Spatial Comparisons of Poverty and Inequality in Living Standards in Malawi

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Abstract

The paper looks at poverty and inequality across areas in Malawi. The focus is on both monetary (consumption) and non monetary (health and education) dimensions of well being. Stochastic poverty dominance tests show that rural areas are poorer in the three dimensions regardless of poverty line chosen. Stochastic inequality dominance tests find that the north and south dominate the centre in health inequality, and there is no dominance between the north and south. With respect to education inequality, dominance is declared for the south-centre pair only. A sub group decomposition analysis finds that the south contributes the most to consumption and education poverty while the centre is the largest contributor to health poverty. We establish that within area inequalities (vertical inequalities) rather than between area inequalities (horizontal inequalities) are the major driver of consumption, health, and education inequality in Malawi.

Keywords: Poverty; inequality; stochastic dominance; decomposition; Malawi.

1 Introduction

The empirical analysis of poverty and inequality tends to be based on income or consumption expenditure as a measure of well being. This one dimensional look at poverty and inequality has been criticized by Sen (1985, 1987), who has argued that poverty and inequality should be viewed multidimensionally. He argues that the measurement of poverty should go beyond income or consumption and look at other dimensions of well being such as health, education, empowerment, freedom of association among others. Income and consumption expenditure are instrumentally important as a means of achieving the other dimensions of well being, but the other dimensions of well being are in and of themselves intrinsically significant. Thus, these dimensions are equally important and deserve recognition and measurement in their own right (Sahn & Younger, 2006).

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There are three main approaches to measuring multidimensional welfare. The first approach aggregates the various indicators of well being into one index. The best known example of this approach is the United Nations' Human Development Index (HDI). The second approach aggregates the various dimensions of well being while at the same time accounting for possible correlations which may exist between the components. This approach is still in its infancy, with serious debates over how to aggregate the various dimensions of well being and how to identify the poor across the dimensions. The third approach which the paper adopts, looks at the various dimensions of well being separately. This approach like the first approach also suffers from an inability to take into account possible correlations between the various dimensions of welfare. This paper adopts this approach despite this weakness, because to allows sub group decompositions of both poverty and inequality in a manner not possible using the second approach.

In Africa, there have been few attempts to measure poverty and inequality multidimensionally. For example, Duclos et al. (2006) use the second approach to conduct spatial poverty comparisons in Ghana, Uganda, and Madagascar using the log of household expenditures per capita and children's height-for-age z scores as indicators of well-being. Sahn & Stifel (2003) use the third approach to look at inequality in living standards in 24 African countries. They use asset indices and 7 other indicators of well being. The common thing about the literature on multidimensional welfare in Africa is that it's either focused exclusively on poverty or inequality. While focusing on Malawi, this paper looks at both multidimensional poverty and inequality.

In order to capture the multidimensional nature of poverty and inequality, we focus on one monetary dimension namely; consumption expenditure and two non-monetary dimensions of well being namely; health and education. In addition to recognizing the multidimensional nature of both poverty and inequality, the paper has three objectives. First, using poverty and inequality stochastic dominance tests, the paper conducts a robust ranking of a) the three regions of Malawi, b) rural and urban areas at the national level, and c) rural and urban areas across the regions. Secondly, the paper establishes how much of the measured poverty and inequality can be attributed to a) the three regions of Malawi, b) rural and urban areas nationally, and c) rural and urban in the three regions. Finally, the paper determines how much of the inequality in Malawi is due to within area inequalities (vertical inequalities) and how much is as a result of between area inequalities (horizontal inequalities).

The rest of the paper is organized as follows. Section 2 dwells on the methods of analysis as well as the data used in the study. Results are the focus of section 3. Finally, section 4 concludes.

2 Methodology

2.1 Standard of Living Indicators

To capture monetary dimensions of well being the paper uses consumption expenditure. The height-for-age z-score (HAZ), and the years of schooling of the most educated household member are used to measure non monetary dimensions of well being. We briefly discuss the indicators.

2.1.1 Consumption Expenditure

The money-metric measurement of poverty and inequality is done using either household income or household consumption expenditure. In keeping with most poverty and inequality studies in Africa we use household consumption expenditure as an indicator of poverty and inequality rather than income. The household consumption expenditure in this study is annualised. To ensure that households are comparable, we generate per capita expenditure for each household. Using per capita expenditure raises two controversial issues. First, by using per capita expenditure we ignore the fact that different individuals have different needs. For example, a young child typically requires less food than an adult. Second, there are economies of scale in consumption for such items as housing, kitchen utensils, and utilities such as electricity. It costs less to house two people than to house two individuals separately. Thus, using per capita expenditure assumes these economies of scale away. We don't interrogate these issues further in this study, but follow an empirical precedent set by Murkhejee & Benson (2003) for Malawi. They use per capita expenditure as a money-metric indicator of household welfare.

2.1.2 Child Malnutrition

We use the height-for-age z-score (HAZ) for children aged between 6 to 60 months. These are pre-school children. We choose the HAZ over other anthropometric measures such as the weight-for-age z-score (WAZ) or weight-for-height z-score (WHZ) because it is a long-term indicator of child nutritional well-being or health. It is unaffected by acute episodes of stress occurring at or around the time of measurement (Sahn & Stifel, 2002). The HAZ measures how a child's height compares to the median of the World Health Organization (WHO) reference sample of healthy children. Until 2006, the WHO recommended the US National Centre for Health Statistics (NCHS) as the standard reference population.

In this study, we follow the WHO's current recommendation of using growth standards based on the Multi-Centre Growth Reference Study (MGRS). The z-scores standardize a child's height by age and gender, and are given as

$$z - score = \frac{x_j - x_{\text{median}}}{\sigma_x} \tag{1}$$

Where; x_j is height for child j , x_{median} is the median height for a healthy and well-nourished child from a reference population of the same age and gender, and σ_x is the standard deviation from the mean of the reference population. The z-scores follow the standard normal distribution, implying that a child who is below -2 z-scores has a 2.3% probability of being of normal height. Conventionally, children whose HAZ is below -2 are considered malnourished or stunted (WHO, 1983).

The measures of poverty and inequality used in the study are defined for nonnegative numbers only, and since z-scores can be negative we transform the z-scores into percentiles using the cumulative density function of the standard normal distribution. For instance, a z-score of +2 in percentile terms is 97.7%, and a z-score of -2 in percentile terms is 2.3%. This transformation is monotonic meaning that a child's ranking is maintained after the transformation.

2.1.3 Years of Schooling

In terms of education, we use the years of schooling of the most educated household member as an indicator of a household's education. This is motivated by the fact you would expect in a household where one person has some years of schooling to be relatively well off as compared to another household where everyone is illiterate. As argued by Basu and Foster (1998), there are positive externality effects - some kind of public good - to having a household member who is literate. They make a distinction between a proximate illiterate person and an isolated illiterate person. A proximate illiterate person stays in a household with at least one literate member, who is like a public good. The literate member of the household may help other members of the household who are not literate to for example read written brochures on modern farming techniques and better health care among other things. An isolated illiterate person on the other hand is defined as a person who lives in a household with no literate members. The person therefore has no access to the benefits offered by a literate household member. The extent of the spillover benefits would arguably depend on the years of schooling of the most educated household member i.e. the maximum number of years of schooling in a household.

2.2 Measures of Poverty

In keeping with most of the literature on poverty, we use a class of decomposable poverty measures proposed by Foster et al., (1984). Although there are other measures of poverty (e.g. the Sen index and the Watts index) which are distribution sensitive; the Foster-Greer-Thorbecke (FGT) measures have one extremely attractive property of being decomposable into sub groups. This allows us to look at the contribution of different areas to aggregate poverty. The FGT measures are given by

$$P(z,\alpha) = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{z-y_i}{z}\right)^{\alpha} I(y_i < z) \tag{2}$$

Where; y_i is a living standard indicator (i.e. per capita consumption expenditure, transformed HAZ, and years of schooling) of household or individual i drawn from a sample of size N , z is a poverty line, α is a measure of poverty aversion, and $I(\cdot)$ is an indicator function equal to one if the condition $y_i < z$holds, and zero otherwise. For $\alpha = 0$, we have the consumption, health, and education poverty headcount indices respectively. This gives the percentage of the population who are consumption, health, and education poor. For example, in the case of health this gives the percentage of children who are stunted or malnourished. When $\alpha = 1$, respectively we have the consumption, health, and education poverty gap indices. For $\alpha = 2$, we have the consumption, health, and education poverty severity indices respectively.

Equation 2 gives poverty measures which are normalized by a poverty line. This normalization renders the poverty measures unitless. Since the HAZ is already unitless (i.e. it is a standardized variable), we do not normalize the health poverty measures. Besides, the absolute gap $z - y_i$ has a meaningful interpretation in that it measures the number of standard deviations that a child's HAZ falls below the poverty line (Sahn & Younger, 2006). In the case of per capita consumption expenditure, we use the poor poverty line which is 16165 Malawi Kwacha (US$145.50) per year defined by the National Statistical Office of Malawi (NSO) for 2004/2005. With respect to our health indicator we use 2.3% as our health poverty line, implying that a child is considered to be suffering from health poverty if his/her transformed HAZ is below 2.3%. This poverty line corresponds to a HAZ of -2, and as per convention a child with HAZ of below -2 is considered malnourished or stunted. In the case of the education indicator, we use 12 years of schooling as our education poverty line. A household is thus defined as education poor if the maximum number of years of schooling in the household is less than 12. This poverty line corresponds to having a senior secondary school education in Malawi.

2.3 Measures of Inequality

In addition to measuring poverty in the three dimensions, we also measure economic, health, and education inequalities. There are two approaches to measuring inequality in non income or consumption dimensions such as health and education where the dimensions are looked at separately. The first, the gradient approach, makes comparisons in health or education outcomes across populations with different social economic characteristics (see for example Filmer & Pritchett (2001) and Wagstaff et al. (1991) for applications of this approach). The second, the univariate approach, focuses on the dispersion of the health or education outcome without regard to how they are correlated with social economic characteristics (see for example Sahn & Stifel (2003) and Sahn & Younger (2006) for applications of this approach). We use the univariate approach in this paper for two reasons. First, it better handles inequality in multiple dimensions in the sense that unlike the gradient approach it does not tie a health or education outcome to a social economic characteristic say income. Second, conventionally consumption inequality is measured by using the dispersion of consumption, and thus the univariate approach ensures health and education inequality measures which are comparable to consumption inequality.

Owing to their subgroup decomposability property, we use the generalized entropy class of inequality indices, $GE(\theta)$ to measure inequality. The generalized entropy class of inequality indices are defined as follows (Duclos & Araar, 2006);

$$GE(\theta) = \begin{cases} \frac{\theta}{\theta(\theta-1)}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\mu}\right)^{\theta} - 1\right], \text{ if } \theta \neq 1, 0 \\ \frac{1}{n}\sum_{i=1}^{n}\log\left(\frac{\mu}{y_i}\right), \text{ if } \theta = 0 \\ \frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\bar{y}}\log\left(\frac{y_i}{\mu}\right), \text{ if } \theta = 1 \end{cases} \quad (3)$$

Where; μ is the mean of a living standard indicator y_i, and n is the number of households or individuals. The values of GE vary between 0 and 8, with zero representing an equal distribution and higher values representing a higher level of inequality. The parameter θ represents the weight given to distances between y_i at different parts of the y_i distribution, and can take any real value. For lower values of θ , GE is more sensitive to changes in the lower tail of the distribution of the welfare indicator, and for higher values GE is more sensitive to changes that affect the upper tail. If $\theta = 0$, $GE(\theta = 0)$ gives the Theil's L inequality index also known as the mean log deviation measure (MLD); if $\theta = 1$, $GE(\theta = 1)$ gives the Theil's T inequality index.

2.4 Stochastic Dominance Tests

In order to check whether or not the observed differences in levels of poverty and inequality between areas are robust to choice of poverty line, poverty measure, and inequality measure, we conduct stochastic dominance tests. Poverty and inequality dominance tests allow us to check whether two distributions can be ranked conclusively in terms of poverty and inequality respectively. We discuss how the rankings are estimated and then how these orderings are tested for statistical significance.

Consider two distributions A and B of a living standard indicator with respectively cumulative density functions (CDFs), F_A and F_B with support in the nonnegative number line. F_A is a CDF for one group (e.g. rural areas), and F_B is a CDF for another group (e.g. urban areas). Let

$$D_A^1(y) = F_A(y) = \int_0^y dF(x) \tag{4}$$

and

$$D_A^s(y) = \int_0^y D_A^{s-1}(x)\, dx \tag{5}$$

for any integer $s \geq 2$, and let $D_B^1(y)$and $D_B^s(y)$ be similarly defined. $D^s(y)$ for any order s can be rewritten as (Davidson & Duclos, 2000)

$$D^s(y) = \frac{1}{(s-1)!} \int_0^y (y-x)^{s-1}\, dF(x) \tag{6}$$

In terms of poverty, distribution B is said to (strictly) dominate distribution A stochastically at order s if $D_B^s(y) \leq (<)\, D_A^s(y)$ for all $y \in [0, z_{\max}]$, where, $z_{\max}$ is the maximum acceptable poverty line for each living standard indicator. Saying that distribution B first order stochastically dominates distribution A up to $z_{\max}$ is the same as saying that the headcount index is always (weakly) greater in A than in B, for any poverty line less than z. For any poverty line not exceeding z , a similar equivalence holds between second order stochastic dominance and the poverty gap index on the one hand, and third order stochastic dominance and the poverty severity index on the other.

If we have a random sample of N independent observations of the living standard indicator

y_i , from a population, then an estimator of $D^s(y)$(equation 6) is given as

$$\hat{D}^s(y) = \frac{1}{(s-1)!}\int_0^y (y-x)^{s-1}\, d\hat{F}(x) \qquad (7)$$
$$= \frac{1}{(s-1)!}\sum_{i=1}^{N} (y-x)^{s-1}\, I(x \leq y)$$

where; $\hat{F}(x)$ is the empirical CDF of the sample, and $I(\cdot)$ is an indicator function as explained earlier. Since we use this estimator on two independent samples of living standard indicators from two groups (i.e. rural vs. urban, south vs. centre etc), the estimator of the variance between two groups (distributions) is given as

$$Var\left(\hat{D}^s_A(y) - \hat{D}^s_B(y)\right) = Var\left(\hat{D}^s_A(y)\right) + Var\left(\hat{D}^s_B(y)\right) \qquad (8)$$

Simple t-statistics are used to test the null hypothesis of nondominance, against the alternative of dominance i.e. $H_0 : \hat{D}^s_A(y) - \hat{D}^s_B(y) = 0$ against $H_1 : \hat{D}^s_A(y) - \hat{D}^s_B(y) > 0$.The tests are done for a series of test points up to an arbitrarily chosen reasonable maximum poverty line. Dominance of order s is declared if the null hypothesis is rejected for each test point, and there is no reversal in the signs of all the t-statistics. We follow the convention of testing up to $s = 3$, after which no dominance is declared (see e.g. Sahn & Stifel, 2000; Sahn & Stifel, 2002). Our discussion of poverty dominance is based on CDFs which are not normalized by poverty lines, as indicated earlier, only health poverty indices are not normalized by the poverty line, and to be consistent we normalize the CDFs for consumption expenditure and years of schooling by their respective poverty lines. The stochastic dominance test conditions remain unchanged if the poverty lines are common (Davidson & Duclos, 2000).

When distributions A and B have different means, given as μ_A and μ_B , inequality dominance can be tested by comparing the mean-normalized CDFs $D^s_A(\mu_A y)$ and $D^s_B(\mu_B y)$. Distribution B is said to (strictly) dominate distribution A in inequality at order s if $D^s_B(\mu_B y) \leq (<) D^s_A(\mu_A y)$ for all $y \in [0, y_{\max}]$. $y_{\max}$ is a critical common proportion of the respective means up to which inequality dominance is met at a given order s for each living standard indicator. The null of no inequality dominance is tested in a similar way to that for poverty nondominance discussed earlier (Davidson & Duclos, 2000).

2.5 Sub group Decomposition of Poverty

In addition to measuring poverty levels as well as conducting poverty dominance tests, the levels of consumption, health, and education poverty are decomposed to see the contribution of each area or region to poverty. The decomposition of poverty into subgroups has important policy relevance. For example, knowledge of which region is the biggest contributor to national poverty can be used to formulate interventions which target that particular area and this would reduce national poverty.

As mentioned earlier, we are using the FGT measures owing to their decomposability property. If we let the population be divided into K mutually exclusive population sub groups, the sub group decomposition of the FGT indices $P(z, \alpha)$ is given as;

$$P(z, \alpha) = \sum_{k=1}^{K} \phi(k)\, P(k, z, \alpha) \tag{9}$$

Where; $P(k, z, \alpha)$ is the FGT poverty index of subgroup k , and $\phi(k)$ is the share of the population found in sub group k.

2.6 Sub group Decomposition of Inequality

Besides looking at consumption, health, and education inequalities, we go further and decompose the same into within and between area or region inequalities. The decompositions enable us to assess how much of the inequality in the monetary and non-monetary dimensions of welfare can be attributed to area differences i.e. horizontal inequality, and how much of the inequality is due to differences in each area i.e. vertical inequality. The decompositions have useful policy implications for instance if most of the inequalities arise from disparities in consumption, health, and education between areas, then policy may target regional and area development with a special focus on areas which seem to lag behind.

Assuming the population can be divided into K mutually exclusive population sub groups, $k = 1...K$, the generalized entropy class of indices (equation 3) can then be decomposed as follows (Duclos & Araar, 2006);

$$GE(\theta) = \sum_{k=1}^{K} \varphi(k)\, \phi(k) GE(k, \theta) + \overline{GE(\theta)} \tag{10}$$

Where; $\phi(k)$ is the population share of group k , $\varphi(k) = \frac{\mu_k}{\mu}$ is the share of the mean of the welfare indicator of group k , and $GE(k, \theta)$ is inequality within group k , as given in equation 3 for the total population. The terms $GE(k, \theta > 0)$ are weighted by the product of population share of each group and the share of the mean of the welfare indicator of each group in the total mean. The terms $GE(k, \theta = 0)$ are strictly population-weighted. The first term in equation 10 therefore represents the weighted sum of the within-group inequalities. $\overline{GE\ (\theta)}$ captures total population inequality when each household or individual in group k is given the mean value of the welfare indicator μ_k of its or his subgroup, i.e. when within sub group inequality has been eliminated. The last term in equation 10 thus measures the contribution of between-group inequality to total inequality. When $\varphi(k) = 1$ and $\overline{GE\ (\theta)} = 0$, equations 10 gives the contribution of each group to the generalized entropy class of indices (equation 3).

2.7 Data

The data for this analysis come from the Second Malawi Integrated Household Survey (IHS2). This is a nationally representative sample survey designed to provide information on the various aspects of household welfare in Malawi. The survey was conducted by the National Statistical Office from March 2004 to April 2005. The survey collected information from a nationally representative sample of 11,280 households. It collected information on among other things; household consumption expenditure, education levels of household members, and anthropometrics for children aged between 6 to 60 months.

3 Results

3.1 Poverty and Poverty Dominance

Table 1 reports results of consumption, health, and education poverty. Across the three dimensions of welfare one consistent finding emerges, which is that the poverty headcount, gap, and severity indices are higher in rural areas than in urban areas. For instance, 55.9 %, 44.5 %, 89.9 % of the people are respectively consumption, health, and education poor in rural areas. In contrast, 25.4 %, 41.2 %, 67.2 % of the people are respectively consumption, health, and education poor in urban areas. The results also indicate that the percentage of people who are poor in terms of education is higher compared to those who are poor in terms of consumption and health. The z-statistics (p-values) for statistical tests of significance of the rural-urban difference in consumption, health, and education poverty headcounts are 10.59 (0.00), 1.20 (0.12), and 7.26 (0.00) respectively[1]. This suggests that the observed headcount differences are statistically significant at the conventional levels of significance for consumption and education poverty only.

TABLE 1 ABOUT HERE

Looking at the three regions in Malawi, the results show a mixed picture. The ranking of the regions depends on the living standard indicator used. In terms of consumption, all the three poverty indices show that the centre is the least poor (rank 1) and the south is the poorest (rank 3). Using the health poverty headcount and the health poverty gap indices the ranking is reversed, in that the north is the least poor (rank 1) and the centre is the poorest (rank 3). The results show a similar ranking for education poverty gap and poverty severity indices, with the north being the least poor (rank 1) and the centre the poorest (rank 3).

When the regions are further disaggregated into rural and urban areas, the results show that in terms of consumption poverty, urban areas in the south are the least poor (rank 1) and rural areas in the south are the poorest (rank 6). This ranking is the same for all poverty indices. The ranking of the areas in terms of health and education poverty is generally different from that based on consumption. For example, using the poverty headcount, the results indicate that north urban is the least health poor, and the south urban is the least education poor. The results also suggest that the ranking in terms of health and education poverty depends on the poverty index used.

A general conclusion from the above discussion is that the ranking of the areas depends on the dimension of well being and poverty index used. Besides, the ranking of the areas is specific to the poverty lines chosen, and it is quite possible to have rank reversals with a different set of poverty lines. In view of this, is it possible to come up with a ranking of the areas which is robust to choice of both poverty measure and poverty line? To answer this question we use stochastic poverty dominance test results in Table 2. Recall that the tests are done up to an arbitrarily chosen reasonable maximum poverty line. We use MK25000, 15.9% (or HAZ= -1) and 15 years of schooling, as maximum poverty lines for consumption, health, and education respectively. Other maximum poverty lines were tried to check the sensitivity of our results, but they do not substantially change our conclusions.

[1] Assuming rural (R) and urban (U) samples are independent with estimated poverty headcounts $\hat{P}_0^R$and $\hat{P}_0^U$, the variance of the difference of the poverty headcounts is, $Var\left(\hat{P}_0^R - \hat{P}_0^U\right) = Var\left(\hat{P}_0^R\right) + Var\left(\hat{P}_0^U\right)$. The z statistic which is assumed to be asymptotically distributed standard normally is then defined as $Z = \frac{\hat{P}_0^R - \hat{P}_0^U}{\sqrt{Var\left(\hat{P}_0^R\right)+Var\left(\hat{P}_0^U\right)}}$.

TABLE 2 ABOUT HERE

The results confirm the rural-urban ranking discussed earlier. For all the three indicators of welfare, urban areas dominate rural areas at order 2. This means the earlier finding that there is a difference in poverty headcounts between rural and urban areas does not hold for all possible poverty lines. Furthermore, the dominance results imply that in terms of the poverty gap and poverty severity indices, poverty is higher in rural areas regardless of poverty line chosen.

Looking at the three regions, the results vary depending on the living standard indicator used. In terms of consumption and health, there is no robust ranking between the north and the south; however the north dominates the south in terms of education poverty. The poverty dominance tests generally suggest that there are no robust rankings between rural or urban areas across the regions. Further to that, the results show that urban areas across the three regions dominate rural areas. The number of dominant relationships depends on the living standard indicator employed. There are 9 dominant relationships for consumption poverty, 5 dominant relationships for health poverty, and 8 dominant relationships for education poverty. These differences among the indicators vindicate the need to not just focus on consumption or income in the analysis of poverty.

3.2 Inequality and Inequality Dominance

The discussion on poverty essentially focuses on the mean of the three indicators of well being, and to get an understanding of their variances we look at inequality. Table 3 reports the Theil L and Theil T inequality measures for consumption, health, and education. In contrast to the poverty results, the inequality results show that the ranking of rural and urban areas depends on the dimension of well being used. The Theil L and Theil T for consumption inequality and education inequality are higher for urban areas, and this means that rural areas are more equal than urban areas in terms of consumption and education.

TABLE 3 ABOUT HERE

We compute z statistics in a manner similar to those for the poverty head counts discussed earlier, to test the hypothesis of no difference between the rural and urban Theil L indices. The z statistics (p values) are -4.20 (0.00) and -2.94 (0.00) for consumption and education respectively. This suggests that the observed differences are statistically significant at the conventional levels of significance. A similar conclusion is reached with respect to the Theil T index.

When one looks at health, rural areas are more health unequal than urban areas. The z statistic (p value) for the null hypothesis of no difference between the rural and urban Theil L index is 1.56 (0.06). This implies that the difference is statistically significant albeit at a higher level of significance, 10 %. The z statistic (p value) for the difference in the Theil T index is 0.65 (0.26). This means that the rural-urban difference in health inequality is statistically insignificant when the upper tails of the health distribution are given more weight.

At the regional level and for all the three dimensions of well being, the results show that the north is the most equal, and the centre is the most unequal region in Malawi. When the regions are sub divided into rural and urban, the results are varied as they depend upon the inequality measure as well as standard of living indicator used. In terms of consumption inequality and health inequality, centre rural is the most equal; however centre rural is ranked number 3 in terms of education inequality. Besides, when one attaches more weight to the upper tail of the health distribution by using the Theil T, centre rural is ranked last.

The inequality results seem to be sensitive to the inequality measure one chooses, and this begs the question can one get an ordering of the areas which is robust to inequality measure used? We answer this question by using inequality dominance test results in Table 4. Recall that the tests are based on an arbitrarily chosen critical common proportion of the respective means up to which inequality dominance is met at a given order. The results are based on a critical common proportion of 0.5 for the three indicators of well being. A robustness check of this choice is done with common proportions ranging from 0.25 to 1.75. Our conclusions remain qualitatively similar. The dominance results indicate we are unable to reject the null of nondominance with respect to the rural-urban difference in consumption and health inequality. This finding implies that we cannot say that rural areas are more equal with respect to consumption or less equal with respect to health for all inequality measures one can use. In contrast, the tests show that urban areas dominate rural areas at order 2 with respect to education inequality. This means that urban areas are more equal than rural areas in terms of education, and this difference is not sensitive to choice of inequality measure employed.

TABLE 4 ABOUT HERE

A comparison between the poverty and inequality dominance test results shows some differences. For instance, the observed lower levels of poverty in urban areas for all dimensions of well being have been found to be stochastically dominant which is in start contrast to the inequality dominance findings. This is interesting because it suggests that even though urban areas have lower levels of poverty, there is no difference between the two areas when one focuses on the distribution of the well being indicators, except for education.

When we look at the three regions and use consumption as a standard of living measure, the results show that the null of nondominance is not rejected for all possible regional pairs. The north and south dominate the centre in health inequality, and there is no dominance between the north and south. With respect to education inequality, dominance is declared for the south-centre pair only. A deeper look at the rural and urban areas across the regions shows that dominance depends on the welfare indicator used. There are 7 dominant pairs for consumption, 5 for health, and 10 for education.

3.3 Poverty and Inequality Decomposition

In this section we focus on the how much of the observed national poverty and inequality levels can be attributed to a particular area. In addition, we discuss the contribution of horizontal and vertical inequalities to national inequality. Table 5 reports results of the sub group decomposition of consumption, health, and education poverty. With a share of the rural population at about 88 %, rural areas' contribution to national poverty is higher than that of urban areas, ranging from 91 % to 96 % for the three dimensions of well being and the three indices.

TABLE 5 ABOUT HERE

The south which has the highest population share of about 45 % contributes the most to consumption and education poverty. On the other hand, at about 46 %, the centre is the largest contributor to health poverty. For all the three welfare indicators and the three indices, about 0.39 % to 0.92 % of poverty in Malawi comes from the north urban, and about 38 % to 57 % is attributed to the south rural. This means that north urban and south rural are respectively the smallest and largest contributors to national poverty. Policy interventions designed to specifically target the identified largest contributors to national poverty would go a long way in reducing poverty in Malawi.

TABLE 6 ABOUT HERE

In Table 6 we present results of the sub group decomposition of inequality. Owing to their larger share of the population, rural areas compared to urban areas contribute more to consumption, health, and education inequality. The contribution of the regions to inequality depends on the inequality measure as well as the welfare indicator. For example, the centre is the largest contributor to consumption inequality when the Theil T and the Theil L. On the other hand, the centre is the largest contributor to health poverty when the lower tails of the health distribution are weighed heavily by using the Theil L, but when the upper tails are given more weight by using the Theil T, the centre becomes the second largest contributor to health inequality. In terms of education inequality, most of the inequality comes from the centre regardless of inequality measure used. Just like the case of poverty, north urban and south rural are respectively the smallest and largest contributors to inequality.

TABLE 7 ABOUT HERE

Results presented in Table 7 show that within area inequalities (vertical inequalities) as opposed to between area inequalities (horizontal inequalities) are the major driver of consumption, health, and education inequality in Malawi. This conclusion is robust to all area partitions used, rural vs. urban, the three regions, and the three regions sub divided into rural and urban areas. The contributions of vertical inequality (horizontal inequality) range from 81 % (19 %) to 99.99 % (0.01 %). In order to significantly reduce inequality, policy interventions should focus more on reducing consumption, health, and education disparities within the areas rather between the areas. While efforts to reduce the differences in levels of development between and among the areas may go a long way in reducing the gaps in living standards; this may not reduce the overall national inequality.

4 Concluding Remarks

The paper has looked at poverty and inequality across areas in Malawi. The focus has been on both monetary (consumption) and non monetary (health and education) dimensions of well being. Stochastic poverty dominance tests have shown that rural areas are poorer in the three dimensions regardless of poverty line chosen. Stochastic inequality dominance tests have found that the north and south dominate the centre in health inequality, and there is no dominance between the north and south. With respect to education inequality, dominance is declared for the south-centre pair only. The decomposition analysis has found that the south contributes the most to consumption and education poverty while the centre is the largest contributor to health poverty. We have established that within area inequalities (vertical inequalities) rather than between area inequalities (horizontal inequalities) are the major driver of consumption, health, and education inequality in Malawi.

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Table 1: Consumption, health, and education poverty indices

FGT Index	Malawi	Rural	Urban	North	Centre	South	North Rural	North Urban	Centre Rural	Centre Urban	South Rural	South Urban
						Consumption						
Poverty Headcount Index	52.4	55.9	25.4	54.1	44.2	59.7	56.3	34.0	46.7	24.6	64.4	24.3
	(0.099)	(0.010)	(0.027)	(0.025)	(0.015)	(0.015)	(0.027)	(0.075)	(0.016)	(0.058)	(0.015)	(0.014)
Rank		2	1	2	1	3	5	3	4	2	6	1
Poverty Gap Index	0.178	0.192	0.071	0.186	0.133	0.218	0.196	0.096	0.141	0.075	0.238	0.061
	(0.005)	(0.005)	(0.011)	(0.014)	(0.006)	(0.008)	(0.015)	(0.026)	(0.006)	(0.024)	(0.008)	(0.005)
Rank		2	1	2	1	3	5	3	4	2	6	1
Poverty Severity Index	0.080	0.086	0.028	0.083	0.055	0.102	0.088	0.037	0.059	0.032	0.112	0.023
	(0.003)	(0.003)	(0.006)	(0.008)	(0.003)	(0.004)	(0.009)	(0.011)	(0.003)	(0.012)	(0.005)	(0.003)
Rank		2	1	2	1	3	5	3	4	2	6	1
						Health						
Poverty Headcount Index	44.1	44.5	41.2	39.4	48.2	41.6	39.8	35.3	48.8	42.5	41.6	41.6
	(0.008)	(0.009)	(0.026)	(0.022)	(0.012)	(0.013)	(0.024)	(0.021)	(0.013)	(0.046)	(0.014)	(0.033)
Rank		2	1	1	3	2	2	1	6	5	3	3
Poverty Gap Index	0.008	0.008	0.007	0.007	0.008	0.007	0.007	0.006	0.009	0.007	0.007	0.006
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Rank		2	1	1	3	1	3	1	6	3	3	1
Poverty Severity Index	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rank		1	1	1	1	1	1	1	1	1	1	1
						Education						
Poverty Headcount Index	87.4	89.9	67.2	91.1	88.1	85.8	93.0	72.4	90.6	68.8	88.6	64.7
	(0.006)	(0.004)	(0.031)	(0.008)	(0.010)	(0.009)	(0.007)	(0.053)	(0.007)	(0.058)	(0.007)	(0.033)
Rank		2	1	3	2	1	6	3	5	2	4	1
Poverty Gap Index	0.668	0.703	0.391	0.593	0.683	0.672	0.622	0.321	0.713	0.456	0.715	0.344
	(0.007)	(0.007)	(0.030)	(0.010)	(0.012)	(0.011)	(0.011)	(0.031)	(0.011)	(0.055)	(0.010)	(0.018)
Rank		2	1	1	3	2	4	1	5	3	6	2
Poverty Severity Index	0.617	0.654	0.328	0.510	0.633	0.627	0.542	0.218	0.664	0.406	0.673	0.277
	(0.008)	(0.008)	(0.032)	(0.011)	(0.013)	(0.013)	(0.012)	(0.025)	(0.012)	(0.056)	(0.012)	(0.018)
Rank		2	1	1	3	2	4	1	5	3	6	2

Notes: The poverty headcount index has been multiplied by 100. In parenthesis are standard errors.

Table 2: Dominance tests for consumption, health, and education poverty

Area Name Pair	Consumption	Health	Education
Rural vs. Urban	-2	-2	-2
North vs. Centre	ND	+2	+2
North vs. South	ND	ND	+2
South vs. Centre	-3	ND	-1
North Rural vs. North Urban	-2	-2	-2
North Rural vs. Centre Rural	ND	+2	+2
North Rural vs. Centre Urban	-3	ND	-1
North Rural vs. South Rural	ND	ND	+2
North Rural vs. South Urban	-2	ND	-2
North Urban vs. Centre Rural	+2	+2	+2
North Urban vs. Centre Urban	ND	+3	+3
North Urban vs. South Rural	+2	ND	ND
North Urban vs. South Urban	ND	ND	ND
Centre Rural vs. Centre Urban	-2	ND	ND
Centre Rural vs. South Rural	ND	ND	ND
Centre Rural vs. South Urban	-1	-2	-2
Centre Urban vs. South Rural	+1	ND	ND
Centre Urban vs. South Urban	ND	ND	ND
South Rural vs. South Urban	-1	ND	ND

+ (-) indicates that the first name in the area name pair dominates (is dominated by) the second name in the area name pair. 1, 2, 3 indicate first, second, and third order dominance. ND means no dominance up to third order.

Table 3: Consumption, health, and education inequality indices

Generalized Entropy Index	Malawi	Rural	Urban	North	Centre	South	North Rural	North Urban	Centre Rural	Centre Urban	South Rural	South Urban
						Consumption						
Theil L Inequality Index	0.252	0.188	0.391	0.199	0.258	0.242	0.184	0.236	0.170	0.473	0.194	0.301
	(0.020)	(0.006)	(0.048)	(0.012)	(0.035)	(0.017)	(0.011)	(0.020)	(0.008)	(0.060)	(0.009)	(0.046)
Rank		1	2	1	3	2	2	4	1	6	3	5
Theil T Inequality Index	0.307	0.205	0.443	0.220	0.320	0.295	0.202	0.244	0.182	0.485	0.219	0.368
	(0.032)	(0.007)	(0.045)	(0.015)	(0.054)	(0.028)	(0.017)	(0.023)	(0.010)	(0.044)	(0.013)	(0.057)
Rank		1	2	1	3	2	2	4	1	6	3	5
						Health						
Theil L Inequality Index	2.411	2.440	2.130	2.181	2.633	2.250	2.209	1.878	2.651	2.430	2.284	1.926
	(0.050)	(0.052)	(0.192)	(0.102)	(0.079)	(0.074)	(0.108)	(0.246)	(0.080)	(0.352)	(0.081)	(0.175)
Rank		2	1	1	3	2	4	6	1	2	3	5
Theil T Inequality Index	0.966	0.970	0.936	0.896	1.055	0.905	0.905	0.805	1.066	0.950	0.899	0.949
	(0.017)	(0.018)	(0.049)	(0.038)	(0.025)	(0.026)	(0.041)	(0.068)	(0.027)	(0.075)	(0.028)	(0.074)
Rank		2	1	1	3	2	3	1	6	5	2	4
						Education						
Theil L Inequality Index	0.021	0.015	0.030	0.015	0.025	0.019	0.013	0.022	0.016	0.039	0.015	0.021
	(0.002)	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.001)	(0.002)	(0.001)	(0.010)	(0.001)	(0.002)
Rank		1	2	1	3	2	1	5	3	6	2	4
Theil T Inequality Index	0.023	0.016	0.032	0.016	0.027	0.020	0.013	0.023	0.017	0.041	0.016	0.022
	(0.003)	(0.001)	(0.005)	(0.001)	(0.005)	(0.002)	(0.001)	(0.002)	(0.001)	(0.008)	(0.001)	(0.003)
Rank		1	2	1	3	2	1	5	3	6	2	4

Notes: In parenthesis are standard errors.

Table 4: Dominance tests for consumption, health, and education inequality

Area Name Pair	Consumption	Health	Education
Rural vs. Urban	ND	ND	-2
North vs. Centre	ND	+3	ND
North vs. South	ND	ND	ND
South vs. Centre	ND	+3	+3
North Rural vs. North Urban	ND	-3	-2
North Rural vs. Centre Rural	ND	+3	ND
North Rural vs. Centre Urban	-3	ND	-2
North Rural vs. South Rural	ND	ND	ND
North Rural vs. South Urban	-3	ND	-2
North Urban vs. Centre Rural	ND	+3	+3
North Urban vs. Centre Urban	+3	+3	+3
North Urban vs. South Rural	ND	+3	ND
North Urban vs. South Urban	+2	ND	+3
Centre Rural vs. Centre Urban	ND	ND	-3
Centre Rural vs. South Rural	ND	ND	-2
Centre Rural vs. South Urban	ND	ND	-3
Centre Urban vs. South Rural	-3	ND	ND
Centre Urban vs. South Urban	-3	ND	-2
South Rural vs. South Urban	+3	ND	ND

+ (-) indicates that the first name in the area name pair dominates (is dominated by) the second name in the area name pair. 1, 2, 3 indicate first, second, and third order dominance. ND means no dominance up to third order.

Table 5: Sub group decomposition (expressed in percentages) of consumption, health, and education poverty indices

	Rural-Urban		Regions			Rural-Urban Across Regions					
FGT Index	Rural	Urban	North	Centre	South	North Rural	North Urban	Centre Rural	Centre Urban	South Rural	South Urban
						Consumption					
Poverty Headcount Index	95.50	5.50	11.62	36.25	52.13	10.91	0.70	33.92	2.34	49.67	2.45
	(0.010)	(0.011)	(0.009)	(0.014)	(0.013)	(0.009)	(0.002)	(0.013)	(0.010)	(0.013)	(0.004)
Poverty Gap Index	95.50	5.50	11.77	32.23	55.99	11.18	0.60	30.14	2.08	54.17	1.82
	(0.010)	(0.011)	(0.012)	(0.016)	(0.016)	(0.012)	(0.001)	(0.015)	(0.010)	(0.016)	(0.003)
Poverty Severity Index	96.00	4.00	11.73	29.89	58.37	11.22	0.50	27.88	2.00	56.86	1.50
	(0.011)	(0.011)	(0.014)	(0.018)	(0.019)	(0.014)	(0.002)	(0.016)	(0.011)	(0.019)	(0.003)
Population Share (%)	88.66	11.34	11.26	43.02	45.72	10.16	1.09	38.05	4.97	40.45	5.28
						Health					
Poverty Headcount Index	91.07	8.93	10.36	46.14	43.50	9.56	0.79	42.34	3.80	39.16	4.34
	(0.015)	(0.015)	(0.010)	(0.017)	(0.016)	(0.010)	(0.001)	(0.016)	(0.014)	(0.016)	(0.007)
Poverty Gap Index	91.39	8.61	10.35	47.03	42.62	9.58	0.77	43.17	3.86	38.64	3.97
	(0.017)	(0.017)	(0.010)	(0.018)	(0.018)	(0.010)	(0.001)	(0.018)	(0.015)	(0.017)	(0.008)
Poverty Severity Index	91.49	8.51	10.37	47.55	42.08	9.62	0.75	43.58	3.97	38.29	3.79
	(0.018)	(0.018)	(0.010)	(0.019)	(0.018)	(0.010)	(0.001)	(0.018)	(0.016)	(0.018)	(0.008)
Population Share (%)	90.44	9.56	11.60	42.24	46.16	10.61	1.00	38.28	3.95	41.55	4.61
						Education					
Poverty Headcount Index	91.20	8.80	11.81	43.44	44.75	10.88	0.92	39.45	3.99	40.87	3.89
	(0.012)	(0.012)	(0.006)	(0.012)	(0.011)	(0.006)	(0.001)	(0.011)	(0.012)	(0.010)	(0.005)
Poverty Gap Index	93.30	6.70	10.05	44.08	45.87	9.52	0.53	40.61	3.46	43.17	2.70
	(0.012)	(0.012)	(0.006)	(0.012)	(0.011)	(0.006)	(0.001)	(0.012)	(0.012)	(0.011)	(0.004)
Poverty Severity Index	93.91	6.08	9.37	44.28	46.35	8.98	0.39	40.95	3.33	43.98	2.36
	(0.012)	(0.012)	(0.006)	(0.012)	(0.012)	(0.006)	(0.001)	(0.012)	(0.012)	(0.011)	(0.004)
Population Share (%)	88.57	11.43	11.33	43.09	45.58	10.22	1.11	38.03	5.06	40.33	5.25

Notes: In parenthesis are standard errors.

Table 6: Sub group decomposition (expressed in percentages) of consumption, health, and education inequality indices

	Rural-Urban		Regions			Rural-Urban Across Regions					
Generalized Entropy Index	Rural	Urban	North	Centre	South	North Rural	North Urban	Centre Rural	Centre Urban	South Rural	South Urban
						Consumption					
Theil L Inequality Index	74.9	25.1	9.18	45.48	45.34	9.17	1.26	31.74	11.53	38.50	7.80
	(0.057)	(0.024)	(0.010)	(0.035)	(0.042)	(0.009)	(0.001)	(0.025)	(0.026)	(0.030)	(0.012)
Theil T Inequality Index	78.35	21.65	8.33	46.30	45.36	9.14	1.18	30.84	10.73	39.45	8.65
	(0.074)	(0.040)	(0.012)	(0.058)	(0.061)	(0.010)	(0.002)	(0.034)	(0.048)	(0.035)	(0.028)
Population Share (%)	88.66	11.34	11.26	43.02	45.72	10.16	1.09	38.05	4.97	40.45	5.28
						Health					
Theil L Inequality Index	91.55	8.45	10.50	46.13	43.07	9.72	0.78	42.10	3.99	39.37	3.68
	(0.016)	(0.016)	(0.010)	(0.018)	(0.017)	(0.010)	(0.002)	(0.016)	(0.015)	(0.016)	(0.006)
Theil T Inequality Index	90.53	9.47	10.58	40.01	48.64	9.75	0.83	35.75	4.16	44.12	4.47
	(0.013)	(0.013)	(0.009)	(0.016)	(0.015)	(0.008)	(0.002)	(0.016)	(0.012)	(0.015)	(0.007)
Population Share (%)	90.44	9.56	11.60	42.24	46.16	10.61	1.00	38.28	3.95	41.55	4.61
						Education					
Theil L Inequality Index	79.48	20.51	8.04	50.98	40.98	7.92	1.46	36.26	11.76	36.05	6.57
	(0.066)	(0.034)	(0.015)	(0.055)	(0.048)	(0.012)	(0.006)	(0.035)	(0.035)	(0.032)	(0.022)
Theil T Inequality Index	79.48	20.51	8.03	51.56	40.40	7.49	1.44	36.46	11.70	36.39	6.51
	(0.071)	(0.041)	(0.016)	(0.062)	(0.054)	(0.012)	(0.006)	(0.038)	(0.043)	(0.034)	(0.025)
Population Share (%)	88.57	11.43	11.33	43.09	45.58	10.22	1.11	38.03	5.06	40.33	5.25

Notes: In parenthesis are standard errors.

Table 7: Within and between consumption, health, and education inequalities (expressed in percentages)

Generalized Entropy Index	Rural-Urban		Regions		Rural-Urban Across Regions	
	Within	Between	Within	Between	Within	Between
	Consumption					
Theil L Inequality Index	83.76	16.24	97.01	2.99	80.95	19.05
Theil T Inequality Index	84.04	15.96	97.54	2.46	81.21	18.79
	Health					
Theil L Inequality Index	99.99	0.001	99.69	0.31	99.63	0.37
Theil T Inequality Index	99.99	0.001	99.24	0.76	99.08	0.91
	Education					
Theil L Inequality Index	86.96	13.04	90.24	9.76	88.11	11.89
Theil T Inequality Index	87.98	12.02	90.64	9.36	87.15	12.85