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Growth and Redistribution Components of Changes in Poverty Measures: Household Budget Survey Analysis 2000/01 and 2007

Stephen L. Kirama*

Abstract

This study estimates the impact of growth and income distribution on poverty in Tanzania using Household Budget Surveys' data for 2000/01 and 2007. The analysis is done by decomposing the change in poverty into growth effect and redistribution effects using the Datt-Ravallion (growth and inequality decomposition). The decomposition of the changes in poverty has been done at the national level. Findings show that the changes in poverty observed in Tanzania are not reflected in the scenario that inequality remained constant over the period. The changes in poverty were expected to be much larger than what is presented in the official statistics. Using the FPL, the decrease is only 1.97%, while in actual fact it was supposed to have decreased by 16.3% during the 2007 growth period, and by 29.2% using the BNPL. If growth in mean consumption was constant as observed in 2001, using the BNPL the change in inequality would have increased poverty by 42.7% (27.03&) in 2001 (2007) growth period. Using the FPL, if growth in mean consumption was constant as observed in 2001, the change in inequality would have increased poverty by 40.9% (14.35) for the 2001(2007) growth period. The implication of the Datt-Ravallion decomposition is that though the growth effect is important in poverty reduction, redistribution would have a significantly positive impact on poverty alleviation. The growth in mean income amidst constant inequality would have had a substantial impact on poverty changes. In addition, policies that address issues of inequality—i.e., redistributive policies—could enhance the positive effects of growth on poverty alleviation more effectively.

JEL Classifications: Q54

Keywords: *growth, income distribution, growth effect, redistribution effects*

1 Background

There is a considerable heterogeneity in the poverty-growth relationship, and understanding these sources of divergence is a growing area of investigation. Recently the intricate relationship between poverty, economic growth and inequality in developing countries has attracted much attention and interest, arising from policy related issues such as the trickle-down effect of economic growth on poverty reduction. As a result, many economic studies have emphasised the role of higher economic growth to tackle the problem of poverty. In particular, Dollar and Kray (2002) present data from nearly 75 countries, which support the view that higher growth rate of real gross domestic product (GDP) per capita is associated with a more rapid reduction in poverty.

* Department of Economics, University of Dar es Salaam, Dar es Salaam: ngareni3@gmail.com

Moreover, the role of economic growth in poverty reduction has also been supported by Jain and Tendulkar (1995), Tendulkar (1998), Ravallion and Datt (1996), Deaton and Dreze (2001), Bhagawati (2001), and Datt and Ravallion (2002). Following the assessment of the selected literatures on poverty and growth, two main questions arise. First, how much do the poor share in aggregate economic growth? Second, what factors explain differences in the impacts of economic growth on poverty?

In order to understand the impact of economic growth on poverty, it is important to decompose change in poverty into change in average income (growth effect) and change in income inequality (redistribution). The enormity of the two components would give the relative sensitivity of poverty levels for changes in average income and redistribution, which can therefore assist policy making and decision on either growth-promoting or inequality-reducing policies.

The debate on the direction of causality between economic growth and poverty is still unresolved. This debate revolves around the issue of whether higher economic growth would lead to reduction of poverty, or low poverty would lead to higher economic growth. Nevertheless, many development economists agree that there is a strong correlation between economic growth on the one hand, and poverty level and inequality on the other hand (Ravallion, 2001). In general economics arena, it is widely accepted that economic growth opens possibilities for improving the living standards of poor people. However, the outcome is not the same in all countries. This study intends to contribute knowledge in this area by examining the relationship between growth and poverty in Tanzania.

This study observes the growth-poverty nexus in Tanzania using the Datt-Ravallion decomposition analysis. The study uses the Foster-Greer-Thorbecke (FGT) poverty measures (Foster et al., 1984) and decomposed it into growth effects, redistribution effects and interaction effects. The FGT poverty measures are also known as the class of decomposable poverty measures.[1] These are headcount ratio (P0); poverty gap (P1) and the squared poverty (P2) indices.[2] These poverty indices are used to determine the extent to which a change in poverty is accounted for by growth in average income and income inequality.

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[1]The FGT can be expressed in a continuous form as $P_\alpha = 1/N \sum_{Y_i \leq z} (z \frac{z-Y_i}{z})^\alpha, \alpha > 0$ where α measures the aversion to poverty among the poor. When α equals zero, the above aggregate collapses to the well-known head count index. This measures the percentage of people with an income below the poverty line. The depth of poverty is obtained when the poverty aversion parameter equals one; and when the parameter equals two then we have the squared poverty gap which measures the severity of poverty. It attaches greater weight to lower incomes amongst the poor.

[2]Head count index measures the number of people below the poverty line; and it is considered insensitive to differences in the depth of poverty. Poverty Gap Index shows the depth of poverty, how deep is one below the poverty line. However it does not show the distribution of poverty amongst the poor. The Squared Poverty Gap, which is a weighted sum of shortfalls of the poor, shows the sensitivity to the distribution among the poor.

2. Literature Review

2.1 Theoretical Literature Review

The persistence of poverty in most developing economies has led to a debate on the relationship between economic growth and poverty reduction,[3] mostly on the assumption that inequality tends to rise at initial stages of development. According to the neoclassical school, the long term effect of economic growth is to lower the level of poverty. This is because economic growth increases the capita-labour ratio, and consequently raises the share of labour at the expense of the share of capital, provided that the elasticity of substitution is less than a unit.

Since labour income is more evenly distributed than property income, the result is to lower levels of income inequality and poverty as the national income increases. The policy implication is that growth-oriented policies may also generate more equal income distribution. Thus, inequality matters to the pace of poverty reduction that is achieved in any given rate of growth. Even in countries in which inequality rises with growth in average living standards, poverty falls in average. However, poverty typically falls at a much slower rate than in countries which are experiencing a more equitable growth. On average, when inequality rises average living standard falls (Banerjee & Duflo, 1999). And even when inequality does not rise, a high initial level of inequality can suppress prospects for pro-poor growth. In an economy where inequality is persistently low, one can expect that the poor would tend to obtain a higher share of the gains from growth than in an economy in which inequality is high (Ravallion, 2001).

The degree of poverty depends upon two factors that are associated with economic growth: the average level of income; and the extent of inequality. The increase in average income that is motivated by increase in economic growth reduces poverty, and an increase in inequality increases poverty.

The importance of growth and inequality in accounting for changes in poverty is built by the decomposition of changes in poverty into growth effect and change in income distribution. Using the headcount ratio of poverty (P), one can model poverty P as a function of average income per capita (Y^*), poverty line (Y) and income inequality (D) such that,

$$P = P(Y^*, Y, D) \qquad (1)$$

The poverty line is constant over the period *0* to t, therefore the change of poverty level can be decomposed from period *0* to period t as follows:

$$\Delta P = P(Y_t^*, D_t) - P(Y_0^*, D_0) \qquad (2)$$

[3]The experience of economic policies in the developing states shows that incomes of the poor groups usually grow slower than the average (Kakwani, 1993; Ravallion 1995). In particular, Ravallion (1995) concluded that in developing countries, the growth process typically neither had strongly adverse impacts on the relative position of the poor nor had it been associated with a tendency for inequality to either increase or decrease.

This can be expanded to yield,

$$\Delta P = [P(Y_t^*, D_t) - P(Y_0^*, D_t)] + [P(Y_0^*, D_t) - P(Y_0^*, D_0)] \qquad (3)$$

The first term on the RHS of equation (3) is the *growth effect*. It measures the change in poverty due to change in the average income over the period *0* to *t* for a given income distribution. This shows that for a given income distribution (*D*) and poverty line (*Y*), growth in average income of the population would lead to reduction in poverty since $P(Y_t^*, D_t) < P(Y_0^*, D_t)$.

The second term on the RHS is the *distribution effect*. It measures the change in poverty due to the change in income distribution. Lowering of income inequality would lead to reduction in poverty ($P(Y_t^*, D_t) < P(Y_0^*, D_0)$ for equation (5) to hold.

The conclusion derived from the theoretical review on economic growth and poverty is that income distribution (inequality) tends to remain relatively stable for most countries, thus decomposition of changes in poverty into growth effect and distribution effect suggests that growth in income per capita is the main source of reduction in poverty. This has been supported by the works of Agrawal (2008), Dollar and Kray (2002), Datt and Ravallion (2002), Bhagawati (2001), Tendulkar (1998), Ravallion and Datt (1996), Tsui (1996), and Kakwani and Subbarao (1990). Based on this, it would be interesting to analyse the situation in Tanzania using both the Datt-Ravallion, Ravallion and Huppi and the Shapley approaches given the measurements of poverty at two dates; namely the HBS 2000/01 and the HBS 2007.

2.2 Empirical Literature Review

The empirical literature on economic growth and poverty has found that growth in average income is negatively correlated with the incidence and depth of poverty. Ravallion and Chen (1997) studied 67 countries and found that inequality changes were uncorrelated with growth rates between 1981 and 1994, indicating that poverty decreases were strongly correlated with growth in mean incomes. The elasticity of poverty incidence to mean household income was estimated to be about -3. However, Ravallion (2001) found a lower elasticity of poverty incidence of about -2.1 when an econometric correction was made for the measurement of errors in the survey.

Dollar and Kraal (2002) studied a sample of 92 countries over four decades and found that growth is good for the poor. The mean incomes of the poorest 20% of the population grew on average at the same rate as overall mean incomes. Several other studies that have studied the role of economic growth to deal with the problem of poverty include those of Kakwani (1993), Ravallion and Huppi (1991), Roemer and Guerty (1997), Gallup et al, (1998), Kakwani and Pernia (2000), Datt and Ravallion (2002), Zhang & Wan (2006), and much recently by Agrawal (2008).

Agrawal (2008) empirically estimates the relation between economic growth and poverty alleviation in Kazakhstan using province level data. He finds that

provinces with higher growth rates achieve a faster decline in poverty. The study reveals that both rapid economic growth and enhanced government spending on social sectors are helpful in reducing poverty. Countries with higher growth rates are likely to experience more reduction in poverty. Zhang and Wan (2006) analyzes the impact of growth and inequality on rural poverty in China employing a version of Shapley decomposition tailored to unit-record household survey data. They find that changes in poverty are attributed to two proximate causes: income growth, and shifts in income distribution. Kakwani (1993) explores the relation between economic growth and poverty, developing a methodology to measure separately the impact of changes in average income and income inequality on poverty, and finds poverty to be highly sensitive to economic growth. With increase in economic growth, poverty decreases faster provided that the growth process does not lead to an increase in income inequality.

Ravallion and Huppi (1991) attempted to measure separately the impact of changes in mean income and income inequality on poverty by means of a regression model, explaining poverty in terms of mean income and Gini index. Their methodology has two limitations. First, it is not accurate because if the regression has a poor fit, much of the changes in poverty would be assigned to the residual term and thus go unaccounted for. Second, their methodology requires quite an enormous amount of data. Ahluwalia (1976), using cross-section information performed two tests of absolute impoverishment thesis and came to the conclusion that incomes of the poor rise systematically with the level of economic development. The elasticities of absolute income with respect to per capita income for poor countries were less than unity, implying that the poor gain absolutely but lose relatively. However, most recent studies indicate that poverty persists even in rapid growing economies.

Galensun (1977) used high economic growth countries in a non-random sample and observed that growth was accompanied by increased consumption of basic goods and services, which reflects rising standard of living. This is in agreement with findings by the World Bank (2009) that growth led to rising consumption in the poorest fifth of the population, while economic growth decline led to falling consumption. This is also in line with the neo-classical view that what matters are policies that promote growth.

Roemer and Gugerty (1997) compare the growth of average income for both the poorest 20% and the poorest 40% of the population to the growth of GDP per capita using data on income distribution data from 26 developing countries. The finding shows that an increase in the rate of per capita GDP growth translates into-one-for one increase in the growth of average income of the poorest 40% of the population. The study finds that for the 20% the elasticity of response is 0.921, and therefore GDP growth of 10% is associated with income growth of 9.21%. Therefore, on average the poor do benefit substantially from economic growth. In addition, the poor do better in countries that grow quickly, even if income distribution deteriorates slightly. Countries that experienced rapid

economic growth over the last thirty years such as Hong Kong, Korea, Malaysia and Indonesia, saw per capita income of the poorest 20% and 40% of the population grow significantly. However, the authors do not explain how the poor can do better in a growing economy, while ensuring that inequality declines (Roemer & Guerty, 1997).

Gallup et al. (1998) examined the relationship between economic growth and poverty using two different models. The first model uses the same essential framework as Roemer and Gugerty (1997), but used data from 69 countries that include 48 growth periods, with an average growth period of 2.7 years. The second model examines the long-term growth episode from the 1960s to the 1990s for 54 countries. Their short panel analysis model finds that growth of income of the poor against overall income the elasticity is nearly one. This indicates that where the initial income share of the poor is low, subsequent growth in the income of the poor is higher than the average income growth. This suggests there is a tendency for countries to converge to similar income shares for the poorest quintile.

Dollar and Kray (2002) regresses growth of income of the poor on a vector of regressors, including overall growth on conducting a study on whether growth is good for the poor. They find a growth coefficient that is insignificantly different from unit. This is interpreted to show that the income of the poor grows along with that of the economy as a whole. In other words, the income of the poor rises one-for-one with overall growth. This finding raises some issues about the definition of poverty that is used in much of the cross-country comparative literature, which focus on income or consumption poverty, as well as on absolute poverty line. This approach is questionable as to the appropriateness of using as an alternative a broader concept of poverty, and also whether economic poverty analysis can be conducted entirely in absolute terms.

Kakwani and Pernia (2000) conducted a cross-country study on growth, inequality and poverty in five African countries. The poverty incidence was decomposed into two components: changes explained by changes in mean consumption levels, and changes arising from changing consumption distribution with mean consumption kept constant. Their general findings were that changes in poverty incidence are predominantly due to changes in mean expenditure. It was found that where there has been economic growth, both mean and redistribution effects had the same sign, and have been combined to reduce poverty. However, the mean effect dominated the redistribution effect.

There are several other studies which have been done in Tanzania on growth, poverty and inequality. These include works by Atkinson and Lugo (2010), Mkenda et al (2010), Leyaro (2000), and Lugoe (2003) amongst others. However, these studies did not go to the extent of decomposing poverty into the growth effect and the redistribution effect, but it worth mentioning them as they offered significant background review literature on growth, inequality and poverty in Tanzania.

Atkinson and Lugo (2010) contribute to the debate on the relationship between economic growth and national objectives, by assessing the alternative indicators of economic and social performance. They find that faster growth of GDP is instrumental rather than a final goal. This has been recognized in recent decades with the emphasis on growth as a vehicle for poverty reduction by most developing countries. The study works with per capita figures and considers inequality purely in relative terms. Unlike this current study, that of Atkinson and Lugo (2010) is rather a descriptive analysis and does not undertake in detail the decomposition of the change in poverty into its growth and inequality effects as undertaken by this study.

Mkenda et al.'s study (2010) tried to answer the question: how come the impressive growth from 2000-2007 in Tanzania did not lead to the reduction in poverty nor did it lead to an increase in income inequality? This study gives some clues as to why this reduction appears not to have happened as expected. The main reason is that the rise in household consumption has not been equally shared. Mkenda et al. (2010) tend to dismiss the role of inequality as it notes that the overall inequality did not increase appreciably. However, the study uses the absolute inequality measure, which means that growth incidence curves have to be seen in a different light. This measure caused the relative measure of inequality to rise slightly. In contrast to this approach, this study employs decomposition analysis to show the contributory effects of growth effects and inequality effects on changes in poverty in Tanzania.

Leyaro (2000) investigates the impact of size and composition of public expenditure in the social sector on poverty by regressing poverty on various public spending variables. While he finds that social sector spending has a positive impact on economic growth, the methodology he uses is not appropriate for the objective outlined. The macro time series data he uses by nature cannot explain the poverty trends well. In addition, the impact of public spending is better captured by an analysis of the benefit incidence. The study did not cover the aspect of decomposition analysis.

On his part, Lugoe (2003) made an enquiry into the behaviour of the growth of inequality and poverty in Tanzania between 1970 and 2000 using time series data with a key objective of examining the impact of economic growth on poverty reduction. He uses distributional corrected economic growth to include the effect of distribution. Basing on OLS estimates, the study finds that distribution-corrected rate of economic growth reduces poverty. Public social spending was found to be vital in reducing poverty. However, like Leyaro's (2000), this study has a limited effect on establishing the impact of economic growth using macro-economic data on a single time series data. This study goes a step further in analysing the impact of economic growth on poverty reduction in Tanzania by using the household budget survey data for 2000/01 and 2007; a micro data that explains the poverty trends well.

The general finding from the reviewed studies is that although the poor generally benefit from a growing economy, there is variation around the average benefits. The share of the variance in poverty changes that is contributed by growth rates depends on the decomposition method used. In addition, there is a wide range of the R-square's reported for regressions of the proportionate rate of poverty reduction on the growth rate of mean income.

We can conclude the following from the reviewed empirical literature. First, economic growth is strongly associated with poverty reduction and accounts for a large share of the variance in performance, but the impact is not the same across countries or even in the same country within different periods of time. So the key questions are: What makes some growth processes more pro-poor[4] than others? Is the growth elasticity of poverty reduction fully determined by historical preconditions, or can policy makers influence it by policy choices? Second, some reviewed empirical studies on economic growth and poverty reduction regressed directly the logarithms of the selected poverty measure on average income and an aggregate inequality measured by Gini index, and therefore establishes the marginal impacts of growth and redistribution.

This methodology implicitly assumes that the three variables are log-linear. The major problem with this methodology is that Gini index determines inequality only under restricted conditions. If the size distribution of income is log-normal, for example, then there is a one-to-one relationship between the Gini index and the Lorenz curve. Despite this, some empirical studies shows that log-normal distribution does not describe real income data well (McDonald, 1984). A given change in the Gini index may be caused by redistribution among the non-poor, among the poor, or between the poor and the non-poor, and therefore poverty would not be affected at all. The methodology used in this study provides an alternative way of separating the effects on mean income growth and income inequality on poverty changes using several decomposition approaches.[5]

3. Methodology

3.1 Introduction

The methodology employed here intends to investigate whether policies should aim towards promoting growth or reducing inequality, and ascertain as to whether economic growth is an effective way to eradicate poverty in developing countries.

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[4] There is a significant debate on how to define pro-poor growth (Duclos & Wodon, 2004; Klasen, 2004; Son, 2004; Ravallion & Chen, 2003). The debate seems to have largely boiled down to absolute and relative definition. But generally, pro-poor growth is a growth that benefits the poor. The relative sense of the term suggests that growth can only be called pro-poor if the growth rate of income of the poor exceeds the average income growth rate. i.e., the income growth of the poor exceeds the average and inequality is low. The absolute sense of pro-poor growth is that growth is pro-poor only if the absolute income gain of the poor is larger than those of the rich (White& Anderson, 2000). There is a weak version of the absolute pro-poor growth which states that a growth is pro-poor if the growth rate of the poor is greater than 0 (OECD, 2006).

[5] These are the Datt-Ravallion decomposition (Datt & Ravallion, 1992; Ravallion & Huppi, 1991), and the Shapley approach.

Changes in poverty can be decomposed into two components: growth effect, which relates to a change in average income; and redistribution effect that relates to income inequality. Growth effect implies the change in poverty that would have occurred if the observed growth in the average income levels had been the same for everyone. On the other hand, redistribution effect implies the change in poverty which would have happened if the observed change in inequality had occurred without mean income change. The magnitude between the two components of growth and redistribution provide relative sensitivity of poverty levels for changes in average income and income inequality growth rates.

3.2 Theoretical Frameworks for the Growth-Redistribution Decomposition

3.2.1 Theoretical Review of the Growth-Redistribution Decomposition

In the 1990s the donor community proposed to the majority of developing countries, mostly in sub-Saharan Africa, the adoption of enhanced growth and poverty reduction strategies with the major belief that economic growth helps to alleviate poverty (World Bank, 1990). In the context of absolute poverty measurement growth it was expected to augment the incomes of at least some of the poor, and therefore lead to a fall in measured poverty using any conventional poverty index.

Income poverty can be fully expressed in terms of the level of income relative to a benchmark poverty line and the distribution of income. The poverty level can be written as $P = P(z, m, l)$. Where z is the poverty line; m is the mean level of income,[6] and l is the Lorenz curve. When poverty line z is kept fixed and there is no ambiguity about it, we shall write the poverty level as simply $P = P(m, l)$. This shows that poverty is a function of only a mean level of income and the distribution of income as measured by the Lorenz curve. Thus, with a poverty line z, poverty at time $t = 0$ would be denoted by $P_{00} = P(m_0, l_0)$ with mean income m_0 and Lorenz curve l_0 at time $t = 0$. In the same way, at $t = 1$, poverty would be denoted by $P_{11} = P(m_1, l_1)$. Poverty at time $t = 1$ would be different from poverty at time $t = 0$ most likely because both the mean income level and the distribution of income have changed over time. The interest is to find what happens if only there is a change in income while distribution is constant and vice versa, and establish what happens to the change in poverty levels.

One can think of several hypothetical situations to clarify the decomposition of poverty changes. First, if only the mean income has changed from m_0 to m_1 and the distribution of income was fixed at l_0, then poverty would have been $P_{10} = P(m_1, l_0)$. Secondly, if only the distribution of income had changed from l_0 to l_1, and the mean income is fixed at m_0, then poverty would have been denoted by $P_{01} = P(m_0, l_1)$. When the mean income changes from m_0 to m_1 and the Lorenz curve changes simultaneously from l_0 to l_1, the total change in poverty is given by:

$$P_{11} - P_{00} = P(m_1, l_1) - Pm_0, l_0) \qquad (6)$$

[6]The mean level income m can also be alternatively denoted by μ_t denoting mean income level at time t, and could likewise be defined in the poverty change equation.

There are several attempts in the literature to decompose the change of poverty in growth and redistribution effects through different approaches such as by Kakwani and Subbarao (1990); Ravallion and Huppi (1991); Datt and Ravallion (1992); Kakwani (1993, 1997); and Shapley (1999).

The Datt-Ravallion approach is the dynamic decomposition of measured poverty between two periods, that is, t and $t + n$, which allows one to rigorously quantify the relative importance of growth against redistribution. Datt and Ravallion (1992) criticized previous approaches on the grounds that the decomposition was not path-independent, i.e., it could be fixed at $t = 0$ or at $t = 1$. The reduction in poverty due to a change in the mean income depends on whether the mean income is held fixed at time $t = 0$ or at $t = 1$. To make each component path independent, they suggest the following type of decomposition:

$$P_{11} - P_{00} = (P_{10} - P_{00}) + (P_{01} - P_{00}) + R \qquad (7)$$

The additional term named R in equation (10) is called the residual term and the other variables are as defined earlier for equation (6) and repeated below for easy reference[7]. The residual measures the difference between the growth and redistribution components evaluated at the final and initial distribution of income. The Datt-Ravallion decomposition procedure has been widely applied and reviewed (see, e.g., Datt & Gunewardena, 1997; Canagarajan et al. 1997; and Mckay, 1997). Nevertheless, the Datt-Ravallion (1992) is not an exact decomposition. There is always a residual component that captures the interaction between growth and redistribution. The methodology decomposes a given change in aggregate poverty[8] between two dates, t and $t + n$, into growth component given as $G(t, t+n, r)$; a redistribution component $D(t, t+n, r)$ and a residual component $R(t, t+n, r)$. In this approach, r is the reference period which may be t or $t + n$.

The growth component G (.) gives the impact on poverty change in the mean income while holding the Lorenz curve constant at the reference level L_r. The redistribution component D (.) gives the change in poverty due to a change in the Lorenz curve while keeping the mean income at the reference level μ_r. On the other hand, the residual R (.) measures the effect of interaction between growth and redistribution terms on poverty.

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[7]Poverty at time $t = 0$ would be denoted by $P_{00} = P(m_0, l_0)$. with mean income m_0 and Lorenz curve l_0 at time $t = 0$. At $t = 1$, poverty would be denoted by $P_{11} = P(m_1, l_1)$. Poverty would have been $P_{10} = P(m_1, l_0)$ meaning that only the mean income has changed from m_0 to m_1 and the distribution of income was fixed at l_0. If only the distribution of income had changed from l_0 to l_1, and the mean income is fixed at m_0, then poverty would have been denoted by$P_{01} = P(m_0, l_1)$.

[8]If we consider the poverty measure in a given country or region at time t is measured by $P_t = P(z/m\_t, L\_t)$ where z is the poverty line, m_t is the mean income and L_t is a vector of parameters fully describing the Lorenz curve at time t. The level of poverty may change due to a change in the mean income m_t relative to the poverty line, or due to a change in relative inequalities L_t. A change in poverty over time t and $t+n$ can be decomposed into $P_{t+n} - P_t = G(t, t, +n; r) + D(t, t, +n; r) + R(t, t, +n; r)$ in which the right hand side is composed of the growth component [*G(t, t+n; r)],* the redistribution component [*D(t,t+n;r)]* and the residual [*R(t,t+n;r)].*

The Datt-Ravallion decomposition approach starts by assuming a fixed absolute poverty line is additive and time consistent. This may be defined as $P_t = P(\frac{Z}{\mu_t}, L_t)$ where μ is mean income (expenditure) and L is a vector fully defining the Lorenz curve. Given this, the change in poverty between two periods can be decomposed as:

$$P_{t+n} + P_t = G(t, t+n; r) + D(t, t+n; r) + R(t, t+n; r) \qquad (11)$$

Where,

$$G(t+n; r) = P\left(\frac{Z}{\mu_{t+n}}, L_t\right) - P(\frac{Z}{\mu_t}, L_t) \qquad (11a)$$

$$D(t+n; r) = P\left(\frac{Z}{\mu_t}, L_{t+n}\right) - P(\frac{Z}{\mu_t}, L_t) \qquad (11b)$$

$$R(t+n; r) = D(t, t+n; t+n) - D(t, t+n; t) \qquad (11c)$$
$$= G(t, t+n; t+n) - D(t, t+n; t)$$

The expressions (11a); (11b) and (11c) give the growth component, the redistribution component and the residual term respectively. In the residual term, the first two arguments in parentheses $(t, t+n)$ refer to the initial and terminate dates of the decomposition period, and the last argument makes explicit the reference date r with respect to which the observed change in poverty is decomposed.

The residual itself does have an interpretation. The residual term in expression (11c) $G(t, t+n; t+n) - D(t, t+n; t)$ is interpreted as the difference between the growth (redistribution) components evaluated at the terminal and initial Lorenz curve (mean incomes) respectively. The residual represents the effect of simultaneous changes in mean income and distribution on poverty that is not accounted for by the other two components. The residual is actually the difference between the growth (redistribution) components evaluated at the final and initial distribution of income. It is important to note that this residual can be negative or positive.

When $R > 0$; the R represents an unexplained part of the decomposition; whereas when $R < 0$; then R represents an over-explained part of the decomposition. If the mean income or the Lorenz curve remains unchanged over the decomposition period, the residual vanishes. Intuitively, if the total change in poverty can be expressed completely in terms of the change in mean income level and in terms of the change in the distribution of income, there is no reason why the decomposition should have any residual. The residual term does not arise out of a conceptual necessity; rather, it arises due to particular procedure adopted to carry out the decomposition.

Therefore, the Datt-Ravallion (1992) decomposition approach is the base of the other proposed approaches presented in the theoretical review below. Whereas the Kakwani and Subbarao (1990), Jain and Tendulkar (1990) and Kakwani (1993) are complete but not path-independent, the Datt-Ravallion (1992) is path-independent but having a residual.

The Datt-Ravallion decomposition analysis is preferred over the other decompositions because it is a standard approach in all the decomposition studies. Results from the Datt-Ravallion decomposition can explain whether changes in a welfare distribution have offset gains from economic growth in reducing poverty. In our study, the Datt-Ravallion decomposition will be complemented by the Shapley approach owing to latter's exact decomposition advantage.[9] These two procedures quantify the relative contributions of economic growth and redistribution to changes in poverty. Thus, the developed methodology aims to decompose poverty changes into growth effects and redistribution effects using the household budget surveys 2000/01 and 2007, employing three poverty measures: the headcount index; poverty gap and poverty gap squared; and the FGT poverty index, a measure that estimates the sensitivity of poverty changes to economic growth.

In this study, attention is on poverty measures that can be fully characterized in terms of the poverty line, the mean income of the distribution, and the Lorenz curve representing the structure of relative income inequalities such that the poverty measure P_t at time t can be written as $P_t = P(^{Z}/_{\mu_t}, L_t)$; where z is the poverty line, μ_t is the mean income, and L_t is a vector of parameters fully describing the Lorenz curve at time t. Given this, the level of poverty may change due to change in the mean income (μ_t), relative to poverty line (Z), or due to change in relative inequalities (L_t).

3.2.2 Model Specification

The Datt-Ravallion decomposition analysis was used to analyse the impact of economic growth on poverty, supplemented by some other minor decompositions. The Datt-Ravallion decomposition technique relies on the definitional relationship between average income, inequality and absolute poverty. The relationship is given as $\theta = \theta(z, \mu, m)$, where θ is the selected measure of poverty, z is the poverty line, m is the mean per capita income, and μ is the inequality of income.

Since the poverty line z remains fixed in real terms, poverty would be lower when average income is higher (given level of inequality) and higher when inequality is higher (given average income). The Datt-Ravallion technique decomposes a change in absolute poverty into a growth effect, redistribution effect and a residual.

Consider θ to be a poverty index which is a function of the poverty line (z), mean per capita income (m) and inequality of income (μ) measured in Gini coefficient index or represented by a Lorenz curve. When the Lorenz curve is characterized by k parameters $m_1, m_2, \ldots m_k$, then shifts in the Lorenz curve would occur as a result of changes in the parameters. With the poverty line z fixed, the total change in poverty index can be written as:

[9]The key advantage of the Shapley approach is that apart from the fact that it gives an exact decomposition, it does not depend on the choice of the base year, and the factors are treated symmetrically in contrast with the standard one suggested by Datt and Ravallion (1992).

$$d\theta = \frac{\partial \theta}{\partial \mu} d\mu + \sum_{i=1}^{k} \frac{\partial \theta}{\partial m_i} dm_i \qquad (14)$$

Given that $d\theta = 0$ the residual would be given by:

$$R = \partial\theta \frac{\partial \theta}{\partial \mu} d\mu - \sum_{i=1}^{k} \frac{\partial \theta}{\partial m_i} dm_i \qquad (14a)$$

Dividing (14) through by θ and manipulating a little gives, $\theta = \varepsilon_\mu \mu + \varepsilon_m m$ where θ, μ and m denotes the growth rates and $\varepsilon_x = \frac{\delta \theta}{\delta x} \frac{x}{\theta}$ denotes the elasticity of θ with respect to *x,* where *x* is either mean income or income inequality. This shows that the rate of change of income poverty depends on how poverty responds to changes in mean income μ, and changes in the distribution of income (*m).*

Equation (14) shows that changes of poverty ($d\theta$) is decomposed into two components that are the impact of growth when the distribution of income does not change and the effect of income redistribution when the total income of the society remains unchanged. These two components are shown on the RHS of equation (14). The first component ($(\partial\theta/\partial\mu)d\mu$) measures the pure effect of growth on selected poverty measure, and the second term ($\sum_{i=1}^{k} \frac{\partial \theta}{\delta m_i} dm_i$) measures the inequality effect on selected poverty measure ($d\theta$). The basic idea behind the growth-redistribution decomposition is that, at any point in time, the income distribution can always be fully described by its mean income and income inequality.

Using equation (14) we can formulate the residual as in equation (14a). If the change in poverty can be completely decomposed into growth and redistribution effects, then there is no reason to have a residual. The residual term, therefore, does not arise out of a conceptual necessity; rather it arises due to the procedure that has been used to carry out the decomposition analysis. This residual is given in equation (14a).

Using equation (14) we can formulate two main hypotheses:

(a) If economic growth is positive, then the pure growth effect ($(\partial\theta/\partial\mu)d\mu$) on poverty index would be positive. If economic growth is negative, then the pure growth effect ($(\partial\theta/\partial\mu)d\mu$) on poverty index would be negative.

(b) If redistribution of income favours the poor, then the inequality effect term ($\sum_{i=1}^{k} \frac{\partial \theta}{\delta m_i} dm_i$) would be negative for the poor, and if it favours the rich, it would be positive for the rich. If redistribution of income favours the rich, then the inequality effect term ($\sum_{i=1}^{k} \frac{\partial \theta}{\delta m_i} dm_i$) would be positive for the rich.

The magnitude of the inequality component provides a useful measure of the degree of trickle-down. The trickle-down effect occurs when there is a reduction in poverty, however small for any positive growth in per capita income.

To test the hypotheses, the study considers several measures of poverty indices. The most widely used poverty measures are the first three FGT (Foster et al., 1984) poverty indices. The general form of the FGT poverty index is given as follows:

$$FGT = \frac{1}{Q}\sum_{i=1}^{Q}\left[\frac{Z-M_i}{Z}\right]^{\alpha} \qquad (15)$$

Where z is the poverty line; Q is the number of households that live below the poverty line; and M_i is the income level of household i.

Note that when $\alpha = 0$, the FGT index becomes the Headcount Ratio; when $\alpha = 1$ the FGT index becomes the Income Gap Ratio; and when $\alpha = 2$, the result is an FGT-Squared Poverty Index. This index is sensitive to any type of income transfer, and one that takes into account the severity of poverty.

When $\alpha = 0$, we have the Headcount Ratio (P_0). Headcount Ratio gives the proportion of the population whose incomes fall below the poverty line z. When $\alpha = 1$ we have the Poverty Gap Index (P_1). Poverty Gap Index measures the average income shortfall in meeting the poverty line. When $\alpha = 2$, we have the Squared Poverty Gap Index (P_2). Squared Poverty Gap Index is the sum of the proportionate poverty gaps weighted by themselves, and therefore more sensitive to income changes of poorer individuals.

The three poverty measures above show different aspects of the same poverty change measuring the incidence, depth and severity of poverty, respectively. Their magnitude and direction of their changes is not always the same, therefore leading to different assessments of the relative role played by income growth in affecting poverty. To be more specific, if we let $F(Y)$ denote the proportion of the population with incomes below Y at time t, and z as the poverty line, $F_t(z)$ as the headcount ratio, and then normalize incomes so that mean incomes equals one; the relative distribution can be denoted by $\hat{F}_t(Y)$.

Thus using the Datt-Ravallion decomposition analysis a change in poverty (P_t) at time t and t_0 has been given in equation (11) and re-defined below as:

$$P_{t_n} - P_{t_0} = G(t_0, t_n; r) + D(t_0, t_n; r) + R(t_0, t_n; R) \qquad (16)$$

where t_0 is the initial year of the period, t_n is the final year of the period, and r is the reference year at which the welfare distribution and mean welfare are held fixed for the growth and redistribution components, respectively.

If we measure poverty index by Headcount Ratio H, between t and t' and the given specifications above, we can write the decomposition equation as:

$$\Delta H = H_{t'} - H_t = \left[\hat{F}_t\left(\frac{z}{\hat{y}_{t'}}\right) - \hat{F}_t\left(\frac{z}{\hat{y}_t}\right)\right] + \left[\hat{F}_t\left(\frac{z}{\hat{y}_{t'}}\right) - \hat{F}_t\left(\frac{z}{\hat{y}_{t'}}\right)\right] \qquad (17)$$

where $\hat{y}$ is mean income, and H is the Head Count Poverty at time t and t'.

The first expression in the RHS of equation (17) is simply the growth effect on poverty, the impact of a uniform increase of all incomes at the previous relative distribution of income (fixed distribution). The second term is the redistribution effect, the change in the relative distribution of income at the new level of mean income.

Using data from the available household budget surveys, one can calculate how changes in income levels, poverty and inequality, interact both at national and regional levels using various poverty indices. We used expenditure per adjusted per adult equivalent scale times the fisher index as a measure of a household economic welfare. The adjusted scales used are as per construed by Glewwe (1987). This takes into account differing needs of various household members.[10] Since the elasticity nature of poverty is the main concern in this analysis, the intention is to show how changes in poverty are attributed to income growth and change in inequality.

4. Result of the Decomposition Analysis and Interpretation

4.1 Introduction

The decomposition of poverty change has been done using three different poverty indices: Headcount Ratio; Poverty Gap Index; and Poverty Squared Index. For analysis we used two household budget survey data, namely the HBS 2000/01 and the HBS 2007. The findings of the decomposition are reported in the following sections using the poverty indices and the poverty lines—the Basic Needs Poverty Line (BNPL) as well as the Food Poverty Line (FPL)—and using the HBS 2000/01 as a reference year.[11]

Growth and Inequality Decomposition: Headcount Ratio

Using the BNPL, the decomposition analysis shows that the *headcount poverty* has decreased by 2.24% points between the two periods. The poverty rates (P_0) are 35.6 and 33.5 for 2000/01 and 2007, respectively. This verifies that the poverty rates in the tables are consistent with other measures of poverty. When we decompose this into the growth and redistribution components, the growth component shows that if

[10]To take account the differing needs of various household members, Glewwe divided the total household consumption by the number of equivalent adults. In his formulation, of equivalent adults, children were given smaller weight than adults. Children less than seven (7) years old were given a weight of 0.2, between the ages of 7 and 13 were given a weight of 0.3, and between 13 and 17 a weight of 0.5.

[11]The decomposition analysis using HBS 2007 as a reference year has been done. The findings are presented on Appendix 8. The findings are similar, only that there is a change in signs from positive (negative) to negative (positive).

the Lorenz curve[12] had remained constant as observed in the HBS 2000/01 (HBS 2007), the headcount poverty index would have decreased by 29.3 (44.9)% during the 2000/01 (2007) periods of growth. This is the change in poverty that would have occurred if everyone had experienced the same rate of growth as the mean shows that distribution curve shifted but maintained the same shape.

On the other hand, the redistribution component shows that if the mean consumption had remained constant as observed in the 2001, the rise in inequality would have increased poverty by 42.7% in 2001 and by 27.03% in 2007. In other words, the rise in inequality would have offset gains from growth in reducing headcount poverty. Nevertheless, the residual term is small enough to question the results of the decomposition.

In Table 1, base year 1 column uses the HBS 2000/01 as the reference year holding the Lorenz curve constant for the growth component, and the mean per capita expenditure constant for the redistribution component. Base year 2 column uses 2007, the year of the second data set HBS 2007, as the reference year. The table has decomposed the change in poverty into headcount index using the basic needs poverty line. The interaction terms show that about 15% of the change in poverty cannot be contributed to by either growth or redistribution components.

Table 1: Growth and Inequality Poverty Decomposition: Headcount Ratio – BNPL

	HBS 2000/01 Base Year 1	HBS 2007 Base Year 2	Average Effect
Headcount Poverty Rate (P_0)	35.63	33.5	
Change in Headcount Poverty	-2.23	-2.23	-2.23
Growth Component	-29.27	-44.94	-37.10
Redistribution Component	42.70	27.04	34.87
Interaction Component	-15.67	-15.67	0.0

Source: Author's calculation using HBS 2000/01 and HBS 2007

Using the FPL, the results of the decomposition for the head count poverty as summarised in Table 2 indicate that the headcount poverty index for HBS 2000/01 is 18.4, and for the HBS 2007 it is 16.7, as closely stipulated by official statistics (URT, 2012; URT, 2007). The results show that headcount poverty using food poverty line has decreased by 1.97% points between the two periods. This implies that if the Lorenz curve had remained constant as observed in the HBS 2000/01 (HBS 2007), the headcount poverty would have decreased by 16.8 (42.8)% during the 2000/01 (2007) periods of growth.

At the same time, the redistribution component shows that if the mean consumption had remained constant as observed in HBS 2000/01(HBS 2007), then an increase in the variance of distribution would have increased poverty by

[12] This means that inequality as measured by the Lorenz Curve is assumed to be constant despite the changes in growth.

40.9% points (14.35). With the food poverty line, about 26.5(26.5)% of the change in poverty cannot be contributed to by growth or redistribution for the HBS 2000/01 (HBS 2007), respectively. Table 2 summarises these findings.

Table 2: Growth and Inequality Poverty Decomposition: Headcount – FPL

	HBS 2000/01 Base Year 1	HBS 2007 Base Year 2	Average Effect
Headcount Poverty Rate (P_0)	18.43	16.45	
Change in Poverty Gap	-1.97	-1.97	-1.97
Growth Component	-16.89	-42.87	-29.6
Redistribution Component	40.89	14.35	27.62
Interaction Component	-26.54	-26.544	0.0

Source: Author's computation using HBS 2000/01 and HBS 2007

Growth and Inequality Decomposition: Poverty Gap Index

The decomposition of the poverty gap index into growth and redistribution components using the BNPL shows that if the Lorenz curve had remained constant as observed in 2000/01 (HBS 2007), the poverty gap index would have decreased by 9.2 (24.5)% during the period of growth.

The redistribution component shows that if the mean consumption had remained constant as observed in the 2000/01 (2007), the rise in inequality would have increased poverty by 23.9% in 2000/01 and by 8.5% in 2007. Again, the rise in inequality offset gains from growth in reducing the poverty gap index. The interaction terms show that about 15.3% of the change in the poverty gap using the basic needs poverty line cannot be attributed to either growth or inequality components as shown in Table 3.

Table 3: Growth and Inequality Poverty Decomposition: Poverty Gap - BNPL

	HBS 2000/01 Base Year 1	HBS 2007 Base Year 2	Average Effect
Poverty Gap (P_1)	10.556	9.893	
Change in Poverty Gap	-0.66	-0.66	-0.66
Growth Component	-9.20	-24.58	-16.89
Redistribution Component	23.91	8.54	16.23
Interaction Component	-15.37	-15.37	0.0

Source*: Author's computation using HBS 2000/01 and HBS 2007*

Moreover, the decomposition of the change in poverty gap index for the HBS 2000/01 and HBS 2007using the FPL produced similar results. The findings show that if the Lorenz curve had remained constant as observed in 2000/01 (2007), the poverty gap index would have decreased by 4.2 (17.0%) during the period of growth. Furthermore, the redistribution component shows that if the mean consumption had remained constant as observed in 2000/01 (2007), the rise in inequality would have increased the poverty gap by 16.8 (4) during the period of growth. These findings are reported in the Table 4.

Table 4: Growth and Inequality Poverty Decomposition: Poverty Gap: FPL

	HBS 2000/01 Base Year 1	HBS 2007 Base Year 2	Average Effect
Poverty Gap (P_1)	4.63	4.41	
Change in Poverty Gap	-0.21	-0.21	-0.21
Growth Component	-4.21	-17.0	-10.63
Redistribution Component	16.84	4.0	10.42
Interaction Component	-12.84	-12.84	0.0

Source: Author's calculation using HBS 2000/01 and HBS 2007

Growth and Inequality Poverty Decomposition: Poverty Squared Index

The last decomposition was of the change in poverty into the *poverty squared index* or the poverty severity, first, using the BNPL, and then the FPL. The findings show that if the Lorenz curve had remained constant as observed in the 2000/01 (2007), the poverty squared index would have decreased by -4.03 (-14.6%) during the period of growth. The redistribution component shows that inequality would have increased poverty by 23.91 in 2000/01 and by 8.54% in 2007(see Table 5).

Table 5: Growth and Inequality Decomposition: Poverty Squared - BNPL

	HBS 2000/01 Base Year 1	HBS 2007 Base Year 2	Average Effects
Poverty Severity (P_2)	4.49	4.27	
Change in Poverty Severity	-0.22	-0.22	-0.22
Growth Component	-4.03	-4.60	-9.31
Redistribution Component	14.37	3.80	9.09
Interaction Component	-10.56	-10.56	0.0

Source: Author's calculation using HBS 2000/01 and HBS 2007

The findings of the decomposition of the change in poverty severity into growth and inequality components using the FPL show that if inequality had remained constant as observed in 2000/01 (2007), the poverty severity would have decreased by 1.6 (8.6%) during this period of growth. On the other hand, if the growth in consumption had remained constant as observed in 2000/01 (2007), the rise in inequality would have increased poverty by 8.67 (1.63%) points (see Table 6):

Table 6: Growth and Inequality Decomposition: Poverty Squared - FPL

	HBS 2000/01 Base Year 1	HBS 2007 Base Year 2	Average Effect
Poverty Severity (P_2)	1.76	1.75	
Change in Poverty Severity	-0.003	-0.003	-0.003
Growth Component	-1.63	-8.68	-5.15
Redistribution Component	8.67	1.63	5.15
Interaction Component	-7.04	-7.04	0.0

Source: Author's calculation using HBS 2000/01 and HBS 2007

The findings from the above decomposition show that redistribution would have played an important role in the change in poverty. They further show that inequality would have reduced poverty further than the growth effects. Inequality in Tanzania, as measured by Gini coefficient, does not show changes over the period of study (URT, 2010). However, these findings show that if inequality would had been as constant as estimated in URT (2010), the poverty reduction as measured by headcount, poverty gap and poverty severity indices would have decreased more than what was stipulated. However, these findings emphasised the importance of inequality in poverty reduction because inequality plays a key role in poverty reduction efforts. Thus policies should be aimed at reducing income inequality for a significant decrease in the poverty level.

5. Summary of the Findings

The Datt-Ravallion decomposition was done using the three poverty indices, namely, the Headcount Poverty (P_0); the Poverty Gap (P_1) and the Squared Poverty Gap (P_2) for the HBS 2000/01 and HBS 2007, separately for the BNPL and the FPL. By using the BNPL, the decomposition analysis shows that poverty decreased by 2.24% with the HBS 2000/01 as a reference year. If the Lorenz curve had remained constant as observed in the HBS 2000/01, the headcount poverty would have decreased by 29.3% during the 2007 period of growth (Table 1).

The redistribution component shows that if the mean consumption had remained constant as observed in the HBS 2000/01, the rise in the inequality would have increased poverty by 42.7% and by 27.03% in 2007. As a result, the rise in inequality would have offset the gains in reducing headcount poverty (Table 1).

By using FPL, the growth effect is -16.8(-42.87%) with the HBS 2000/01 (HBS 2007) as a reference year. That means that if the Lorenz Curve had remained constant as observed in the HBS 2000/01 (HBS 2007); the headcount poverty would have decreased by 16.3 (42.87%) during the 2000/01 (2007) period of growth. Moreover, the redistribution effect shows that if the mean consumption had remained constant as observed in HBS 2000/01 (HBS 2007), the increase in the variance of distribution would have increased poverty by 40.9 (14.35) during the 2000/01 (2007) period of growth (Table 2). The poverty gap and the poverty severity, both using the FPL as well as the BNPL, show similar results.

The implication of the Datt &Ravallion decomposition is that though the growth effect is important in poverty reduction, redistribution would have a significantly positive impact on poverty alleviation. The growth in mean income, amidst constant inequality, would have had a substantial impact on poverty changes. In addition, policies that address issues of inequality, that is, redistributive policies, could enhance the positive effects of growth on poverty alleviation more effectively. However, the findings also indicate that poverty reduction in Tanzania, amid constant inequality, leaves much to be desired in respect to the estimation of inequality indices and the role that constant inequality would have played in poverty reduction effects.

This study shows that the decomposition findings in Tanzania deviate from the general findings in the literature that growth effects tend to dominate the effects of changes in the distribution of income (Datt & Ravallion, 1992; Mckay, 1997). The inequality components overwhelmingly dominate the redistribution components. In this regards, inequality poses a significant constraint for the significant improvement in poverty reduction. In general, the decomposition analysis for the change in poverty in Tanzania compares differently with the findings of the decomposition in other developing countries as shown in Table 7. This is because, for Tanzania, the role of redistribution would have much more impact on the change of poverty compared to the impact of the growth in the mean incomes.

Table 7: Growth-Redistribution Decomposition Results Reported from Studies in Other Developing Countries

Author	Method	Country	Period	Total	Components		
					Growth Effect	*Redist. Effect*	*Residual Effect*
Baye, 2006	Datt-Ravallion	Cameroon	1984-1996	0.288	0.2611	-0.017	0.0439
Baye, 2006	Shapley	Cameroon		0.288	0.283	0.005	
Dhongde, (2004)	Datt-Ravallion	India	1984-1994	-44.22	-35.35	1.95	-10.83
Bigstein et al. (2003	Datt-Ravallion	Ethiopia	1994-1997	-5.7	-10.6	5.9	-1
Kakwani (1997)	Kakwani	Thailand	1988-1994	-16.27	-20.31	4.04	
Kabore (2003)	Datt-Ravallion	Burkina Faso	1994-1998	0.9	2.27	-1.59	0.27
	Datt-Ravallion	Senegal	1995-2000	-18.8	-35	3.89	12.3
	Kakwani	Burkina Faso	1994-1998	0.9	2.4	-1.45	
	Kakwani	Senegal	1995-2000	-18.8	-28.8	10	
Datt&Ravallion 1992	Datt-Ravallion	Brazil	1985-1987	2.24	-0.01	2.33	-0.08
Datt&Ravallion 1992	Datt-Ravallion	India	1986-1987	1.19	-9.74	-6.05	-0.07

Source: Baye (2006); Bigestein et al. (2003); Kakwani (1997); Datt&Ravallion, (1992) and Kabore (2003).

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