relative income hypothesis' as earlier alluded to above.

13 Specifically, using a semi-logarithmic specification, Ali and Thorbecke (2000) find that the poverty line increases with income but at a decreasing rate, with a turning point at US$2270 (1985 PPP-adjusted dollars) according to our calculations (that is $1.58x10^{-3}/2(3.485x10^{-7})$). Since, furthermore, the maximum of the mean income in the present sample is US$1690, the estimates are well within the feasible range. For details, see Ali and Thorbecke (2000: 13, footnote 3).

Table 1

Income distribution, growth, and poverty reduction: summary statistics

Variable*	Mean	Std. Dev.	Min.	Max.	Rural	Urban
P_0	50.3	11.7	32.1	77.6	58.7	43.0
P_1	21.0	10.4	9.0	55.6	26.0	16.3
P_2	11.9	9.1	3.5	45.9	15.9	8.5
Y	621.1	344.6	191.0	1690.0	380.7	828.7
G	42.8	9.1	29.7	66.7	42.9	42.2

Notes: *The variables P_i (i=0,1,2) are the head-count, poverty-gap and squared poverty-gap measures, respectively, expressed in percentages (see text for details), Y is the mean income in 1985 PPP US$, based on Summers and Heston (1991) and G is the Gini coefficient, in percentages. Figures under 'rural' and 'urban' are the respective rural and urban means.

Source: Computed, using raw data from Ali and Thorbecke (2000) and World Bank (1997).

3.3 Summary statistics

Summary statistics of the relevant variables are provided in Table 1. According to these data, 50.3 per cent of the African population were in poverty in the 1990s.[14] This headcount ratio, however, ranged from less than 32.1 per cent in Ghana to as high as 77.6 per cent in the Central African Republic (CAR). Similarly, the shortfall of incomes of the poor from the poverty line, represented by P_1, averaged 21.0 percent, but its range was from as little as 9.0 per cent in Ghana to as high as 55.6 per cent in rural Sierra Leone. The squared poverty rate P_2 averaging 11.9 percent, also ranged from 3.5 per cent in Ghana to 45.9 per cent in rural Sierra Leone. While annual income averaged 621 in 1985 PPP-purchasing dollars, it varied considerably from a minimum of slightly less than US$200 in rural Zambia to a maximum of nearly US$1700 in urban Kenya. The Gini coefficient, measuring the level of inequality, also averaged 43 percent;[15] it varies quite considerably, from a low of 30 per cent in rural Côte d'Ivoire to nearly 70 per cent in rural Sierra Leone.[16]

There are generally sectoral differences in the above variables. In particular, as reported in Table 1, the mean poverty rates for all the three measures are considerably higher in the rural than in the urban sector. This observation led Ali and Thorbecke (2000) to state that poverty in Africa is essentially a rural phenomenon. It is also notable that the average rural income is substantially lower in the rural sector, suggesting that the relatively high rural poverty may be explained by the sector's low income. It is interesting to note, however, that the level of inequality as measured by the Gini coefficient is about the same between the two sectors.

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14 It is noteworthy that this estimated poverty rate is not considerably different from the 46 per cent figure reported for the US$1 per day measure for the 1990s (World Bank 2006).

15 Comparatively, Milanovic (2003: table 2) reports for the 1990s similar respective SSA mean and median Gini values of 46 per cent and 44 per cent (versus 38 per cent and 36 per cent for the rest of the world).

16 Remarkably, Milanovic (2003: table 1) also reports minimum and maximum values of 38 per cent and 66 per cent, respectively, 'around year 1998' as well as a standard deviation of 8 per cent, compared with our estimate of 9 per cent (Table 1).

3.4 Estimation and results

Both the full and constrained (c_3=0) versions of equation (5) are estimated using the White heteroscedasticity-consistent standard errors and covariance procedure. The simpler constrained version is also estimated in order to compare the results based on the full model with those from the simpler model which implies that income distribution, represented by inequality, has no influence on the impact of income on poverty. Results from estimating the constrained version of equation (5) are presented in Table 2 as equations A.1, B.1 and C.1 involving the respective P_i (i=0,1,2) measures of poverty. Equations A.2, B.2 and C.2 are the corresponding results for the full model, respectively.

Table 2

Income distribution, growth, and poverty reduction:

regression results[*]

(absolute values of the 't' ratio in parentheses)

Eqn.	Const	Y	g	y*g	d	AR^2	SEE	W(λ)
A. Head-count poverty measure (p_0)								
(A.1)	1.663[a]	-0.347[a]	0.606[a]	--	-0.013	0.845	0.041	20.1(.01)
	(7.41)	(5.34)	(7.18)		(0.60)			
(A.2)	9.847[a]	-3.464[a]	-4.353[a]	1.888[a]	-0.002	0.948	0.024	13.4(.34)
	(8.61)	(8.02)	(6.20)	(7.13)	(0.18)			
B. Poverty-gap measure (p_1)								
(B.1)	0.254	-0.577[a]	1.603[a]	--	0.010	0.883	0.065	7.0(.54)
	(0.80)	(6.70)	(10.04)		(0.31)			
(B.2)	11.886[a]	-5.007[a]	-5.445[a]	2.684[a]	0.025	0.943	0.046	11.1(.52)
	(10.54)	(10.93)	(7.87)	(9.52)	(1.04)			
C. Squared poverty-gap measure (p_2)								
(C.1)	-1.035[a]	-0.726[a]	2.468[a]	--	0.014	0.873	0.097	2.8(.94)
	(2.46)	(6.85)	(10.41)		(0.31)			
(C.2)	14.371[a]	-6.606[a]	-6.880[a]	3.566[a]	0.028	0.926	0.074	5.3(.95)
	(5.54)	(6.42)	(4.32)	(5.65)	(0.89)			

Notes: [*]The estimation uses the White heteroscedasticity-consistent procedure. The respective dependent variables, p_i (i=0,1,2), are log P_i, y and g are log Y and log G, respectively (see Table 1 for the definitions of P, Y and G), d is a dichotomous variable that equals unity if urban, zero otherwise. The analysis is conducted for the 1990s using 32 observations on rural and urban areas of 16 SSA countries. For details on the data, see text. AR^2 and SEE are the adjusted coefficient of determination and the standard error of estimate, respectively. W(λ) is the White specification test statistic (λ is the critical p-value), which is distributed as chi-square with K(K+1)/2 degrees of freedom, where K is the number of regressors, including the constant term, in the original regression (White 1980).

[a] Statistically significant at the 0.01 level (two-tailed).

Before discussing the results, however, we note that model-specification test is additionally conducted based on the 'White statistic' (see notes for Table 2). Not only does this test provide evidence on the possible existence of heteroscedasticity but also on whether 'the errors are independent of the regressors, and that the model is correctly specified'. (White 1980: 823) According to the results in Table 2, except for the case of equation (A.1), we fail to reject the null hypothesis that the model is 'correctly specified', thus providing support for the view that there are unlikely to exist problems of heteroscedasticity or endogeneity in the estimation.

We discuss first equations A.1, B.1 and C.1 of Table 2. The coefficients of the logarithmic income, y, and logarithmic Gini coefficient g are both highly significant, and also exhibit the correct signs. That is, growth would reduce poverty, while a rise in inequality would raise it. These results are similar to those of Ali and Thorbecke (2000), who present separate estimates for the rural and urban subsamples using a similar model and reach a similar conclusion. For the purpose of statistical efficiency resulting from a substantial increase in the degrees of freedom, however, we pool both rural and urban subsamples, but introduce the dichotomous variable d to account for possible differences in the levels of poverty between the two sectors. As the results in Table 2 indicate, though, the dummy variable is not significant, suggesting that there is little net difference in poverty between the rural and urban settings, that is, once the effects of income and inequality are accounted for. This result implies that the finding by Ali and Thorbecke that poverty is essentially a rural phenomenon is accounted for by differences in income and inequality across the rural and urban sectors. That is, even though the poverty rate is much higher in the rural than in the urban sector, as observed above, that difference evaporates once the effects of income and inequality are controlled for.

We now turn to the results from estimating the fully specified model: equations A.2, B.2 and C.2 of Table 2. The most obvious observation is that these equations display considerably better fit than their counterparts that exclude the income-inequality covariant term, as exemplified by, for instance, the substantially higher AR^2 and lower standard error of estimate (SEE) characterizing the fully specified equations. Furthermore, the covariant term coefficient is positive and highly significant, while the coefficient of y is significantly negative, as anticipated. These results suggest that a higher level of inequality would decrease the poverty-reduction efficiency of growth. Specifically, the partial elasticity of poverty with respect to income would be reduced at a rate of 1.9 percentage points per each percentage point increase in the Gini coefficient, that is, in the case of P_0, and 2.7 and 3.6 percentage points for P_1 and P_2, respectively. Hence, the saliency of inequality in lowering the poverty-reduction effect of growth appears to increase with the order of the poverty measure.

The coefficient of g is negative, suggesting that at very low levels of income, an *increase* in inequality would *reduce* poverty. As argued above, this is indeed the correct result, despite its seeming counter-intuitiveness. Most people in a given country are likely to be poor at very low levels of incomes; hence a redistribution of income that increases inequality would likely put more individuals above the poverty line, thus decreasing poverty. The above results would not be possible under the relatively simple specification in equations A.1, B.1 and C.1. In effect, the present modelling makes it possible to uncover the non-linear, and possibly non-monotonic, nature of the implications of both growth and inequality for poverty reduction.

Table 3 presents the estimated partial elasticities of poverty with respect to y and g, respectively. Interpreting first the figures evaluated at the means (not those in brackets or parentheses), we note that the estimates of the elasticities with respect to y are considerably lower than their counterparts for g. Note, moreover, that this outcome is rather similar between the covariant and non-covariant models. Thus, we find that poverty reduction would be more responsive to decreasing inequality than to growth.[17] Indeed, the growth elasticities of poverty for SSA appear quite low, especially when the elasticity estimates for P_0 for example are compared with those for the general sample of developing countries of between 2.0 and 3.0 (Adams 2004). These low estimates for SSA may actually help to explain the recent stylistic fact that though African countries have generally grown substantially faster since the mid-1990s compared to the 1980s and early 1990s, the poverty rate has hardly budged between the 1990s and 2000 (World Bank 2006). Nonetheless, the earlier observation above that the poverty rate has declined from 46 per cent in 2000 to 41 per cent in 2004 (World Bank 2007) is a hopeful sign that the recent economic growth in SSA is finally being translated to poverty reduction, consistent with the above finding.

It is observable from Table 3 that both growth and inequality have larger impacts on poverty at higher orders of P (that is, for P_1 than for P_0 and for P_2 than for P_1). Furthermore, the importance of inequality, relative to income in explaining poverty, increases with the order of P_i (i=0, 1, 2). This outcome is to be expected, since the P_i

Table 3

Income distribution, growth, and poverty reduction:

income and inequality elasticities of poverty*

	p_0	p_1	p_2
Y	0.398 [0.347]	0.658 [0.577]	0.833 [0.726]
Range	(0.02-0.683)	(0.111-1.053)	(0.102-1.353)
g	0.791 [0.606]	1.850 [1.603]	2.819 [2.468]
y/g	0.503 [0.573]	0.356 [0.360]	0.295 [0.294]

Notes. *Elasticities are computed using the results from the respective equations of Table 2. The figures corresponding to y (logarithmic income) and g (logarithmic Gini) are derived from the models with the covariant term (equations A.2, B.2 and C.2, Table 2), computed at the means using equations (6) and (7) of the text: $c_2 + c_3g$ and $c_4 + c_3y$, respectively (note that all logarithms are to the base 10). The bracketed figures are the relevant regression coefficients from the non-covariant term equations (equations A.1, B.1 and C.1, Table 2). The figures corresponding to y/g are the respective ratios of the partial elasticities of y relative to those of g. The parenthetical figures are the ranges, with g in the relevant equation above evaluated at the respective maximum and minimum values. All variables are defined in Table 2.

17 This finding is similar to that by Ali and Thorbecke (2000) who estimate the simpler model using the same data set. However, more interestingly it is similar to the estimates by Bruno et al. (1998), reported by Adams (2004: 1991), of -2.28 for growth and 3.86 for inequality using 1984–93 data of 20 developing countries based on the fixed international poverty line of US$1 per day.

Table 4

Income distribution, growth, and poverty reduction: threshold values*

	p_0	p_1	p_2
y	US$207	US$107	US$85
g	68%	73%	71%

Notes: *The figures corresponding to y are the threshold values of income below which an increase in the Gini reduces poverty. They are based on equations A.2, B.2, and C.2 for p_0, p_1 and p_2, respectively, and are obtained as the antilogs of 4.353/1.888, 5.445/2.684, and 6.880/3.566, based on equation (9) of the text. Similarly, the figures corresponding to g are the values of the Gini coefficient above which increases in income would raise poverty, and are computed as the antilogs of 3.464/1.888, 5.007/2.684, and 6.606/3.566, respectively, based on equation (8) of the text.

measure becomes more sensitive to disparities between the incomes of the poor and the non-poor as the depth and then, severity of poverty are considered.

As reported in Table 3, ranges of the estimated growth elasticity of poverty are 0.02-0.68, 0.11-1.05 and 0.10-1.35 for P_0, P_1 and P_2, respectively. Hence, various SSA countries would appear to benefit differently, in terms of poverty reduction, from economic growth, with the largest benefit accruing to those with the least inequality levels.[18]

Theoretically speaking, the growth–poverty relationship could also be non-monotonic, with the threshold values shown in Table 4. For the current sample, though, income growth decreases poverty monotonically, regardless of which poverty measure is used.[19] Thus, for all practical purposes, we should expect growth to reduce poverty in African countries, albeit at a decreasing rate with respect to inequality. Similarly, as observed above, an increase in inequality could actually lower poverty if the income level fell below the threshold shown in Table 4. Fortunately, for the present sample at least, it is only for P_0 that the minimum income of US$191 is below the threshold of US$207, and barely so. Hence, for all practical purposes, reductions in inequality would decrease poverty.

3.5 Rural-urban differences

As an illustration for policy purposes, we shed light on rural-urban differences in the responsiveness of poverty to income growth. Presented in Table 5, therefore, are esti-

18 Similar findings have been reported by others using different samples. For example, employing the more general sample of developing countries, and based on the fixed international poverty line of US$1 per day, Adams (2004) obtains growth elasticity of poverty estimates of –5.866 and –2.461 for low level Gini (inequality) and high level Gini groups, respectively. Our present study, however, provides estimates based on a continuous specification of the inequality–growth–poverty relationship and is thus capable of estimating elasticities along the continuum.

19 The maximum value for the Gini is 77.6 per cent, which is higher than all the threshold values of 68 per cent, 73 per cent and 71 per cent for P_0, P_1 and P_2, respectively.

Table 5

Estimated income elasticity of poverty for the sample of African economies

Country	y_{imp}
Côte d'Ivoire_R	0.68
Niger_R	0.64
Niger_U	0.62
Guinea_R	0.61
Nigeria_U	0.59
Tanzania_R	0.58
Ghana_R	0.57
Gambia R_	0.54
Ghana_U	0.53
Côte d'Ivoire_U	0.52
Tanzania_U	0.51
Uganda_R	0.48
Burkina Faso_R	0.47
Guinea_U	0.46
Madagascar_R	0.43
Senegal_R	0.43
Zambia_U	0.43
Gambia_U	0.37
Uganda_U	0.34
Senegal_U	0.34
Burkina Faso_U	0.34
Zambia_R	0.33
Madagascar_U	0.33
Sierra Leone_U	0.32
Guinea Bissau_U	0.29
Nigeria_R	0.29
Kenya_U	0.24
Kenya_R	0.24
CAR_U	0.24
Guinea Bissau_R	0.15
CAR_R	0.05
Sierra Leone_R	0.02

Notes: y_{imp}= income elasticity of poverty, computed as: $c_2 + c_3g$ (equation (6) of the text), where c_2 is the coefficient of income and c_3 the coefficient of the interaction term involving income and the logarithmic Gini, g (base 10), coefficient estimates are from Table 2. The R and U suffixes denote the respective rural and urban sectors.

mates of the income elasticity by sector for each country for the headcount ratio, the usual policy poverty variable. We note that the top and bottom quartiles are dominated by the rural sector, however, there are country disparities. For example, Nigeria's urban sector appears in the top quartile, while its rural sector is in the bottom quartile; thus, a much larger growth effort is required in the rural sector for a given poverty reduction. In contrast, Gambia's income elasticity estimate is higher for the rural than for the urban sector, implying a greater required growth effort in the urban sector.

There are countries where both sectors exhibit similar values of the income elasticity, however. For example, the estimates for the rural and urban sectors are both in the top quartile for Ghana and Niger, suggesting that growth would most readily be translated to poverty reduction in both sectors for these countries. In contrast, for CAR and Kenya the elasticity estimates for both sectors are in the bottom quartile. On the whole, it is not discernible from Table 5 that either sector dominates. For instance, the top and bottom quartiles are both predominately rural; the second top quartile is equally populated by the two sectors, and the penultimate bottom quartile is predominantly urban. Indeed, from table 5, the means of the estimated elasticity for the rural and urban sectors can be computed as -0.408 and -0.404, respectively, so that, *on average*, there appears to be no sectoral difference in the responsiveness of poverty to income growth. As noted above, however, there are substantial disparities across countries in the rural-urban income elasticity pattern.

4 Conclusion

The current paper has derived and estimated an analysis-of-covariance model for assessing the importance of inequality in the growth–poverty relationship. Using 1990s data for urban and rural sectors of African economies, it finds that a more equitable distribution of income would enhance the rate at which growth might be transformed to poverty reduction. However, the independent effect of a decrease in inequality could be adverse, by actually raising poverty in very low income countries.

The paper also uncovers that while countries in the SSA sample would all enjoy poverty reduction from growth, the effectiveness differs substantially among them and even between rural and urban sectors in certain countries. The ranges of the income elasticities of poverty are estimated at: 0.02 to 0.68, 0.11 to 1.05 and 0.10 to 1.35 for the poverty spread (P_0), depth (P_1) and severity (P_2), respectively. The importance of a more equitable distribution of income relative to growth for poverty reduction, then, appears to increase with the order of these poverty measures, that is, highest for P_2, and higher for P_1 than for P_0.

The results of the present study suggest that an efficient poverty-reduction strategy requires country-specific relative emphases on growth versus income distribution. In particular, that the responsiveness of poverty to income growth between the rural and urban sectors varies substantially across countries implies different optimal intersectoral policies as well. Although growth is crucial for African countries generally if poverty is to be meaningfully reduced in the region, in certain countries greater attention should be accorded to understanding the basis for the relatively large levels of income inequality. Such country-specific knowledge is crucial, if we are to ensure that redistribution does not harm economic growth more than it enhances growth's ability to reduce poverty.

Meanwhile, the current evidence suggests that greater attention accorded the possible rural-urban dichotomy across countries.

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