Can Africa Reduce Poverty by Half by 2015? The Case for a Pro-Poor Growth Strategy*

by

Arne Bigsten and Abebe Shimeles

Department of Economics
Göteborg University

Box 640
SE 405 30 Göteborg
Sweden

arne.bigsten@economics.gu.se
abebe.shimeles@economics.gu.se

23 August 2005

Abstract
This study uses simulations to explore the possibility of halving the percentage of people living in extreme poverty in Africa by 2015. A pro-poor growth-scenario and a constant-inequality scenario are compared. It is shown that initial levels of inequality and mean per capita income determine the cumulative growth and inequality-reduction required to achieve the target. The trade-off between growth and inequality varies greatly among countries and their policy-choices are thus quite different. In some cases small changes in income-distribution can have a large effect on poverty, while in others a strong focus on growth is the only viable option.

JEL Classification: I32, O15.

Keywords: Poverty, pro-poor growth, millennium development goals, Africa,

* An earlier version of this paper was presented at "International Conference on Shared Growth in Africa, July 21-22, 2005 in Accra" organized by The Institute of Statistical, Social and Economic Research (ISSER-University of Ghana), the Africa Region of the World Bank and Cornell University. We thank participants of this conference for their insightful comments. We are also grateful to Rick Wicks for very useful comments. Financial support from the Department for Research Cooperation (SAREC) and the African Economic Research Consortium is gratefully acknowledged.

1. Introduction

The international community has formulated Millennium Development Goals to be reached by 2015. The first of these goals (MDG1) is that the proportion of people with an income less than $1/day shall be reduced to half from what it was in 1990. From 1990 to 2001 the headcount-ratio of poverty for all LDCs fell from 27.9% to 21.1%, but for Africa actually increased from 44.6% to 46.4% (Chen and Ravallion, 2004).[1] It is not surprising then that several recent studies (e.g. UNDP, 2003) argue that most African countries will not achieve the target.[2]

The change in poverty for a given rate of economic growth defines the elasticity of poverty with respect to growth, which depends on the level of the poverty-line, mean income, and income-distribution (Kakwani, 1991; Datt and Ravallion, 1992; Bourguignon, 2002, 2004). Although it varies with the level of economic development and income-distribution, for simplicity, most studies have used a constant elasticity of poverty with respect to growth. This study utilizes new insights regarding the determinants of the elasticity of poverty to assess the challenge of achieving MDG1 in Africa.

Conventional wisdom has been that the elasticity of poverty with respect to growth would be high for low-income countries, where many people are clustered around the poverty-line. We find, however, that African countries with low initial per capita incomes and high income-inequality would need very high growth rates and/or reductions in income-inequality to achieve MDG1.

We show that the attainment of MDG1 is very much dependent on the income/inequality trade-off with respect to poverty in each country, which can vary with the level of both income and inequality (as we will see). Focusing on growth alone might not be the best way to halve poverty by 2015, since a slight decline in inequality might lead to a substantial decline in poverty. Thus it is necessary to study and understand the growth-inequality-poverty nexus.

[1] These estimates are based on nationally representative household surveys in 97 countries.
[2] The studies largely extrapolated linearly from data on poverty-changes over short periods. Most used estimates of the elasticity of poverty with respect to growth as the basis for extrapolation.

The next section explains the analytical framework used, while Section 3 briefly explains the data sources, poverty-lines and estimating-equations. Section 4 discusses the results. Section 5 then discusses the robustness of our results, and Section 6 discusses the policy implications and areas for future work.

2. Analytical Framework

Since the statement of the International Development Goals by the OECD in the mid-1990s, several studies have used the elasticity of poverty with respect to growth to evaluate the growth required to halve poverty by 2015 (Demery and Walton, 1998; ECA, 1999; Hanmer and Naschold, 1999, 2000).

Any poverty measure can be defined over per capita income and a measure of income-inequality (Kakwani, 1991; Ravallion, 1992), and there are at least three approaches available to estimate the elasticity of poverty with respect to growth (Kakwani and Pernia, 2000; White and Anderson, 2000; Ravallion and Chen, 2003; and Son, 2004). One is to use cross-country data on poverty, inequality, and per capita income; the coefficients generated from a regression of the log variables can be converted to elasticities with respect to growth or inequality. This approach is frequently used (e.g., Ali and Thorbecke, 2000; Fosu, 2002) in cross-country studies, where data on poverty and inequality are not available for more than one period in a given country. Another approach, when data is available, is simply to use the ratio of change in poverty to change in income over a given period as a measure of the elasticity of poverty with respect to growth (e.g., Ravallion, 2001). The third approach decomposes changes in a poverty-measure into growth and inequality components (e.g., Kakwani, 1991; Datt and Ravallion, 1992; Bourguignon, 2002; and Kraay, 2004). The data-requirement for this approach is minimal (one-period information on inequality is sufficient), and the discussions below about the possibility of achieving MDG1 in Africa is thus based mainly on it, since for most African countries the data available on poverty and inequality is limited to one period. But we present results based on the first approach to check the robustness of the reported values.

Decomposing changes in poverty into growth and inequality components provides point-elasticities, while the other approaches provide arc- or average elasticities. Which is better for such kind of analysis depends on a number of factors, including the type of poverty being measured.

What follows sketches the decomposition-method used to evaluate the relevant elasticities. Given per capita income (μ), a measure of inequality (the Gini coefficient, G) and a poverty line (z), we can obtain a measure of poverty (P) consistent with standard axioms.[3]

$$P = P(\mu, G, z) \tag{1}$$

Poverty decreases with per capita income but increases with inequality and the poverty line. It is homogenous of degree zero with respect to per capita income and the poverty line.[4]

Using these properties of the poverty-index (and assuming a constant poverty-line), we can generate a set of per capita incomes and Gini coefficients that give rise to a certain level of poverty, that is the iso-poverty curves as depicted in Figure 1. Iso-poverty curves have been used in Bourguignon (2002), Ashan and Oberi (2002), Bigsten and Shimeles (2003), Kakwani and Pernia (2003), and ECLAC (2002) to illustrate the complex link between economic growth and poverty reduction.[5]

[3] These are mainly the axioms of focus, monotonicity, transfer, sub-group consistency, and decomposability; Hagenaars, (1987) provides an in depth discussion of the properties of poverty-indices.

[4] As is well known, any changes in inequality that takes place within the non-poor population do not affect most poverty measures, including the headcount ratio. In addition, some increases in inequality can reduce the headcount ratio if for example it is the case that in the growth process some poor people are made non-poor and other poor people are made even poorer. This is one of the objections raised in the literature on the sufficiency of the headcount ratio as an ethically consistent measure of poverty. To avoid such anomalies, we assume through out that the changes in inequality or poverty are brought about through a shift in the underlying Lorenz function.

[5] Bourguignon (2002, Figure 3) used G on the vertical axis and $\frac{z}{\mu}$ on the horizontal to depict downward-sloping iso-poverty curves, for a given poverty-line. His main concern was to address the cross-country variation often reported in elasticities of poverty with respect to growth

< Figure 1 here >

The slope of the iso-poverty curves is the issue; Following Kakwani, Kandhker, and Son (2003) Figure 1 makes the reasonable assumption that, at a given inequality, poverty falls with rising incomes, and that, at a given income, poverty is higher with greater inequality. The result is upward-sloping iso-poverty curves as shown. Common practice in the empirical literature (e.g., Besley and Burgess, 2003; Fosu, 2002; Ali, 1996), is to regress the log of poverty on the log of inequality and per capita income. Assuming a Cobb-Douglas specification for the poverty-function, its specific curvature is then revealed by the resulting elasticity-values.

We can totally differentiate Equation (1) with respect to growth and inequality to get

$$\frac{dP}{P} = \frac{\partial P}{\partial \mu}\frac{\mu}{P}\frac{d\mu}{\mu} + \frac{\partial P}{\partial G}\frac{G}{P}\frac{dG}{G} \qquad (2)$$

where the first term expresses the percentage-change in poverty resulting from a marginal change in per capita income, and the second expresses the effect from a marginal change in inequality. The poverty measure is jointly determined by per capita income and the distribution of that income. Thus, in a discrete case, Equation (2) will have a cross-term expressing the interaction of per capita income and inequality (Datt and Ravallion, 1992). Equation (1) is therefore not additively separable between μ and G: The marginal effect of per capita income on poverty will depend on the level of inequality, and vice versa.[6] In a continuous case, the cross-term is vanishingly small and even in a discrete case it is considered quite small (Kraay, 2004).

[6] The above decomposition of a change in poverty into components of growth and income distribution refers to a small change around the poverty line in the case of the headcount ratio. As a result, the elasticities tend to be larger in countries where significant percentage of people is clustered around that line.

Now setting

$$\frac{\partial P}{\partial \mu}\frac{\mu}{P}=\varepsilon,$$

$$\frac{\partial P}{\partial G}\frac{G}{P}=\theta,$$

$$\frac{d\mu}{\mu}=\beta,$$

$$-\frac{dG}{G}=\alpha,$$

we can rewrite the target of halving poverty by 2015 as a function of α and β, which are the rates of growth and reduction in inequality needed to achieve the target, given ε and θ, the elasticities of poverty with respect to growth and inequality. Thus we have

$$\alpha = \frac{1}{2\theta} + \frac{\varepsilon}{\theta}\beta \qquad (3)$$

Equation (3) approximates an iso-poverty function at the MDG1 target: Given estimates of ε and θ, it shows the possible combinations of growth (β) and inequality reduction (α) required to meet it. Equation (3) expresses α in terms of β, that is, how much inequality reduction would be required given any amount of growth. Thus for example we can calculate the required reduction in inequality if the historical rate of per capita growth were to prevail up to 2015. Conversely, taking $\alpha=0$, we can calculate the cumulative rate of growth required to achieve the target without any reduction in inequality.

Setting changes in poverty equal to zero and rewriting, we can get.

$$\frac{d\mu}{dG}\frac{G}{\mu} = -\frac{\frac{\partial P}{\partial G}\frac{G}{P}}{\frac{\partial P}{\partial \mu}\frac{\mu}{P}} \qquad (4)$$

which we in turn can express as

$$\nu = -\frac{\theta}{\varepsilon} \tag{5}$$

where ν is the "trade-off" between per capita income and inequality-reduction at constant poverty, while ε and θ are the elasticities of poverty with respect to growth and inequality. If ν is small, say less than unity, the effectiveness of redistribution as a tool for poverty reduction would be small. If ν is large, on the other hand, the effectiveness of redistribution as a tool for poverty-reduction would be much higher.

3. Data, Poverty-Lines, and Estimating Equations

The data on quintile distributions of income, Gini-coefficients, and real per capita growth were obtained from the World Development Indicators (2005).[7] In addition, where headcount ratio figures at a dollar a day poverty line were available for recent years, corresponding real per capita consumption were obtained using distributional data for the same period.

Based on these data-sets, we computed headcount-ratios of poverty using three alternative poverty-lines: two fixed poverty lines for purposes of international comparison ($1/day/person and $2/day/person), plus national poverty lines.[8] The relevant elasticitiesε, θ, and ν (discussed in the previous section) were estimated by fitting the quadratic and beta Lorenz functions (see Datt and Ravallion, 1992, for details). The computer program POVCAL was used to generate the results.

[7] The larger data set used for the diagrams in the Appendix are from the WIDER data-set on income distribution and from Penn World Tables.

[8] Following Thorbecke (2003), Ali and Thorbecke (2000), and Ravallion, Datt, and van de Walle (1991), the estimating-equation linking poverty-lines with per capita incomes was

$$\underset{(57)}{\text{Ln}(z) = 1.3719} + \underset{(10.96)}{0.00303\mu} - \underset{(-5.25)}{0.00000186\,\mu^2} \qquad R^2=0.96$$

where μ is mean per capita income in 1985 PPP dollars and z is national poverty lines assembled from household surveys.

4. Results

The scatter diagrams in the Appendix show correlations between the cumulative per capita income growth and inequality-reduction needed to reduce poverty by half, and initial headcount-ratios, Gini coefficients, and per capita incomes. Each point on the diagrams can be considered as a country-specific elasticity of poverty with respect to either growth or inequality. There are obvious correlations among these elasticities and the initial headcount-ratios, Ginis and per capita incomes. Consistent with Bourguignon (2002, 2004) the correlations show up more clearly (linearly) in the second set of diagrams where national poverty lines were used instead of $1/day for all countries.[9] For example, countries with higher initial headcount-ratios will need higher growth or greater inequality-reduction to reduce poverty by half, which indicates that their elasticities or poverty with respect to growth or inequality are generally lower, i.e., they will get less proportional poverty reduction. Similarly, countries with higher initial Ginis will require greater growth or inequality reduction to halve poverty, again indicating lower elasticities, whereas countries with higher initial per capita incomes will require less growth or inequality reduction to halve poverty, indicating higher elasticities.

Elasticities of poverty with respect to both growth and inequality thus vary across countries, and the ratio (ν) between those elasticities (which can be expressed in iso-poverty curves for any given country) also varies across countries. It might be easier to reduce poverty (to move to a "higher" iso-poverty curve) through growth, in others through reduction of inequality – and thus there might be a range of desirable combinations of pro-growth and inequality-reduction policies, depending on the country and its circumstances. Equation 5 expressed this ratio analytically. Table 1 reports values of ν_1 (for poverty-line at $1/day) and for ν_2 (for poverty line at $2/day) for 21 African countries.[10]

[9] There is a debate in the literature whether or not to hold poverty-lines constant in cross-country comparisons. One view (e.g., Foster, 1998, Ali and Thorbecke, 2000) is that poverty-lines reflect level of development, and should be adjusted for differences in standard of living. The other view (e.g., Ravallion, 1998) is that it is difficult to make comparisons of poverty across countries without fixing the welfare indicator.

[10] It would have been more sensible to use national poverty-lines but data was not available. For some countries we could not compute the ratios, especially for relatively high-income countries when the poverty-line was set at $1/day. To make the analysis comparable the figures reported in Tables (1) and (2) and Figures 1-4 were based on official poverty figures reported in WDI (2005), and so were the elasticities.

<Table 1 here>

For most African countries, this ratio is quite small, suggesting that there is little to gain in terms of poverty-reduction from redistribution policy. For countries with high initial inequality, however, such as Namibia, South Africa, Lesotho, and Botswana, the inequality-growth trade-off is high. In those cases there would be significant poverty-reduction even from small reductions in inequality. As Table 1 illustrates the differences between the values in columns ν_1 and ν_2, the ratio varies considerably according to where the poverty-line is located and the slope of the Lorenz-curve at that point.[11] Figure 2 gives the ratios with ν_2. Caution in interpreting these ratios is also advised, since they are essentially mechanical, not behavioural relations.

<Figure 2 here>

For example, in South Africa where $\nu_2 = 7.7$, it would take almost 8% growth to attain the same poverty reduction as would be obtained from a 1% drop in the Gini coefficient. On the other hand, for low-income countries such as Burundi, Niger, Mali, and Zambia, the scope for poverty-reduction via redistribution would be very limited, whereas even a low rate of growth would offset rising inequality.

Now that we have looked at the elasticities themselves and the trade-off between them, let us consider the implications for a pro-poor growth strategy to MDG1. Table 2 shows results for 21 African countries selected on the basis of the availability of information for the period around 1990, the base year for MDG1.

<Table 2 here>

The median reduction in inequality required to achieve MDG1 without growth in per capita income is about 25% (Ethiopia, Mauritania). From 2005 to 2015, then, the

[11] The ratio is also considerably higher at the lower poverty-line, which suggests that redistribution policies would be more beneficial for the very poor, because there are more people just below the lower poverty-line than just below the higher one.

required annual reduction in inequality without growth would be about 2.5%. On the other hand, without change in inequality, the median growth in per capita income needed to achieve MDG1 is 50% (Ethiopia, Nigeria, and Rwanda) or an annual rate of about 5%. In other words, reducing income inequality, or at least not increasing it, could, with reasonable growth, would lead to the attainment of MDG1 for at least some African countries.

But African countries are quite diverse. The reduction in inequality required to meet MDG1 without growth varies from a low of 4% for South-Africa (a very unequal society with a Gini coefficient of 58.2) to a high of 83% for Rwanda and Tanzania (68%) (which are countries with low per capita income and also relatively low inequality). Very unequal countries can thus benefit substantially from marginal reductions in inequality, but could also suffer hugely from a slight increase in inequality. Similarly, the growth in per capita income required to meet MDG1 without change in inequality varies from a low of 21% for relatively rich South Africa to a high of 111 for Central African Republic (a poor economy with very high inequality).

We compared the actual growth-rates from 1990 to 2001 with the neutral growth-rate (i.e. no change in income inequality) required to achieve MDG1 (see Figure 3). Indicative of the overall stagnation in African economies in the 1990s, the median rate of actual growth in per capita income was around 0.46%. However, growth exceeded that required to reach MDG1 for Botswana and Mozambique. If they could sustain such growth up to 2015, these countries even could even afford to increase inequality and still meet MDG1.

<Figure 3 here>

For most African countries growth during 1990-2003 was either negative or so small that to attain MDG1 they may need both accelerated growth and reduction in inequality. Figure 4 shows the reduction in inequality required to achieve MDG1 if recent growth-rates continue. Kenya, South-Africa, Botswana, and Mozambique need only a very low reduction in inequality to achieve MDG1, while Burundi, Rwanda, Nigeria, Tanzania, and Niger would require major reductions in inequality to meet MDG1 at recent growth rates.

<Figure 4 here>

5. Robustness

The results reported above on the relationships between growth, inequality, and poverty, were based on an identity. There was no causal relationship used between inequality and per capita income growth that can be exploited to reduce poverty. This is a major drawback. Since there is in fact a structural relationship between growth and inequality, the choices that a country has may be restricted. The much harder question to analyse is how different pro-poor policies might affect the growth-rate of an economy. This would require tools of analysis, such as economy-wide equilibrium-models, which would take us far beyond the simple analysis of this paper.

But our results tend to be robust when checked against a 'poverty-production function' (e.g., Fosu, 2002) relating poverty, income, and inequality as in

$$P = P(\mu, G(\mu)) \tag{6}$$

The key assumption of Equation (6) is that poverty (P) can be reduced via growth ($\Delta\mu$), but that reduction can be slowed if inequality (ΔG) increases through interaction with μ. Equation (6) does not depend on the identity between poverty, income, and inequality. A double-log estimating-equation based on it gave

$$\text{Ln } P_i = 50.14 - 8.16\ln \mu_i - 9.41 \ln G_i + 1.71 (\ln \mu_i \ln G_i) \tag{7}$$

(3.7) (-4.3) (-2.8) (3.6) Adj. R^2=76 N=48

where the terms in parenthesis are t-ratios. Partial poverty-elasticities with respect to growth (ε) and inequality (θ) were then obtained for each country in the sample, as

$$\begin{aligned} \varepsilon_i &= -8.16 + 1.7 \ln G_i \\ \theta_i &= -9.41 + 1.7 \ln \mu_i \end{aligned} \tag{8}$$

These elasticities can be compared with those obtained directly form the Lorenz functions. The correlation is 60% for the elasticity of poverty with respect to growth and 76% for the elasticity of poverty with respect to inequality. Thus there is significant correlation between those model-based poverty-elasticities and those derived from the poverty-identity. The discussion in the preceding section should then be quite robust to those different formulations.

6. Conclusions

There is an abundance of empirical research trying to explain Africa's poor economic performance, mainly based on macroeconomic aggregates.[12] A wide range of factors have been identified ranging from macroeconomic instability (caused by external or domestic shocks) to a set of initial conditions, such as geography (Sachs and Warner, 1997); ethnic fractionalisation and conflict (Collier and Hoeffler, 1998); 'bad' policies (Sachs and Warner, 1997; Collier and Dollar, 1999; Easterly, 2000); poor governance (Barro, 1997); weak institutions (Acemoglu, Johnson, and Robinson, 2003; Rodrik et al., 2002); and low human capital. Recently, Sachs et al. (2004) have argued that there are three types of poverty traps in Africa: the savings trap, the demographic trap, and the low capital-threshold trap. Thus Africa seems to suffer from many deep-seated, structural problems that propagate poverty.

Several recent studies (Dollar and Kraay, 2002, Kraay, 2004) have concluded that inequality reduction has had little to do with reducing poverty in recent decades. Kraay reports that an overwhelming share of the change in poverty over time in his data set is explained by growth rather than by changes in distribution. Like Besely and Burgess (2000), and White and Anderson (2000), our results show that even modest reductions in inequality could reduce poverty substantially in certain countries. If a pro-poor growth pattern can be achieved, poverty-reduction in Africa could be quite rapid. But there is as yet very little empirical research available on the determinants of inequality in Africa, and its interaction with economic growth. This is an area where much work remains to be done.

[12] One of the important contributions in this area comes from case studies conducted by the African Economic Research Consortium.

Future research should include changes in the structure of the economy and composition of household income to determine the sources of growth and inequality. Micro-simulations can be used to analyse how investments in physical and human capital, for example, contribute to growth and income inequality, and thus to poverty. In Africa, such analyses have so far been constrained in many countries by lack of household or individual data on living standards. Recent household-budget surveys, for example the Living Standard Measurement Surveys of the World Bank, provide a basis for a deeper analysis of the challenges of achieving Millennium Development Goals in Africa.

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Table 1 Equity-growth 'trade-off' for selected African countries

Country	Year	V^*_1	V^{**}_2	Gini coefficient	Per capita income (in 1985 PPP)
Botswana	1993	3.30	0.44	67.4	1550
Burundi	1992	0.24	0.04	42.5	440
CAR	1993	0.33	0.23	61.3	480
Cote d'Ivoire	1993	2.84	2.84	45.5	1400
Ethiopia	1995	0.67	-0.23	30.1	610
Ghana	1997	1.07	0.36	40.2	760
Kenya	1994	1.20	0.34	42.4	870
Lesotho	1993	2.73	1.09	62.3	1350
Madagascar	1993	0.24	0.04	48.2	456
Mali	1994	0.01	0.00	50.5	370
Mauritania	1995	1.06	0.34	39.6	748
Mozambique	1996	0.59	0.12	40.6	585
Namibia	1993	5.14	-----	77.0	2350
Niger	1995	0.11	0.04	50.5	410
Nigeria	1997	0.66	0.16	51.7	380
Rwanda	1995	1.14	0.52	45.5	523
Senegal	1994	1.36	0.46	41.8	868
South Africa	1993	5.46	7.74	58.2	2350
Tanzania	1993	0.53	-0.25	38.2	303
Zambia	1996	0.17	0.01	53	430
Zimbabwe	1990	0.50	0.39	50	540

*Elasticity ratio between growth and change inequality needed to keep poverty constant at 1 dollar a day per person. ** Elasticity ratio between growth and change inequality needed to keep poverty constant at 2 dollar a day per person

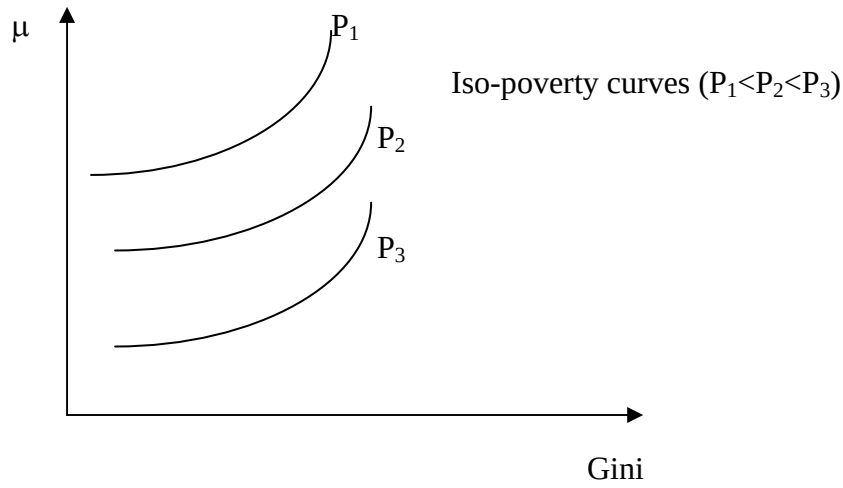
Source: Authors' computations using data from WDI (2005).

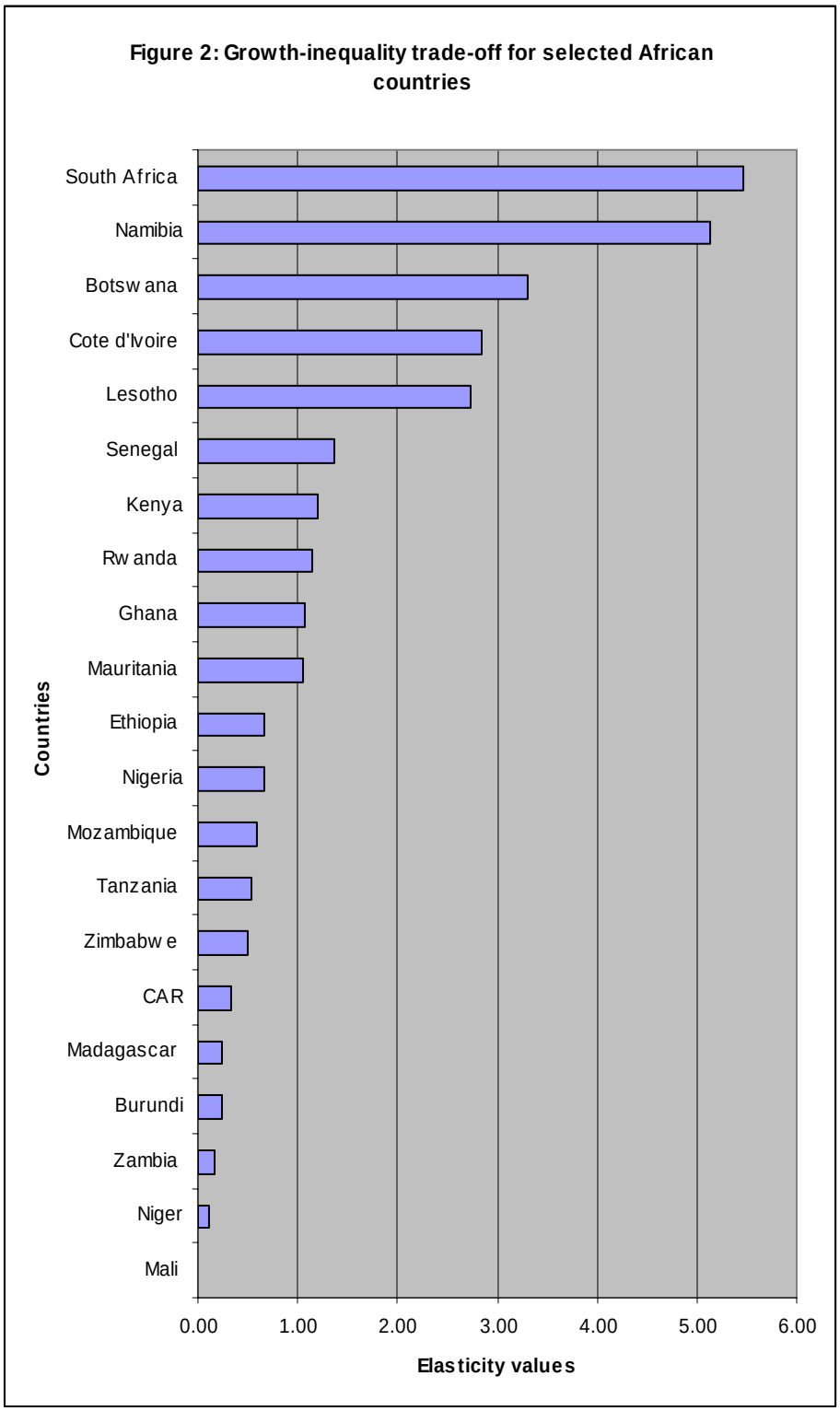
Table 2: Growth-inequality trade-off for selected African countries to achieve MDG1

Country	Year	Headcount (1 dollar a day)	Gini coeffi-cient	Per capita consum ption (in 1985 PPP)	Growth rate of per capita GDP required to halve poverty without change in inequality (%)	Reduction in Gini required to halve poverty without growth (%)
Botswana	1993	30.66	67.4	1550	49	15
Burundi	1998	54.56	42.5	440	45	50
CAR	1993	66.58	61.3	480	111	13
Cote d'Ivoire	2002	10.80	45.5	1400	20	7
Ethiopia	2000	22.98	30.1	610	50	25
Ghana	1997	29.42	40.2	760	33	31
Kenya	1997	22.80	42.4	870	25	21
Lesotho	1995	36.43	62.3	1350	65	24
Madagascar	2001	61.03	48.2	456	68	36
Mali	1994	72.29	50.5	370	96	20
Mauritania	2000	25.93	39.6	748	29	28
Mozambique	1996	37.85	40.6	585	31	53
Namibia	1993	34.93	77.0	2350	69	14
Niger	1995	60.56	50.5	410	78	50
Nigeria	1997	70.24	51.7	380	50	76
Rwanda*	1995	51.70	41.2	523	50	83
Senegal	1995	22.30	41.3	868	25	19
South Africa	2000	10.70	58.2	2350	21	4
Tanzania*	1993	76.00	38.2	303	36	68
Zambia	1999	63.65	53.0	430	66	20
Zimbabwe	1995	56.12	50.0	540	63	33

*The figures for the headcount are based on 1 dollar a day per person in 1985 PPP.
Source: Authors' computations using data from WDI (2005).

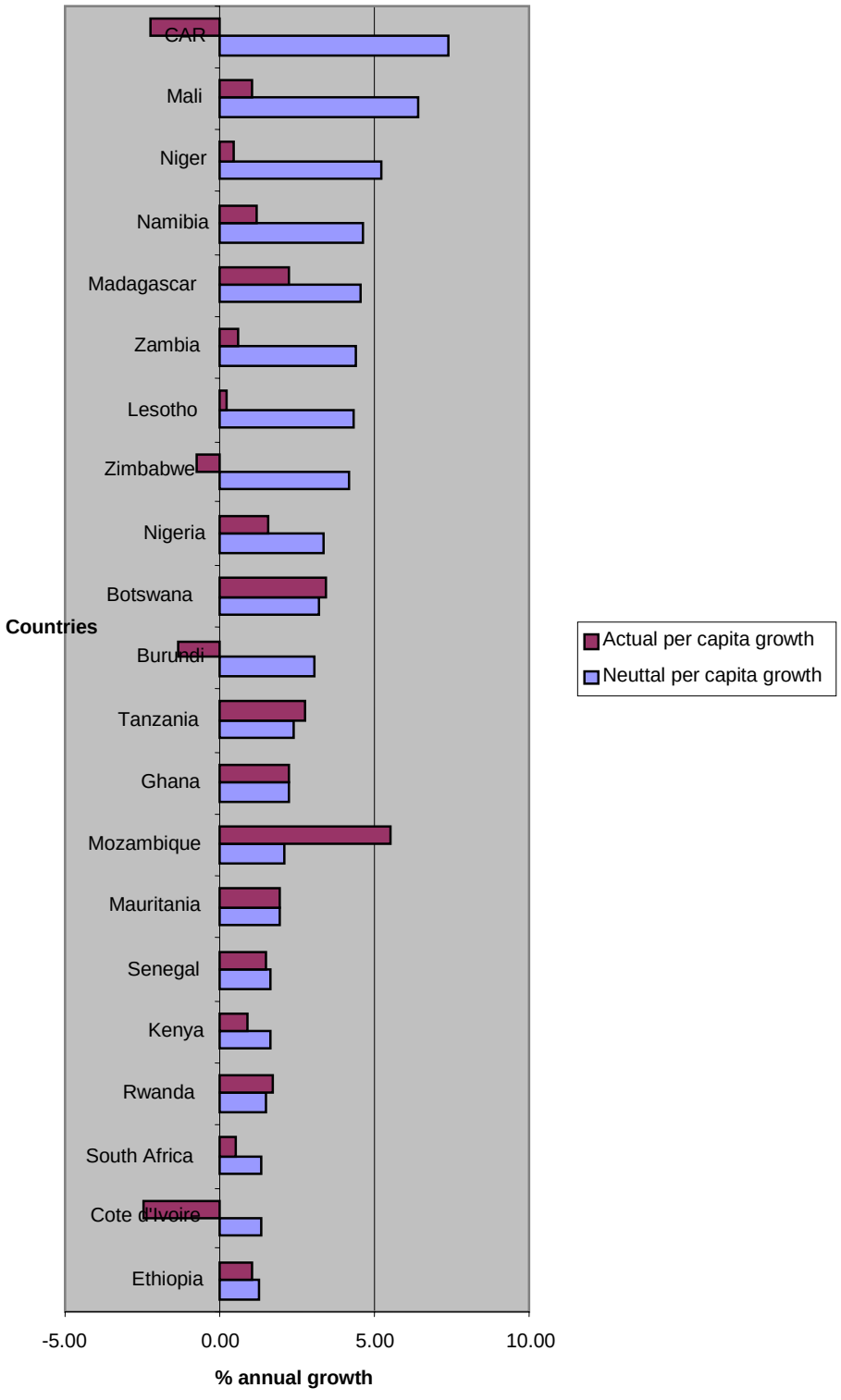
Figure 1: Per capita income-inequality trade-off



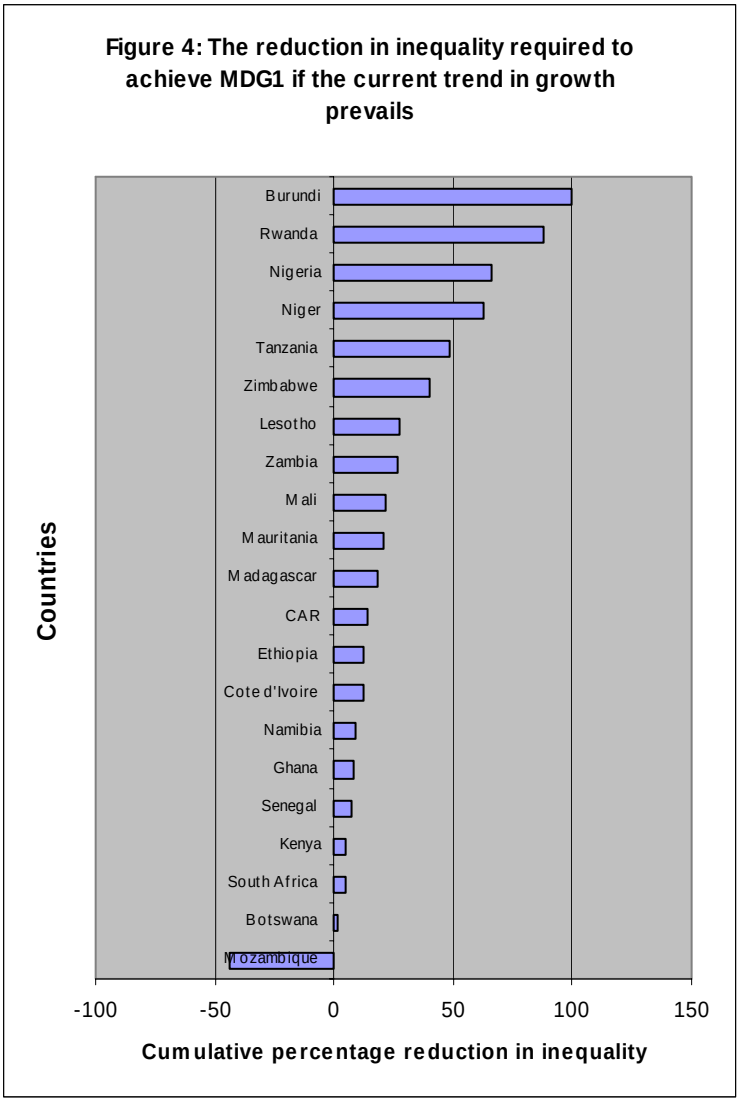


Source: Authors' computations using WDI (20045) data.

Figure 3: Actual per capita growth (1999-2003) vs neutral growth

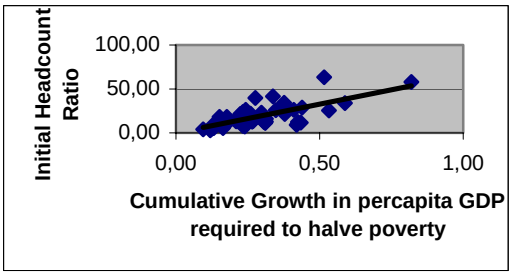


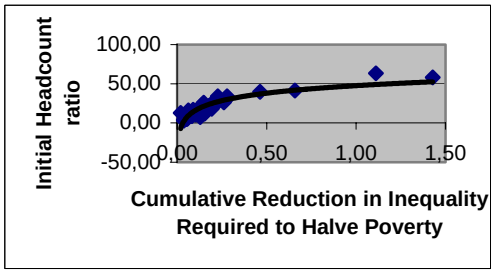
Source: Authors' computations using WDI (2005) data.

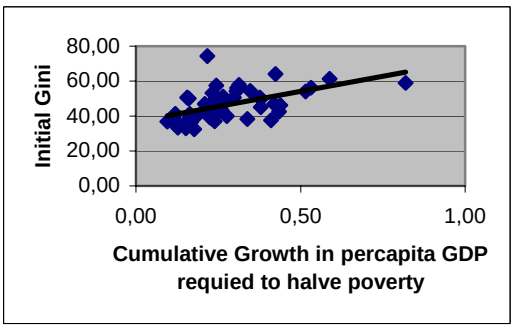


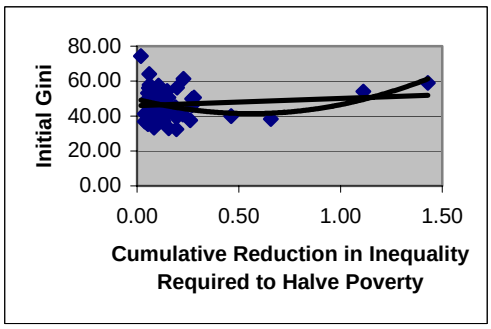
Source: Authors' computations using WDI (2005) data.

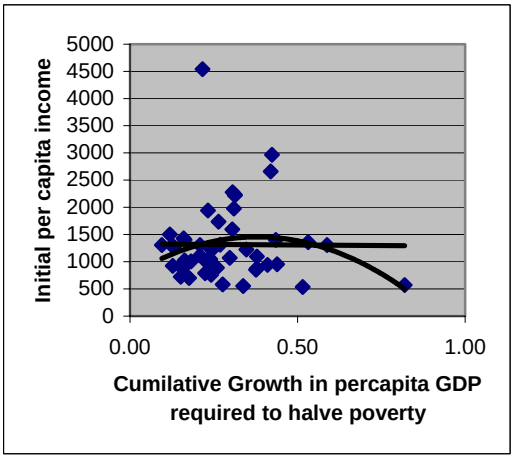
Appendix Figures 1-12: Initial per capita GDP, income inequality, poverty and the cumulative rate of growth and reduction in income inequality required to achieve goal 1 (1$ a day and National poverty lines)

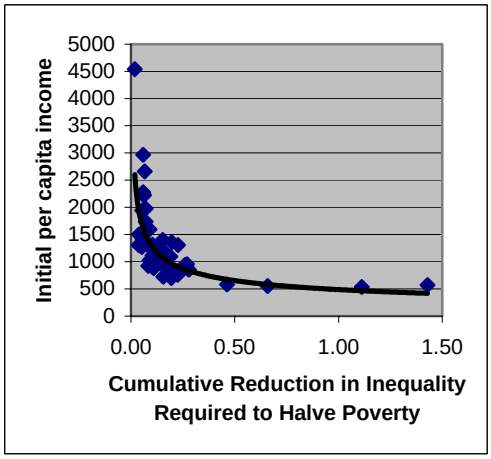


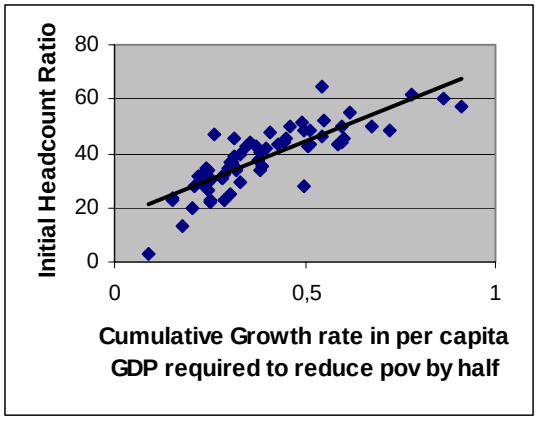


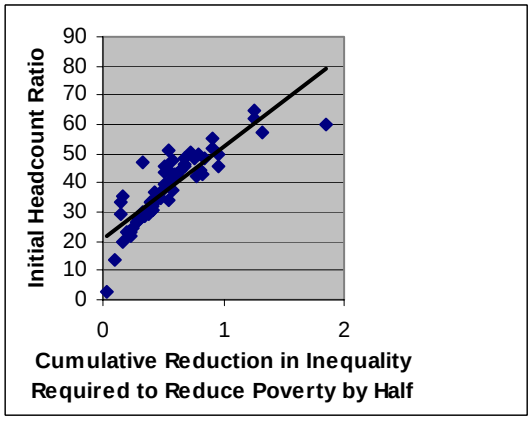


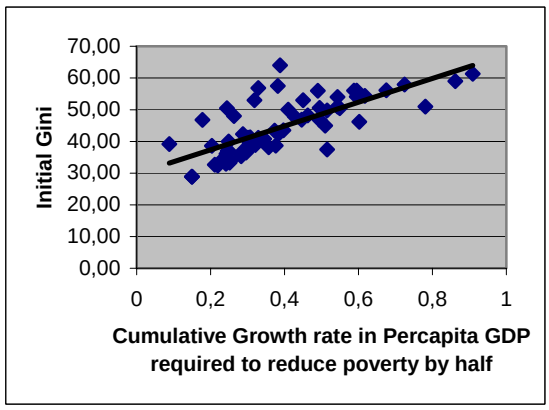


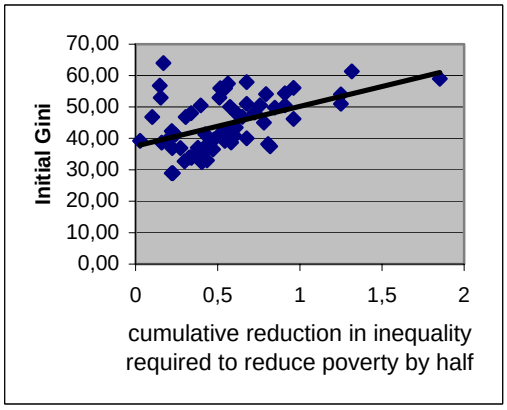


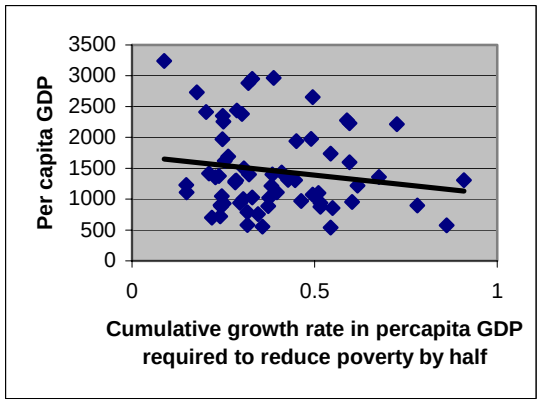


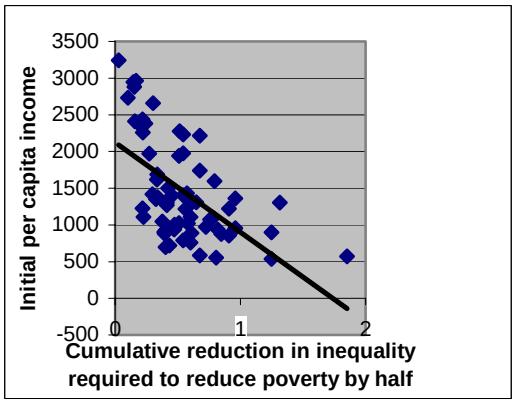












Source: Authors computations using WIDER's income distribution data base and Penn World Tables for per capita incomes.