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Economic growth, inequality and poverty in Africa

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Peace!

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1. Introduction

The most important development endeavor is to reduce poverty. There has been an ongoing debate on the actual contribution of growth to poverty reduction. In addition, a related question frequently raised is whether the main focus of development strategies should be placed on growth, or poverty reduction with or without a change in inequality. Without doubt, faster economic growth is associated with faster poverty reduction, given other factors affecting poverty. But an interesting policy implication can be drawn by answering the question of how responsive is poverty for a given level of economic growth or a given change in inequality. In other words, what are the growth and inequality elasticity of poverty? In effect, the prevailing magnitudes of growth elasticity and inequality elasticity of poverty may help in choosing a right strategy from among various poverty reduction strategies.

The United Nations Millennium Declaration[1] endorsed the commitment to halve the proportion of people living in extreme poverty between 1990 and 2015. Therefore, the knowledge of the relative importance of growth and inequality elasticities of poverty can be used to determine the minimum economic growth required to achieve the Millennium Development goal of poverty reduction.[2] Sub-Saharan Africa being the major poverty-stricken part of the world, my study focuses on this region with a view to understanding how best to achieve the goal of poverty reduction.

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[1] General Assembly Resolution 55/2 of September 2000.

[2] The first of the seven Millennium Development Goals says, "Reduce by half the proportion of people living on less than a dollar a day," and "Reduce by half the proportion of people who suffer from hunger."

Part of the growth debate on poor countries concerns the not so apparent relationship between growth, poverty and inequality. Bourguignon (2003) indicates that analytically, an identity links the growth of mean income in a given population, the change in the distribution of relative incomes, and the reduction of poverty. In other words, poverty reduction in a given country and at a given point of time is fully determined by the rate of growth of the mean income of the population and the change in the distribution of income.

Most social scientists agree on the relationship between growth and poverty, i.e. growth contributes to poverty reduction with the assumption that distribution of income remains more or less constant. However, Bourguignon (2003) notes that the growth-poverty relationship is not simple and the corresponding elasticity is certainly not constant across countries and across the various ways of measuring poverty. There is also no consensus on the relationship between income inequality and growth. Heltberg (2002) asserted that growth and distribution are interconnected in numerous ways, and the effectiveness with which growth translates into poverty reduction depends crucially on initial inequality. On the other hand, the growth optimist believes in the "trickle down" effect assuming that growth in average income will finally benefit the poor. By implication, growth is the main tool for fighting poverty and 'growth is all that matters'. However, the opposing view argues that reductions in inequality are required to combat poverty.

Much of the literature emphasizes that growth is a necessary condition for poverty alleviation, but inequality also matters and should be on the agenda. Moreover, much of the recent literature rejects constant growth elasticity of poverty and questions the

precision of results of the poverty projection studies based on constant elasticity. Bourguignon (2003) notes that because the actual contribution of growth to poverty reduction is not precisely identified when we assume a constant elasticity, it follows that the contribution of a distributional change to poverty reduction is also imprecisely estimated. Correcting for such imprecision is a methodological challenge. Theory and evidence shows that both the growth and distribution elasticities of poverty depend positively on the level of development and negatively on the degree of inequality.

Another important part of the discussion surrounds cross-country heterogeneity of the average growth elasticity of poverty figures. According to Bourguignon (2003), the sources of this heterogeneity include: the stage of development and degree of inequality across countries, and changes in the distribution of relative income over time. This paper tries to examine the relationship among economic growth, shifts in income distribution, and poverty reduction. More specifically, the paper attempts to address the following questions:

1. How responsive is poverty to economic growth and changes in inequality?
2. Do initial inequality and level of development matter for growth elasticity of poverty?

Recent literature in development economics makes the issue of poverty reduction and its link to economic growth and inequality an important agenda. However, there have been few studies conducted in this area of research despite its strong policy relevance for poor developing countries. My research aims to contribute to the on-going discussion on linkages between poverty, growth and inequality by extending previous studies in several

ways. Through attempts to uncover the intricate nature of interrelationships between the three major factors in the context of the poorest region in the world, this study seeks to achieve a better understanding of the determinants of poverty reduction.

2. Literature review: Theory and Evidence

2.1 The Poverty-Growth-Inequality Link

Poverty reduction in a given country is a function of the changes in average income and changes in income inequality (Lopez and Serven, 2004). In this section, we present a review of the papers that have explored the relative contribution of income growth and distributional changes to changes in poverty. The issue is relevant because even if poverty responds to both factors, gaining knowledge about their relative importance may be helpful when trying to strike the right balance between pro-poor and pro-growth interventions. A second group of papers considered below focuses on the growth-inequality relationship, with some paying attention to the potential impact that the growth process has on inequality and others stressing the potential effect of inequality on growth. These papers have largely focused on whether countries will have to face trade-offs between reducing inequality and improving growth performance, or instead whether there exists a virtuous circle in which growth leads to lower inequality, with lower inequality in turn leading to faster growth.

2.2 The Importance of Growth and Inequality to Changes in Poverty

A series of recent studies have explored the relative contribution of income growth and distributional changes to changes in poverty. All in all, the papers suggest that the extent to which governments should focus on growth or distributional change to achieve poverty reduction depends on country conditions, and in particular the levels of economic development and initial inequality, as well as the society's level of tolerance for inequality.

There is plenty of evidence suggesting that growth is important for poverty reduction (Deininger-Squire, 1996; Foster and Szekely, 2001; Dollar and Kraay, 2002; Ravallion 2002; Bourguignon 2003). Building on his earlier work, Kraay (2004) provides the *case for pro-growth focus*. He disentangles the impact of growth on poverty reduction by identifying three potential sources of pro-poor growth, understood as growth that leads to a fall in a given poverty measure. These are: (i) a high growth rate; (ii) a high sensitivity of poverty to growth; and (iii) a poverty-reducing pattern of growth. His results suggest that roughly 70 percent of the variation in short-run changes in poverty can be explained by growth in average incomes. In the medium- to long-run, growth would account for an impressive 97 percent of the changes in (headcount) poverty. Virtually all of the remainder of the variance would be due to changes in relative incomes, with the cross-country sensitivity of poverty to growth accounting for little of the variation. He also finds that the relevance of growth for poverty reduction declines as one moves from headcount poverty to the squared poverty gap. He explains this finding by noting that

more bottom-sensitive poverty measures place more weight on changes in the distribution of income than on growth.

Datt and Ravallion (1992) developed a method to decompose changes in poverty into 'growth effect', stemming from changes in average income, and a 'distribution effect', caused by shifts in the Lorenz curve[3] holding average income constant. Using data from India and Brazil, they found the growth effect to explain the largest part of observed changes in poverty.

Other studies state the case for looking also at distribution. Focusing on the expected change in poverty (rather than on the share of variance explained) that would be associated with a one percent growth rate (i.e. the growth elasticity of poverty), and how this impact is affected by inequality, Ravallion (1997) presents a parsimonious empirical model of the relationship between poverty and growth where the rate of poverty reduction associated with a given growth rate depends on a distributional correction (one minus the initial Gini index). In Ravallion (2004) the model is improved (in empirical terms) by using an adjustment for possible nonlinearities in the relationship between the growth elasticity of poverty and initial inequality. His estimates suggest that depending on the initial level of inequality, growth elasticity of poverty lies between 0.6 (high inequality countries) and 4.3 (very low inequality countries). Against this background, Ravallion (2004) concludes, "*growth will be quite a blunt instrument against poverty unless that growth comes with falling inequality*".

[3] The Lorenz curve of income distribution shows the proportion of income earned by any given proportion of households, when the households are arranged from the poorest to the richest.

Bourguignon (2003) also emphasizes the importance of the growth elasticity of poverty and how it is affected by distributional changes, as well as by initial inequality and a country's level of development. Specifically he explores alternative specifications for the relationship between poverty, inequality and growth and concludes that, at least for headcount poverty, the assumption that income follows a log normal distribution may prove satisfactory. He finds that a distributional change is as much responsible for variation in poverty reduction across spells as the heterogeneity in growth rates itself. Bourguignon pinpoints two channels as to how redistribution affects growth: a permanent redistribution of income reduces poverty instantaneously through what was identified as the distribution effect; but also redistribution contributes to a permanent increase in the growth elasticity of poverty reduction - therefore accelerating the rate of poverty reduction for a given rate of growth.

Heltberg (2002) estimates growth elasticities of poverty using real-world income distributions for three countries: Mozambique (for its high level of poverty), Vietnam (for its equal distribution) and South Africa (for its high degree of inequality). In doing so, he simulates the impact of distributional–neutral growth by maintaining the income distribution fixed and calculate the growth elasticity for a rage of artificial 'poverty lines' spanning from the 1st percentile where 99 percent are poor to the 99th percentile where just 1 percent of people are poor. He finds that for a given income distribution, the absolute value of the poverty elasticity increases as average income grows relative to the poverty line. Poverty is more (less) elastic to growth the lower (higher) is poverty. For a given location of poverty line, poverty elasticities are largest (in absolute value) in Vietnam, which has the most equal income distribution and lowest in South Africa,

which is the most unequal of these countries. It is natural to conclude that inequality does matter to poverty alleviation.

Finally, the relative importance a country places on growth and inequality may depend on societal preferences. Certain societies have higher levels of aversion to inequality, which make it advisable to concentrate on redistribution policies, whilst others have a much higher tolerance to inequality which allows governments to focus on maximizing growth in the first stages of development and correct later on for distribution imbalances.

2.3 Growth-to-Inequality Link

Is there any causal link between growth and inequality? Unlike the papers that focus on the growth-inequality-poverty relationship, which to a large extent have been written over the past three years, the analysis of the growth-inequality link has a long tradition in the economics literature. These papers have largely focused on whether countries will have to face trade-offs between reducing inequality and improving growth performance, or instead whether there exists a virtuous circle in which growth leads to lower inequality, with lower inequality in turn leading to faster growth.

On the growth-to-inequality link, while the theoretical literature is divided as to whether there is a causal relationship, the empirical literature is unanimous that growth does not have a systematic impact on inequality.

The starting point for the theoretical literature on the relationship between growth and inequality is the Kuznets hypothesis. This hypothesis suggests that the distribution of income would deteriorate over the initial stages of development as an economy

transforms itself from rural to urban and from agricultural to industrial. Subsequently, inequality would decrease as the labor force in the industrial sector expands and that of the agricultural sector falls.

More recently, however, a number of economic models have argued that technological progress (arguably the major source of economic growth) may lead to higher inequality whenever it is not neutral, or in other words, whenever it affects the productivity of different types of labor in different ways. For example, if the introduction of new technologies increases the demand for skilled labor (relative to unskilled labor), one might argue that inequality will likely increase. Admittedly, one also has to consider that if the higher growth associated with technological progress leads to an expansion in the pool of skilled labor (and hence to a reduction in the skills premium), the impact of technological progress on education is likely to be ambiguous.

Looking at the empirical literature, Deininger and Squire (1996), Chen and Ravallion (1997), Easterly (1999), and more recently, Dollar and Kraay (2002) all argue that growth, as such, does not have an impact on inequality. This would suggest that on average a typical pro-growth strategy would not be useful in addressing high levels of inequality and that there is no virtuous circle between higher growth and falling inequality levels.

Theoretical and empirical literature are both divided in their conclusion, with some studies concluding that inequality leads to faster growth, and others suggesting that inequality is likely to lower growth.

2.4 Inequality-to-Growth Link

In the theoretical literature, there are three main arguments for the detrimental impact of inequality on growth. The first is the political economy argument (Alesina and Rodrick (1994)), which is based on the following three premises: (i) redistributive government expenditure and taxation are negatively related to growth because of their adverse effect on capital accumulation; (ii) taxes are proportional to income but the benefits of public expenditure accrue equally to all individuals, which in turn implies that an individual's preferred levels of taxation and expenditure are inversely related to his income; and (iii) the tax rate selected by the government is the one preferred by the median voter. Taken together, those premises would imply that growth increases as inequality falls.

A second argument for an inequality-to-growth direction of causality relies on the so-called sociopolitical instability approach (Alesina and Perotti (1996)) which can be summarized as follows: (i) highly unequal societies create incentives for individuals to engage in activities outside normal markets, such as crime, etc; and (ii) sociopolitical instability discourages accumulation because of current disruptions and future uncertainty. This approach would also imply that growth increases as inequality falls A third argument for the proposition that increases in inequality lead to lower growth is the presence of credit constraints. Galor and Zeira (1993) note that if (i) the process of development is characterized by complementarity between physical and human capital so

that growth increases as investment in human capital increases; and (ii) credit constraints prevent poorer individuals from investing in education, then inequality will adversely affect growth prospects by reducing the number of individuals who are able to invest in human capital. Similarly Aghion et al. (1999), show that if (i) there are decreasing returns with respect to individual capital investments; and (ii) credit imperfections cause individual investments to be an increasing function of initial endowments, then inequality would be detrimental to growth by concentrating investment in fewer richer people (with a lower marginal return to investment).

It is worth noting here that even if the three arguments above predict that inequality hampers growth, their predictions on the impact of redistribution on growth are different. For example, the political economy argument is based on the premise that progressive distributional change has a negative impact on growth. According to this argument, redistribution would negatively affect growth through two different channels. First, it would provide an incentive to reduce work effort to those on the receiving side. Second, if would discourage investment from those who transfer the bulk of resources. On the other hand, the sociopolitical and credit constraints arguments would predict that redistribution - by increasing political stability and the associated investment in the first case and by creating investment opportunities with high marginal returns in the second case - would have a positive impact on growth.

Admittedly, there are also models that predict that inequality is likely to be growth enhancing. First, one may consider Kaldor's hypothesis that the marginal propensity to save of rich people is higher than that of poor people. Then if the investment rate is

positively related to the saving rate, and growth is positively related to investment, more unequal economies can be expected to grow faster. Bourguignon (1981) builds a more elaborate model and shows that with a convex saving function, aggregate output depends on the initial distribution and is higher the more unequal the society.

A second reason why inequality may lead to faster growth is related to investment indivisibilities. If new investment projects require large initial sums, in the absence of effective capital markets that allow pooling of resources by small investors, wealth concentration would support new investment and therefore lead to faster growth.

A third reason supporting this argument can be based on the potential trade-offs between efficiency and equity. For example, compressed wage structures that do not reward merit will lead to more equal societies, but it is also likely that they will reduce workers' incentives to put in additional effort or aim at outstanding achievements Mirrlees (1971).

Like the theoretical literature, the empirical results are not unanimous on the existence of a causal link between inequality and growth. Alesina and Rodrik (1994) and Perotti (1996) find a negative relationship from inequality to growth; Barro (2000) and Lopez (2004) find no relationship; and finally, Li and Zhou (1998) and Forbes (2000) find a positive relationship between income inequality and economic growth. Iradian (2005) uses an unbalanced panel dataset for 82 countries and finds that the long-run relationship between inequality and growth (constructed as 10-20 year averages) is negative and statistically significant. However, the short to medium-term effect of inequality on growth is positive. He noted that credit market imperfections may be a source of the positive link between inequality and growth.

One can find several explanations for these apparent contradictions of results. For example, Forbes (2000) explores the role played by five different factors: (i) use of different variables; (ii) different samples; (iii) data quality issues; (iv) time span; and (v) omitted variable bias in the papers using cross section data. She concludes that the most likely reasons for the discrepancy are country-specific but time-invariant, the omitted variable bias, and the length of the period under consideration. Banerjee and Duflo (2003), on the other hand, explain the differences arguing that the growth rate is an inverted U-shaped function of net changes in inequality. In addition to being able to explain the discrepancies, they also show that changes in inequality (in either direction) would be associated with lower growth in the next period.

2.4 Redistribution vs. Growth

On the impact of redistribution on growth, the work by Easterly and Rebelo (1993) and Perotti (1996) are worth noting. Using several measures of redistribution (marginal tax rates, average tax rates, social spending), Easterly and Rebelo (1993) find that redistribution is likely to have a positive impact on growth. Similarly, Perotti (1996) tests whether income inequality has an impact on the marginal tax rate, and whether the latter affects growth. His results suggest that while inequality may play no role in setting the marginal tax rate, higher marginal tax rates will have a positive impact on growth.

There is, however, some evidence that asset inequality—more than income inequality—can undermine growth and the effectiveness of pro-poor policies. Deininger and Squire (1998) find that high inequality in the distribution of land (a possible proxy for asset inequality) had a significant negative effect on future growth. Similarly, Birdsall and

Londoño (1997) also find a strong relationship between growth and initial distribution of assets. They also note that, once it is accounted for, a set of variables measuring initial asset inequality (such as initial land distribution and the initial distribution of human capital) income inequality does not seem to play a role in explaining growth outcomes (in one or another direction) any longer.

All in all the previous discussion suggests that there is some consensus (at least in the cross-country empirical literature) on the lack of causality from growth to income distribution in one or the other direction. However, on the potential causality from inequality to growth, views are much more divided, with some studies concluding that inequality leads to faster growth, and others suggesting that inequality is likely to lower growth. All the results are summarized in the following table:

Table2.1. Review of Literature

Impact of growth on income distribution	
Dollar and Kraay (2002)	no impact
Easterly (1999)	no impact
Chen and Ravallion (1997)	no impact
Deininger and Squire (1996)	no impact
Impact of income inequality on growth	
Forbes (2000)	Positive
Li and Zhou (1998)	Positive
	no impact

Barro (2000)	
Lopez (2004)	no impact
Alesina and Rodrik (1994)	Negative
Perotti (1996)	Negative
Impact of asset inequality on growth	
Deininger and Squire (1998)	Negative
Birdsall and Londono (1997)	Negative
Impact of redistribution on growth	
Easterly and Rebelo (1993)	Positive
Perotti (1996)	Positive

3. Sub-Saharan Economy

Africa is the world's poorest continent. But for the first time in a generation—amid all the bad news—there seems hope for change. An increasing number of countries in sub-Saharan Africa are showing signs of economic progress, reflecting the implementation of better economic policies and structural reforms. These countries have successfully cut domestic and external financial imbalances, enhancing economic efficiency. They have given greater priority to public spending on health care, education, and other basic social services. In addition, there has been a growing movement toward more open and

participatory forms of government that encourage cooperation between the state and civil society.

Nonetheless, the economic and social situation in Sub-Saharan Africa remains fragile and vulnerable to domestic and external shocks, and the region has a long way to go to make up for the ground lost over the past two decades. Despite some upturn in economic growth rates, poverty is still widespread and in many parts of the continent extremely acute. Investment remains subdued, limiting efforts to diversify economic structures and boost growth.

Furthermore, a number of countries have only recently emerged from civil wars that have severely set back their development efforts while, sadly, new armed conflicts have erupted in other parts of the continent. These conflicts and other adverse factors, notably poor weather conditions and deterioration in the terms of trade, have led to some loss in economic momentum in the region over the past two years.

Sub-Saharan African countries therefore face major challenges: to raise growth and reduce poverty, and to integrate themselves into the world economy. Economic growth rates are still not high enough to make a real dent in the pervasive poverty and enable these countries to catch up with other developing nations (Basu et.al. 2000).

The impact of growth on poverty has been explored in a number of recent country studies. These studies conclude that growth *is* strongly correlated with poverty reduction: on average, countries with more rapid growth experience a greater reduction in poverty, especially over the long term. The elasticity of poverty with respect to growth—the

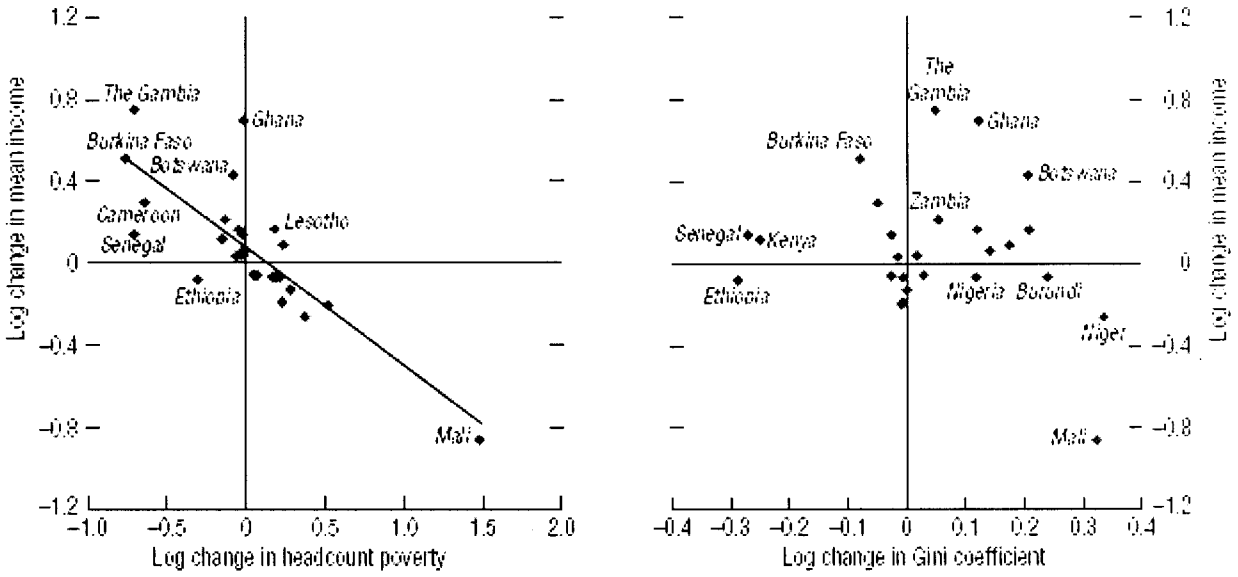
percentage change in headcount poverty for a 1 percent change in growth—has been estimated at –1.7, on average. This estimate is derived using national data from growth episodes of 12 developing countries between the early 1990s and early 2000s. Ghana, Senegal, and Uganda have elasticities of –1, whereas for Burkina Faso it is equal to –2. This variation is attributable to differences in changes in inequality in accounting for poverty reduction. For example, a decomposition of poverty outcomes shows that if inequality had not increased in Uganda during 1992–2002, the headcount poverty rate would have been 8 percentage points lower than it actually was. Nonetheless, because growth was so strong, headcount poverty still fell by 18 percentage points over this period. On the other hand, Burkina Faso's headcount poverty level dropped by nearly 5 percentage points more than it would have as a result of growth alone in 1994–2003, because inequality also fell at the same time.

The World Bank's a-dollar-per-day data, covering a longer period (1981–2001) and more countries, also show considerable country variation in poverty reduction (Figure 1, left panel). There is no tendency for inequality to increase with growth. The right panel of Figure 1 that shows income growth and changes in the Gini coefficient (the standard measure of inequality) for countries in SSA suggests that there is no systematic relationship between the two variables.

Case studies have identified three related drivers of pro-poor growth: growth in agriculture and rural areas; broad-based enhancement of productive capacity, through investment in infrastructure; and aid inflows. This is because the poor depend on

agriculture for their livelihood, aid supplements resources for the provision of critical social services, and investment in infrastructure enhances the productive potential of the economy. However, infrastructure investments have been neglected in many countries in SSA (IMF, 2005).

Figure 1: Growth and Changes in Poverty and Inequality for Sub-Saharan Africa, 1981-2001



Source: IMF, 2005

4. Data and Methodology

4.1 Data

Data quality and measurement errors are major concerns in cross-country studies, particularly the studies that use inequality and poverty data. This paper uses the data set used by Iradian (2005)[4] for his research that examined the relationship between inequality and growth.

Data on poverty and inequality may not be comparable across countries as a result of differences in definition and methodologies used by these countries. Iradian (2005) indicated that national household surveys are often the source for constructing consumption or income distribution and estimating poverty. But their design is not standardized across countries and over time, leading to significantly different estimates of average consumption or personal income. As a way to addressing the problems, he suggested the use of only one type of survey for each country and restricting cross-country comparisons to changes in (as opposed to levels of) poverty and inequality. Our data set in this study is an unbalanced panel of selected African countries[5].

In assessing the impact of growth on poverty, we use the elasticity of poverty with respect to the growth of per capita real GDP / mean income (consumption) as calculated

[4] The data set is reported in Appendix II, pp28. World Bank, IMF staff report and Poverty Reduction Strategy are the main sources of this data set.
[5]The countries included are: Algeria, Cameroon, Egypt, Ethiopia, Ghana, Ivory Coast, Lesotho, Madagascar, Mali, Mauritania, Morocco, Nigeria, Senegal, Tunisia, Uganda and Zambia.

from household budget surveys. Adams (2004) argues that estimates of the growth elasticity of poverty are sensitive to the measure of growth being used. He notes that most traditional estimates of the growth elasticity of poverty have used changes in mean income as calculated from household budget surveys as their measure of economic growth. There are other popular measures of economic growth such as changes in GDP per capita. Our study uses both per capita real GDP growth rates that are annual averages between two survey years and mean survey income growth rate. The inequality data (Gini coefficient) are derived from World Bank data, OECD, and the IMF staff report and Poverty Reduction Strategy Papers (PRSPs).

We use the common poverty measure, the headcount index (*H)* given by the proportion of the population who are poor. The poverty data is defined as the percentage of population living on less than $1 a day at 1993 prices and adjusted for purchasing power parity. Of course this poverty line differs between countries, depending on the domestic price level, so in order to get a consistent measure of absolute poverty, we will use the United Nations' 1 dollar a day-measure of poverty. This poverty line[6] is assumed to be constant over time-at least during the period being analyzed.

In studying the evolution of poverty and its causes, many recent papers- for instance Dollar and Kraay (2000) and, Ravallion and Chen (1997)- are based on linear regression where the evolution of some poverty measure between two points of time is explained by

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[6] Poverty lines are cut-offs points separating the poor from the non-poor. There are two main ways of setting poverty lines-in a relative or absolute way: (i) relative poverty lines are defined in relation to the overall distribution of income or consumption in a country; and (ii) absolute poverty lines are anchored in

the growth of income or GDP per capita and the host of other variables. Other studies—for instance, Datt and Ravallion (1992), and Kakwani (1993)—fully take into account the poverty-mean income-distribution identity and carefully distinguish the effect on poverty reduction of growth and distributional changes. Heltberg (2002) noted that poverty projection studies based on a constant elasticity linking poverty reduction to the rate of growth yield imprecise results due to failure to take into account the fact that the growth elasticity of poverty depends on initial inequality and the level of development. He argued that some precise analytical results on the growth elasticity of poverty can be possible as long as one is willing to make a constant inequality assumption, that is, that inequality does not change. Because inequality can change in number of ways, it is hard to say anything general about the growth-poverty relationship when the distribution is allowed to change during growth. Heltberg (2002) suggested a formula developed by Kakwani (1993) for the inequality elasticity of poverty under the assumption of an equal proportionate change in the Lorenz curve and another road ahead is to assume a particular functional form for the income distribution, and work out the growth-inequality-poverty relationship for that distribution. Bourguignon (2003) does this, assuming incomes follow the log-linear distribution. He derives an explicit formula linking the growth-elasticity of headcount poverty to mean income and inequality in the log-linear case. The formula shows that the growth elasticity of poverty (ε) is an increasing function of development (z /y) and a decreasing function of income inequality, σ:

$$\varepsilon = \frac{\Delta H}{\Delta \log(\bar{y}) H_t} = \frac{1}{\sigma} \lambda \left[\frac{\log(z/\bar{y}_t)}{\sigma} + \frac{1}{2}\sigma \right].$$

Under the lognormal approximation, the growth elasticity may be defined as the relative change in the poverty headcount for 1 percent growth in mean income. And found to be increasing with development and decrease with rising inequality.

Bourguignon (2003) argued that by adopting a linear regression framework or investing too little in functional specification testing, these studies ignore a complex yet identity-related relationship between mean income growth and poverty change.

Bourguignon (2003) explored various models based on a data set comprised of 114 spells covering 50 countries. The models are ranging from the "naïve" model that assumes a constant elasticity between poverty reduction and growth to the lognormal model that relies on the lognormal approximation. The estimation results fully confirm the identity relationship described earlier. Of all the models, those that assume the nonlinearity of the change in inequality on poverty reduction perform well with a significant improvement in the explanatory power of the models.

According to Bourguignon (2003), the best fit was obtained with lognormal approximation. This model relies on functional approximations of the identity and, in particular, on an approximation based on the assumption that the distribution of income or consumption expenditure is lognormal. No assumption is made in the regression on the way the income growth, the development level, and the initial degree of inequality interact to determine poverty reduction. However, it is assumed that the joint effect of these three variables is in accordance with the theoretical elasticity derived under the assumption that the underlying distribution of relative income is lognormal.

The resulting explanatory variable in the poverty reduction regression thus is this theoretical elasticity times the observed growth of the mean income. Bourguignon (2003) refers to this as an 'identity check' on the logical identity linking growth and poverty. And he confirms this identity by finding the coefficient of the growth elasticity term to be not significantly different from unity. However, Heltberg (2002) notes that Bourguignon (2003) does not compare his model to the distribution-corrected rate of growth and even if he incorporates the lognormal growth-poverty 'identity', it does not give a perfect fit. He, therefore, suggested that the best fit is likely to incorporate non-linearities and interactive terms between the poverty line relative to average income, inequality and growth. Here in this paper, we use the 'improved' standard model suggested by Bourguignon (2003). In this model, the growth elasticity is taken to be nonconstant and depends on initial inequality and level of development (poverty line relative to mean income). In line with Heltberg's (2002) suggestion the model includes interaction terms and assumes nonlinearity in the change in inequality since distributional changes now depend both on the initial level of development and initial level of inequality.

Table4.1. Definition of Variables

Variables	Definition
Growth	Annual average per capita real GDP growth rate between two survey years/mean survey growth rate
GINI	Inequality Index in percent
Gnppc	Per Capita Gross National Product at PPP($US)

Poverty	The percentage of population living on less than $1 a day at 1993 prices adjusted for purchasing power parity
Devlvl	Ratio of poverty line ($1 a day) to the mean income
School	Average years of schooling of total population aged 15 and over
Trade	Trade openness: export and import ratio to GDP
Enrolsec	Secondary school enrollment as % of age group is at the beginning of the period

Table 4.2: Summary of variables used in the regression.

Variable |	Obs	Mean	Std. Dev.	Min	Max
Growth |	40	1.298	2.437	-5.6	4.8
Gini |	56	42.473	6.548	32	60
dGini |	40	.51	4.372	-12.8	14
$Gini_{-1}$ |	55	42.289	6.460	32	60
Poverty |	52	40.365	19.623	4	74
Devlvl |	56	.303	.194	.058	.874
$Devlvl_{-1}$ |	55	.302	.195	.058	.874
School |	40	3.125	1.292	.64	5.51
Trade |	56	66.474	27.350	26.048	146.15
Enrolsec |	40	34.375	15.052	16	75

4.2 Methodolgy

First, the elasticity of poverty to growth will be estimated for the whole data set. This will be done by simply running a regression with the change in poverty as the dependent variable and change in per capita income as the independent variable. Formally the equation to be estimated is:

$$\Delta Pov_{it} = \alpha + \beta_1 Growth_{it} + \epsilon_{it}, \quad (1)$$

where ΔPov is the percentage change in poverty level, *Growth* is annual growth rate of per capita income/mean survey income growth rate, the subscript i refers to a country, and the subscript t refers to a time period.

An estimation of equation (1) gives the average growth elasticity of poverty in developing countries. This is the "naïve" elasticity. This elasticity should, however, differ across time and countries depending on other determinants that play a role in poverty variation. Hence, the next step is to run the regression again conditional on country- and time-specific characteristics. Again, the change in poverty is regressed on changes in per capita income/mean survey income and, in addition, on distributional changes and on interaction of terms since the relation of poverty with other factors is assumed to be non-linear, particularly in the inequality variable. The growth elasticity and inequality elasticity of poverty also depend on the development level of a country and the initial inequality in income distribution. Thus, we estimate an improved model that includes the

growth and inequality elasticity of poverty taking initial development and inequality level of a country into consideration. This is shown in equation (2):

$$\Delta Pov_{it} = \alpha_{it} + \beta_1 \Delta GINI_{it} + \beta_2 Growth_{it} + \beta_3 \Delta GINI_{it} * Devlvl_{it-1} + \beta_4 \Delta GINI_{it} * GINI_{it-1} + \beta_4 Growth_{it} * GINI_{it-1} + \beta_5 Growth_{it} * Devlvl_{it-1} + \epsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where:

ΔPov_{it} = annual percentage change in poverty level in country i (our cross-sectional unit) in year t from the preceding survey year,

$\Delta GINI_{it}$ =annual percentage change in Gini coefficient,

$Growth_{it}$ = per capita real GDP growth rates (annual average between two survey years),

$Devlvl_{it}$ = ratio of poverty line ($1 a day) and the mean income,

$GINI_{i-1t}$ = initial inequality level (lagGINI),

$Devlvl_{it-1}$ = initial development level (lag *Devlvl*), and

ϵ_{it} = disturbance term.

The next model (equation 3) includes human capital as well as other terms in equation (2). Following literature on growth and development, we measure human capital by the average years of schooling[7]. Human capital theory (associated with the work of Gary Becker and many others) asserts that education creates skills which facilitate higher levels of productivity amongst those who possess them in comparison with those who do not. Effective anti-poverty strategy should incorporate the enhancement of education and

[7] Average years of schooling refer to educational attainment of the total population aged 15 and over. The

skills amongst poor households if more human capital enhances their productivity in the informal urban and rural economies. Greater human capital is also likely to increase workers' eligibility for paid employment in the formal sector and for advancement once they are employed. Therefore, human capital may affect poverty reduction. The modified equation to be estimated is given in (3) below:

$$\Delta Pov_{it}=\alpha_{it} + \beta_1 \Delta GINI_{it} + \beta_2 Growth_{it} + \beta_3 \Delta GINI_{it}*Devlvl_{it-1} + \beta_4 \Delta GINI_{it}*GINI_{it-1}$$

$$\beta_5 Growth_{it}*GINI_{it-1} + \beta_6 Growth_{it}*Devlvl_{it-1} + \beta_7 School_{it} + \epsilon_{it} \ldots\ldots\ldots \quad (3)$$

Where $School_{it}$ shows average years of schooling, I use also secondary school enrollment rate for comparison.

The last model (equation 4) includes trade openness[8] in the regression. This is because openness to international trade may potentially affect poverty. Fewer empirical studies have focused on the impact of trade on poverty and inequality. On the relationship between trade and poverty, a recent survey concludes that the empirical evidence broadly supports the view that trade liberalization is poverty-alleviating in the long run and on average, as predicted by economic theory, mainly due to its effect on growth (Winters et.al, 2004). The study finds that, since trade policy is only one of the many determinants of growth (and, by extension, of poverty reduction), greater trade should generally contribute positively to poverty reduction but the ultimate outcomes are jointly determined by a host of additional factors.

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source of the date set is Barro-Lee 2000. For more information look at http://post.economics.harvard.edu/faculty/barro/data.html

[8] while trade openness can be measured several different ways, we take it as the ratio of exports plus imports to GDP. For various definitions of openness, see, among others, Edwards (1998). For an integrated

$$\Delta P_{it}=\alpha_{it}+\beta_1\Delta GINI_{it}+\beta_2 Grate_{it}+\beta_3\Delta GINI_{it}*INP/Y_{it-1}+\beta_4\Delta GINI_{it}*INGINI_{it-1}$$

$$\beta_5 Grate_{it}*INGINI_{it-1}+\beta_6 Grate_{it}*INP/Y_{it-1}+\beta_7 Trade+\epsilon_{it} \quad (4)$$

In order to estimate the above specification, we used Generalized Least-Square (EGLS or FGLS) method to control for the presence of heteroskedasticity. The STATA command *(xtgls)* fits a pooled cross-sectional time-series model using feasible generalized least squares. This command allows estimation in the presence of AR (1) autocorrelation within panel and cross-sectional correlation and/or heteroskedasticity across panel.

5. Results and Discussion

5.1. Growth and Inequality Elasticity of Poverty

Based on the available unbalanced data set for the selected African countries, different models are run for the purpose of comparison. The first corresponds to the naïve view that there is a constant elasticity between poverty reduction and growth. As expected, the scatter plot of observations shows an inverse relationship between a change in poverty and growth rate in mean income GDP (Figure 1).

approach to measuring openness, see Sachs and Warner (1995) and Warner (2003). Our data for openness come from World Development Indicators, 2005.

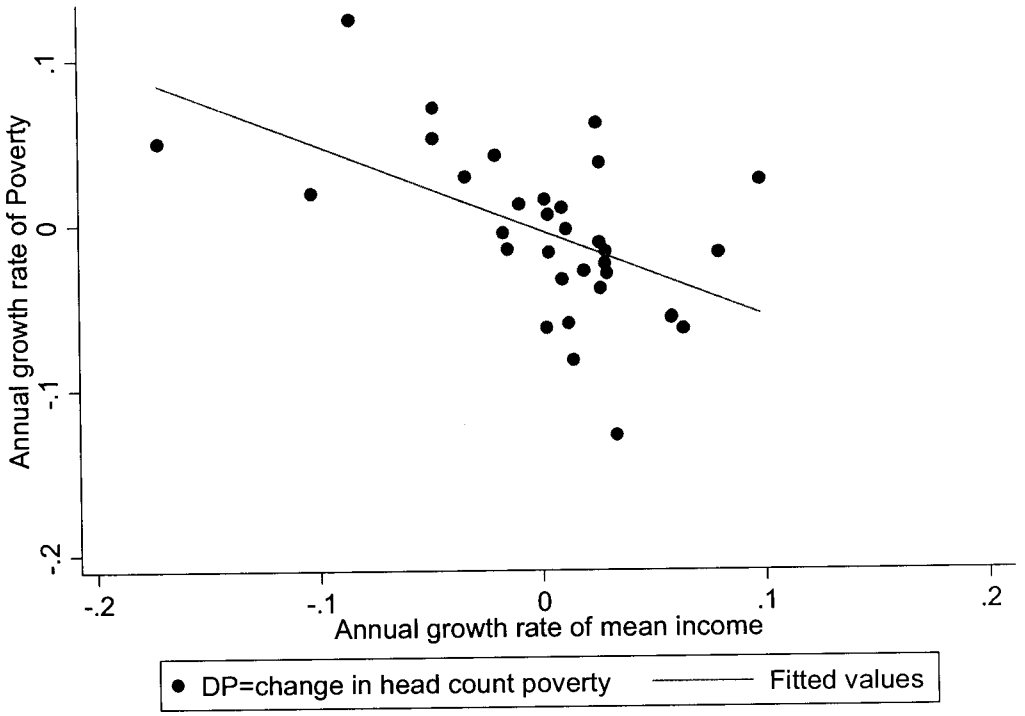


Figure 1: Scatter plot of change in poverty and growth

The estimation of the naïve model (equation1) confirms a significant negative elasticity of poverty with respect to growth (Table 5.1). However, growth of mean income significantly explains only 29 percent of the variance of observed changes in poverty headcount. The estimation result shows that growth elasticity of poverty is about -0.51, which implies that a growth rate of one percent reduces the ratio of people living under the poverty line by -0.51 percent per year.[9] It comes as no surprise that the relationship between poverty and mean survey income is stronger than between poverty and GDP per capita. As pointed out earlier, there is a large discrepancy between the two income

[9] In an alternative specification, we used growth rate of per capita real GDP based on national income accounts to compare with the results for mean income growth rate based on household surveys. As expected, it has a negative relationship with a change in head count poverty, but now the value of growth elasticity of poverty falls dramatically to -0.001^{9} .

measures and since mean survey income comes from the same household survey as the poverty measures, it is natural that these are more strongly correlated.

Table 5.1: Growth Elasticity of Poverty (Naïve Model)

(Dep. variable: ΔPov_{it} = percentage change in poverty headcount)

Variables	Coefficient[10]
Growth	−0.51541*** (0.14476)
constant	−0.004398 (0.007515)
Number of obs =	33
Number of groups =	16
Wald chi2 (1) =	12.68
Prob > chi2 =	0.0004
R^2 overall =	0.2902

In our second specification (equation 2), we assume that the growth elasticity of poverty is an increasing function of the level of development of a country and a decreasing function of the degree of inequality of the income distribution. Moreover, the effect of the distributional change on poverty reduction is assumed to depend on both the initial level of development and the initial level of inequality. The result of the panel regressions are reported in Table 5.2 below.

[10] Standard errors are given in parenthesis. *** denotes 1% significance, ** denotes 5% significance and * denotes 10% significance

Table 5.2: Poverty reduction, growth and inequality

(Dep. variable: ΔPov_{it} = percentage change in poverty headcount)

Variables	Coefficient[11]
Growth[12]	-0.006048*** (*0.002324*)
dGini	2.562008** (*1.212814*)
dGini*Gini$_{-1}$	-.0604439** (*0.02904*)
Growth*Gini$_{-1}$	-0.0454928*** (*0.00597*)
Growth*Devlvl	2.693214*** (*0.41686*)
dGini*Devlvl	-0.591006 (*1.23158*)
Constant	-0.005612 (*0.00632*)
Number of obs =	33
Number of groups =	16
Wald chi2(6) =	95.20
Prob > chi2 =	0.0000
Log likelihood =	74.734

The regression coefficients of all variables are significant except for *dGini*Devlvl*, or the interaction terms of annual percentage change in distribution of income with initial development level. As expected, lower level of development reduces growth elasticity of

[11] Standard errors are given in parenthesis. Standard errors are given in parenthesis. *** denotes 1% significance, ** denotes 5% significance and * denotes 10% significance

poverty. At the overall mean growth of GDP per capita, 1.29 percent a year, an increase in the initial level of development by one standard deviation increases poverty reduction by 0.66 percent.

Similarly, if a country has initial inequality that is one standard deviation higher than the mean, it will likely experience a reduction in poverty of 0.32 percent. This result, in fact, shows unexpected relationship between initial level of inequality and poverty reduction. This may be partly because the most relevant measure of inequality in relation to the responsiveness of poverty to growth is the density of the income distribution around the poverty line (Mesterton, 2006).

The regression results also show that the effect of the distributional change on poverty reduction depends significantly on initial level of inequality. This indicates that the role of the change in inequality on poverty is unlikely to be linear. However, the interaction term between distributional changes and level of development fails to acquire statistical significance. When we take into account the interaction terms in the regression, we find that the growth elasticity of poverty is −1.10 at the mean value of initial level of inequality (42.28) and initial level of development (0.3015). Similarly, inequality elasticity of poverty is found to be 0.03[13]. A one percent increase in per capita GDP growth is likely to reduce poverty by 1.10 percent. Similarly, deterioration of income distribution equal to one percent (i.e., a one percent increase in Gini) increases poverty by 0.03 percent. These elasticity figures confirm the relative importance of economic growth

[12] Growth in this regression refers per capita real GDP growth rate.

in poverty reduction and indicate that growth can still be considered to be the main tool in fighting poverty.

5.2 Human capital and Poverty reduction

The third specification (equation 3) includes human capital which we measure in terms of average years of schooling of total population aged 15 and over and also secondary school enrollment for comparison purpose. The human capital variable shows unexpected sign, indicating that an increase in average years of schooling increases poverty. One possible reason for such a positive relation may be because channeling a larger proportion of investment on schooling may undermine other opportunities for poverty reduction. Growth literature gives several possible reasons why human capital variable tends not to perform very well in econometric exercises. One of these is the mismeasurement problem. Average years of schooling or school enrollment ratio can only measure one aspect of human capital and even this seems to ignore the lag with which education seems actually to affect growth or in our case poverty. Or, there may be other econometric problems associated with the human capital variable. The use of secondary school enrollment, however, shows the expected sign, but stays far from the zone of statistical significance.

[13] The interaction term between inequality and initial development level is not included in the calculation of inequality elasticity due to its statistical insignificance.

Table 5.3: Poverty reduction and human capital[14]

(Dep. variable: ΔPov_{it} = percentage change in poverty headcount)

Variables	Coefficient[15]
Growth	-0.0060706*** (0.002312)
dGini	2.224072* (1.328808)
dGini*$Gini_{t-1}$	-0.05433* (0.0305835)
Growth*$Gini_{t-1}$	-0.0442584*** (0.006218)
Growth*Devlvl	2.602401*** (0.4408212)
dGini*Devlvl	-0.459984 (1.243723)
Enrolsec	-0.000209 (0.097123)
constant	.0001996 (0.0140418)

Number of obs	=	36
Number of groups	=	16
Wald chi2 (7)	=	17.38
Prob > chi2	=	0.0151
R-sq: overall	=	0.3830

5.3 Trade Openness and Poverty reduction

On the relationship between trade and poverty, a recent survey concludes that the empirical evidence broadly supports the view that trade liberalization is poverty-alleviating in the long run. As predicted by economic theory, this may be mainly due to

[14] Human capital is proxied by either average years of schooling (*School*) or secondary enrollment ratio (*Enrolsec*).

[15] Standard errors are given in parenthesis. Standard errors are given in parenthesis. *** denotes 1% significance, ** denotes 5% significance and * denotes 10% significance.

its effect on growth (Winters et.al, 2004). It also finds that since trade policy is only one of many determinants of growth (and, by extension, of poverty reduction), greater trade should generally contribute positively to poverty reduction. The ultimate outcomes on growth and poverty may, however, be jointly determined by a host of additional factors.

The regression analysis shows (Table 5.4) that openness to international trade does not seem to have a significant impact on poverty reduction. However, as expected, I found a negative relationship between trade and change in poverty. The effect of trade on poverty (and income inequality) should depend largely on other policies being implemented simultaneously. Such impact can perhaps be significantly enhanced and the possible adverse effects on inequality mitigated by policies that increase the provision and access to skills and other productive assets for the poor.

Table 5.4: Poverty reduction and trade openness

(Dep. variable: ΔPov_{it} = percentage change in poverty headcount)

Variables	Coefficient [16]
Growth	-0.0066***
	(0.0023)
dGini	2.5369**
	(1.214)
DGini*$Gini_{t-1}$	-0.0597*
	(0.029)
Growth*$Gini_{t-1}$	-0.0459***
	(0.006)
Growth*Devlvl	2.7174***
	(0.424)
dGini*Devlvl	-0.6194
	(1.233)
Openness	-0.000057
	(0.060)
Constant	-0.0018
	(4.606)

Number of obs	=	36
Number of groups	=	16
Wald chi2 (7)	=	95.55
Prob > chi2	=	0.0000
Log likelihood	=	74.77984

[16] Standard errors are given in parentheses: *** denotes significant at 1% level, ** denotes significant at 5% level, and * denotes significant at 10% level.

6. Conclusion

The increasing public focus on world poverty reduction has been accompanied by a growing economic literature on the determinants of poverty. While growth is universally deemed important for poverty reduction, there is an ongoing debate about what would be the circumstances under which poverty responds most to economic growth. This paper confirms that growth reduces poverty. In addition, I found that development level matters for poverty reduction. The regression results also confirm that distributional change also plays a role in poverty reduction. An unequal income distribution works as an impediment to effective poverty alleviation. Poverty reduction policies should thus be designed in the light of country-specific circumstances, particularly the degree of inequality. Even if most empirical finding supports a negative and a significant linkage between human capital and poverty reduction, my results show that the relationship is far from robust. Trade is found to have no significant impact on poverty. My results suggest that the study of growth, inequality and poverty linkage may require the inclusion of important variables such as level of indebtedness, socio-political variables – civil war, type of governance – and others. I also suggest using more rigorous econometrics. Finally, the current trend of collecting more data from household surveys may allow access to a better data set and allows working on many observations.

APPENDIX

Table A.1: Growth Elasticity of Poverty (Naïve Model)

(Dep. variable: ΔPov_{it} = percentage change in poverty headcount)

Variables	Coef.[17]
Growth[18]	-0.00122** (0.0005)
constant	0.001826 (0.009307)

Number of obs	= 36
Number of groups	= 16
Wald chi2 (1)	= 4.59
Prob > chi2	= 0.0322
R^2 overall	= 0.1205

[17] Standard errors are given in parenthesis. *** denotes 1% significance, ** denotes 5% significance and * denotes 10% significance

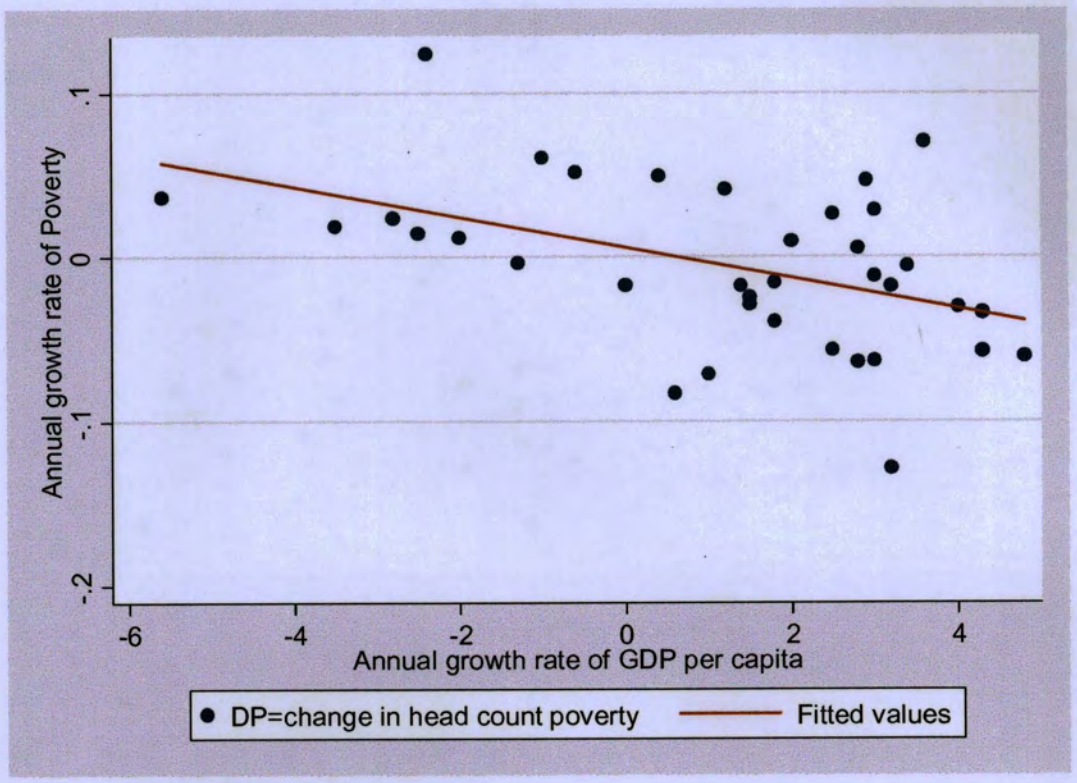
[18] Growth here refers to per capita real GDP growth

Table A2: Poverty reduction, growth, inequality and human capital

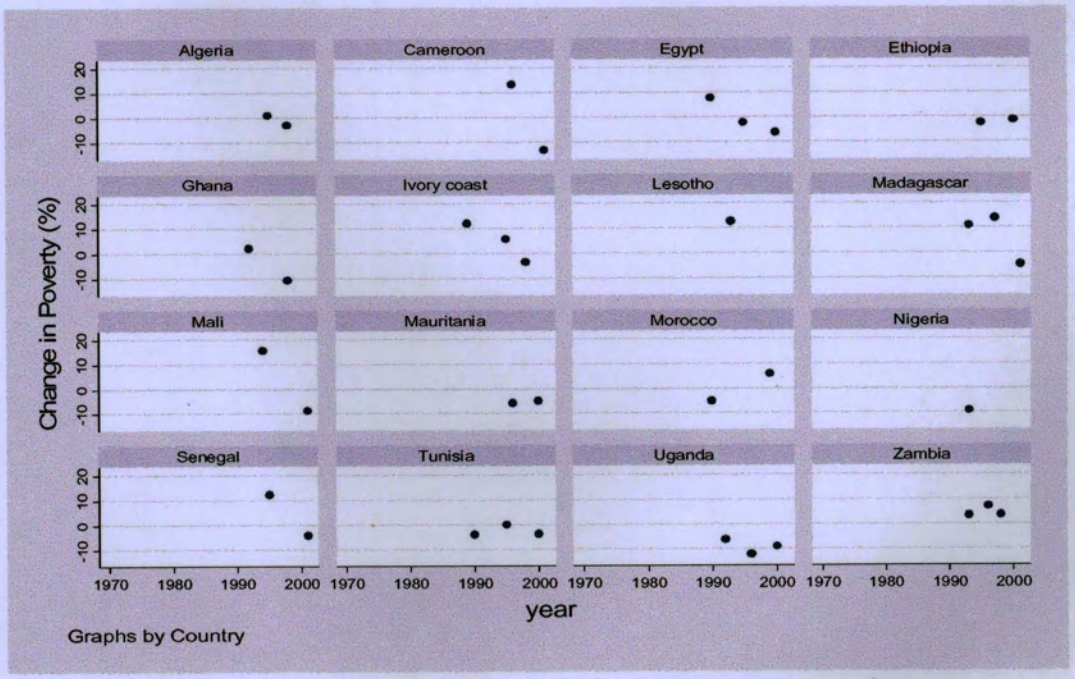
(Dep. variable: ΔPov_{it} = percentage change in poverty headcount)

Variables	Coef.[19]
Growth	-0.0077876** (0.0032775)
dGini	4.302199** (2.043712)
dGini*$Gini_{t-1}$	-.0942901** (0.0395835360)
Growth*$Gini_{t-1}$	-0.0553502*** (0.009743)
Growth*Devlvl	3.271391*** (.6077651)
dGini*Devlvl	-1.018408 (1.786747)
School	0.0051797 (1.465082)
Constant	-0.031729 (0.0223613)
Number of obs =	21
Number of groups =	11
Prob > chi2 =	0.0000
Wald chi2 (7) =	57.58
Log likelihood =	47.29315

[19] Standard errors are given in parenthesis. Standard errors are given in parenthesis. *** denotes 1% significance, ** denotes 5% significance and * denotes 10% significance



FigA1. The relationship between poverty reduction and per capita GDP growth



FigA2. Change in Headcount Poverty (%)

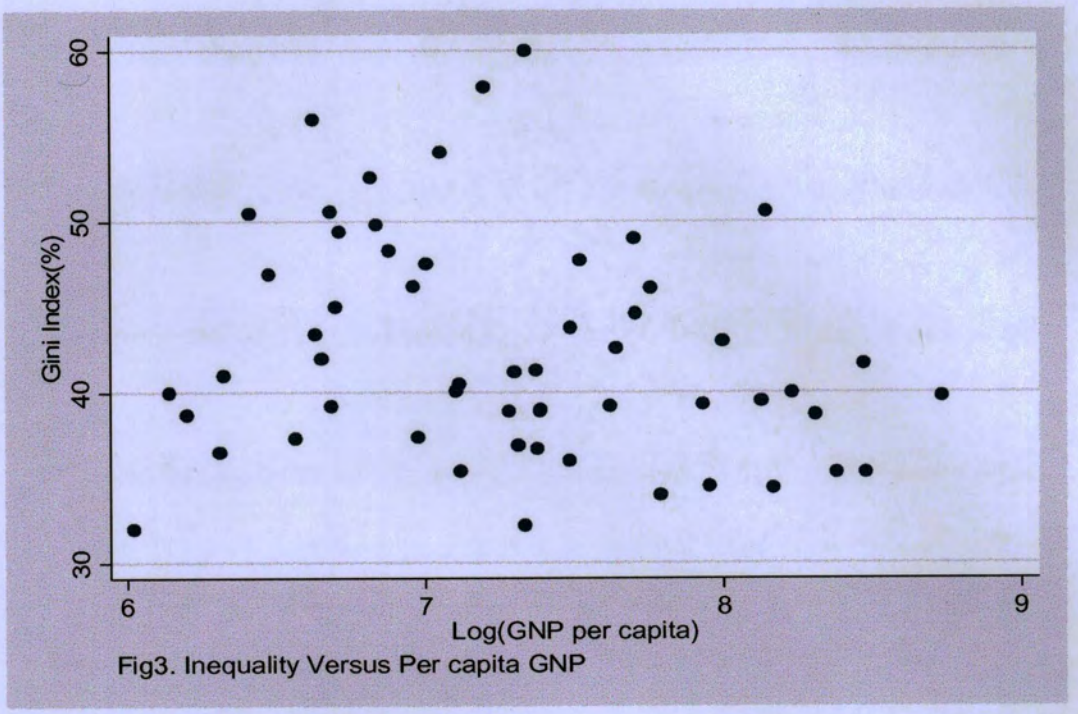


Fig3. Inequality Versus Per capita GNP

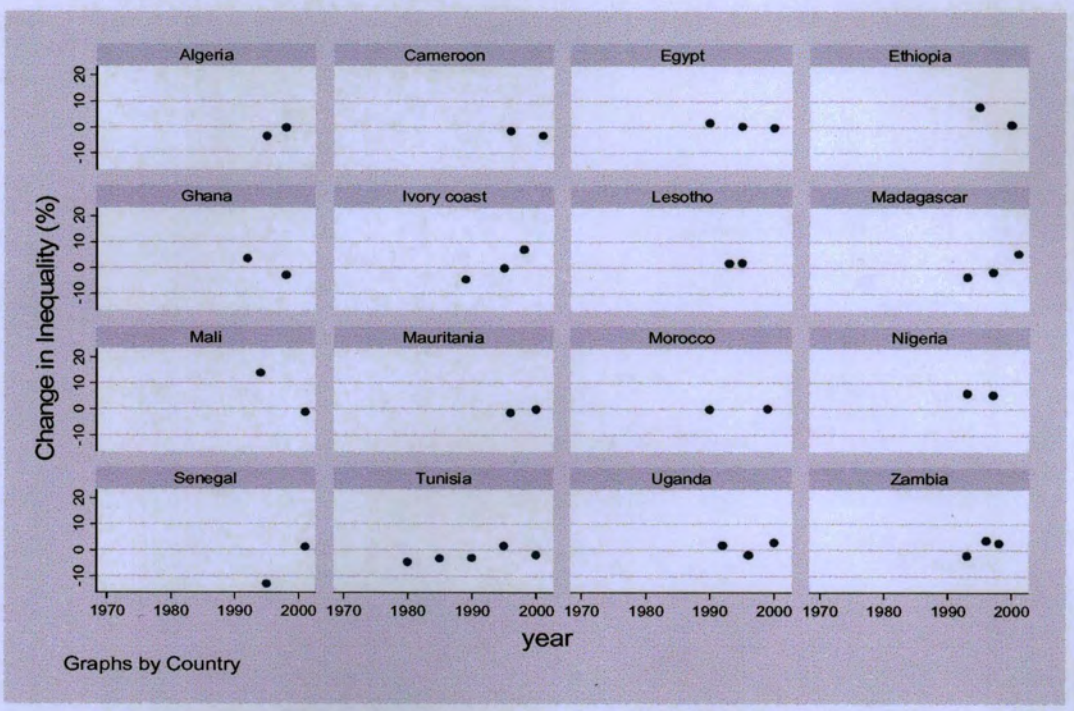


Fig A4: Change in Inequality (Gini Index)

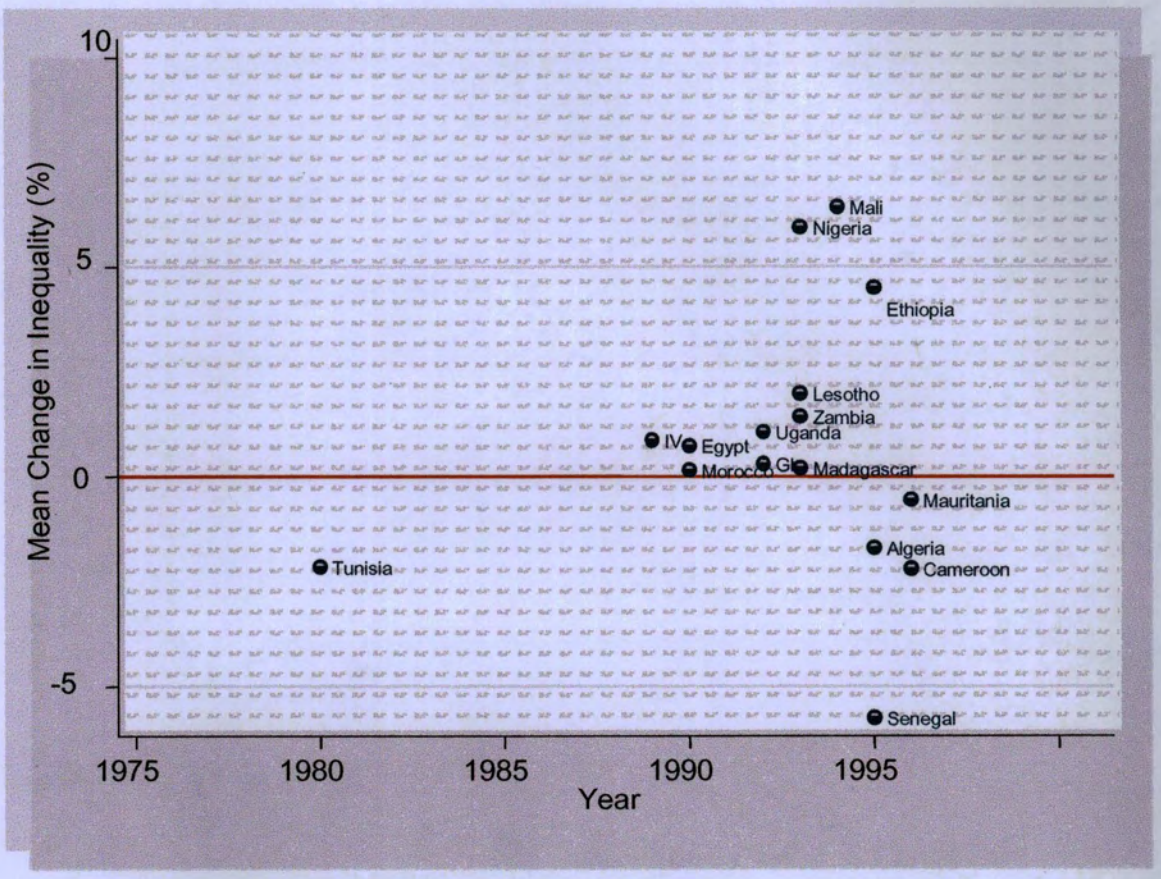
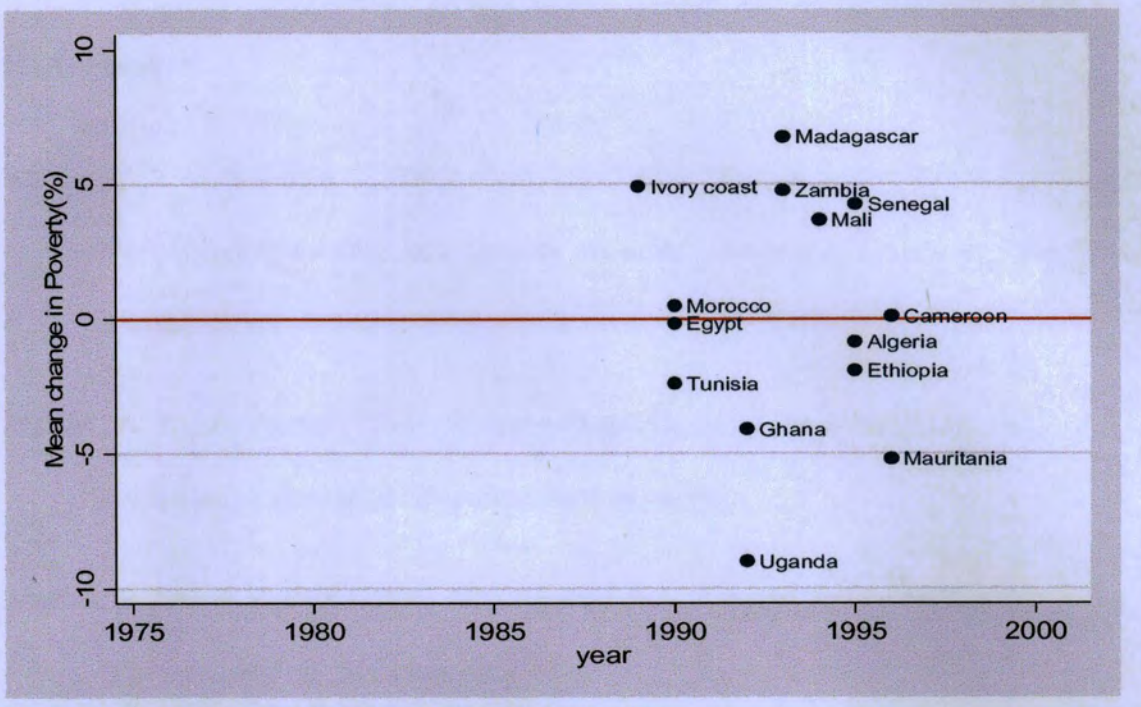


Fig A5: Mean Change in Inequality (Gini Index)



FigA 6: Mean Change in Headcount Poverty (%)

FigA 7: Per Capita Real GDP Growth versus Change in Inequality

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