Welfare in Rural and Urban Centres in Nigeria: A Test for Dominance

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Abstract: The 1980s through the 1990s and the earliest part of the 2000s witnessed a number of development programmes particularly in rural centres in Nigeria. To relate the effect of these programmes on the level of aggregate welfare experienced by households in rural and urban centres, distributional analysis is often employed. This paper used stochastic dominance approach to test for rural and urban aggregate welfare preference. Household expenditure survey data collected by the National Bureau for Statistics in 2004 were used. Result showed rural centres had a better income inequality and consequently a better aggregate welfare only for the class of welfare function that is equity loving. For the class of welfare function that is equity and efficiency loving, welfare dominance of rural centres over urban centres was inconclusive. With further imposition of Pigou Dalton transfer condition using the generalized Lorenz curve, rural aggregate welfare showed dominance over urban aggregate welfare. The policy implication is that increases in the incomes of the very poor may have much more effect on aggregate welfare than similar increases for the better off. Therefore expenditure on basic education and health services would have had a larger impact on welfare relative to expenditures on bigger projects in both rural and urban centres.
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1. INTRODUCTION

Across space in Nigeria is the existence of rural and urban centres. Olofin (2001) described an economy exhibiting such a phenomenon as dual economy in the same country. Although the progression from one centre to another traverses a continuum of settlement patterns, population and functional densities. The predominant occupation in rural centres is agriculture while for urban it is industry or trading or urban services. In general, rural centres are larger and harbour about three-fourths of the poor (NBS, 2005).

Beginning from the 1980s and through the 1990s, a number of rural development programmes were initiated to reduce poverty. The Directorate for Food, Road and Rural Infrastructure (DFFRI), Nigerian Agricultural Land Development Agency, (NALDA), Better Life Programme (BLP), Family Support Programme (FSP), Agricultural Development Programme (ADPs), Family Economic Advancement Programme (FEAP), Community Banks (CBs), People's Bank of Nigeria (PBN), and National Economic Recovery Funds (NERFUND) were instituted to bring about better welfare for the rural dwellers.(NISR,2000) These efforts were also intensified at the start of another civilian administration in 1999 with the implementation of National Economic Empowerment Development Strategy (NEEDS) and Poverty Alleviation Programmes.

To relate the effect of these programmes to aggregate welfare experienced by households, Shorrocks (1983) pointed out the normative judgements which emphasize inequality between households and the extent to which greater inequality can be compensated by higher mean per capita income. The normative approach underlies distributional analysis covering poverty, inequality and welfare. Litchfield, (1999) points out that although welfare and inequality capture the whole distribution, inequality is narrower and concerned with the dispersion of the income distribution while welfare is broader and concerned with both the mean income and the dispersion of the distribution. In a sense, measuring welfare presupposes simultaneous evaluation of inequality and mean income.

Stochastic dominance analysis holds a bright promise in this regard and its use has been growing. (Bishop, et al, (1992), Beach and Slotsve, (1994) Araar, 2007). Since this approach considers inequality and absolute income simultaneously, it averts the arbitrary judgements about the success or failure of development programmes underlying studies that considered inequality and mean income separately. Furthermore, a Parallel development in the use of this approach is the use of inferential statistics to test validity of results (Beach and Davidson, 1983 and Bishop et al, 1991, Shimeles and Taddesse, 2005). This paper focuses on establishing dominance between aggregate welfare in rural and urban centres at a point in time. To achieve this, this study presents the hypothesis that aggregate mean income for rural

centres is statistically lower than that for urban centres and also a lower welfare relative to that of urban centres. The paper proceeds as follows. The next section reviews the concept of income distribution, stochastic dominance and its variousapproaches and application. The third section presents the theoretical framework while the last section describes the results and discussion.

2. LITERATURE REVIEW

To conclusively rank the distributions, we employed the generalized Lorenz dominance. This simply means scaling up the Lorenz values with the mean of the distribution (Shorrocks, 1983). The new values are shown in Table 3.

The issue of the appropriate indicator for welfare, inequality and poverty is narrated along two views in the literature of development economics. There is the welfarist approach which uses observable proxies such as income, expenditure and consumption to indicate levels of welfare, inequality and poverty in a given population. This approach is commonly used by economists (See Duclos et al. 2006). The second view known as the non-welfarist is a follow up of the perceived lapses in the welfarist approach and considers non monetary indicators such as public goods and non market commodities such as safety, liberty, peace and health (see Sen 1992). Notwithstanding, we adopt the welfarist approach to indicate welfare because it is relatively simply and straightforward.

Economist categorise the distribution of income or expenditure into personal and functional income distributions. The first category refers to income share allotted to individuals or households or group of individuals in a given population. Functional or factor share distribution of income defines the share of total national income that each of the factors of production viz: land, labour and capital receives (Todaro and Smith, 2003). In this study, personal distribution of income is employed since welfare and inequality are better captured by household income or expenditure. There are many measures in literature used for the analysis of income distribution. Examples are the Gini coefficients, Theil index, mean logarithmic deviation, and coefficient of variation. These measures consider the dispersion of the distribution and are based on implicit normative consideration (Nygard and Sandstorm 1981, Bartels and Nijkamp, 1976).

A recent contribution in the field of income distribution analysis is the stochastic dominance approach used to analyse alternative distributions in terms of their means and inequality using explicit normative consideration (Bishop et al 1992). It is also a popular tool in financial economics (Breton, 2006). Underlying the approach is the expected utility theory as revived by Von Neumann and Morgenstern (Bawa, 1982). This underlying theory allows the expression of alternative distributions in a manner that facilitates the establishment of dominance. Thus ranking or comparing distributions across time, country or regions become possible. Bishop et al (1992) used the Lorenz curve and the generalized Lorenz curve and inferential statistics to assess if there was convergence over time of south and Non-south income distributions.

Lorenz dominance is said to exist if the Lorenz curve for one distribution dominates that for another. Further more if the two income distributions have the same mean, then social welfare in that distribution that Lorenz dominates is higher for the set of social welfare function that is equity loving (Atkinson, 1970). However, Rothschild and Stiglitz (1973) suggested the introduction of efficiency preference to allow establishment of social welfare dominance. Efficiency preference is a sufficient condition for social welfare to be established and indicates that one distribution should have both a higher mean and higher Lorenz curve than another distribution. This means that the dominating distribution is that in which equity and efficiency preferences converge.

Shorrock (1983) pointed out that this sufficiency condition is unnecessarily strong and may preclude many important situations in which alternative distributions can be ranked. Thus he proposed the generalized Lorenz curve technique as an alternative which allows ranking of one distribution over another if that distribution has both a higher mean and higher Lorenz curve or a higher mean sufficient to compensate for a lower Lorenz curve. Pointed out that it constitutes the first step in the evaluation of the distribution of welfare and can later on be supplemented by the choice of particular indices to resolve cases of inconclusiveness. The generalised Lorenz have been extensively used in practice for making welfare and inequality comparisons with a reasonable degree of success.

The generalized Lorenz curve is constructed by scaling the ordinary Lorenz curve by the mean of the distribution. In testing these approaches, Shorrocks (1983) compared the Lorenz curve and the generalized Lorenz curve in their conclusiveness in ranking alternative distributions using the distributional data for 20 countries. Using the sufficiency criteria or Lorenz curve ranking, there was intersection of Lorenz curves in at least 108 of the 190 pair wise comparisons. In 29 cases where Lorenz curves did not intersect, the country with the higher Lorenz curve has the lower mean. Thus ranking countries only when one has both a higher Lorenz curve and a higher mean would produce conclusive results in just 28% of the total possible pair wise ranking. For the generalized Lorenz curve

ranking, that is softening the sufficiency criteria, there was intersection in only 31 of the 190 possible pair wise comparisons and found dominance to be conclusive in 84 percent of the cases.

Furthermore, Tam and Zhang (1996), suggested that scaling up the Lorenz curve by a constant does not change the relative inequality in a distribution and as such rather than multiplying the ordinates of the Lorenz curve by the mean of the total distribution, they suggested the $\beta-$ dominance criterion where β is one's preference for efficiency and ranges between 0 and 1. If β =1, the $\beta-$ dominance criterion reduces to the generalized Lorenz curve dominance. Shimeles and Taddesse (2005) applied the Lorenz dominance, generalized Lorenz dominance and $\beta-$ dominance criterion using panel data from 1994 to 1997 on household expenditure in Ethiopia. They found no clear difference of rural and urban welfare.

Stochastic dominance approach is complemented by hypothesis testing for more robust ranking and has received considerable attention in literature(see for example, Barrett and Donald 2003, Davidson and duclos, 2000, Beach and Davidson, 1983,Beach and Richmond, 1985, Araar, 2007) Beach and Davidson (1983) proposed the distribution- free statistical inference test. The advantage is that that they do not require knowledge of the underlying population distribution from which the sample income data was drawn. Bishop et al (1992) documented the application of hypothesis testing using the union intersection test which is simple and easy to apply.

Araar (2007) advanced a theoretical framework to check the dominance of poverty and inequality using discrete data. Also proposed stochastic dominance conditions that check for the statistical robustness of the inferred ranking. The methodology developed was applied to Burkina Faso's household expenditure for the years 1994 and 1998. Chotikapanich and Griffiths (2006) used the Bayesian approach of testing dominance. This approach involves the comparison of two income distributions in terms of the posterior probabilities for each of three possible outcomes: (a) X dominates Y, (b) Y dominates X, and (c) neither X nor Y is dominant.

3. MATERIALS AND METHODS

3.1 Data

Secondary data from 2004 Nigeria Living Standard Survey, collected by the National Bureau of Statistics, were used. Data obtained were on 19158 households. The reason for this choice is that it is the only comprehensive and professionally collected data made available for public use. It can also be disaggregated by rural and urban sub-population groups. Stratified random sampling technique was employed and in each state of the federation, 120 census enumeration areas (EAs) were randomly selected. We chose total consumption expenditure as welfare indicator and the household as the unit of analysis. Total household consumption expenditure is the sum total of expenditure on household own produced food, purchased food; expenditure on health, education, housing, non food expenses on frequently purchased items and none food expenses on less frequently purchased items. Further adjustment was made on total household expenditure by adult equivalent scale and by consumer price index to reflect household size and composition and also regional price differences.

3.2 Analytical Technique

This frame follows shorrocks (1983), Beach and Davidson (1983) and Bishop et al (1992) to test for rural and urban welfare dominance using the Lorenz and the generalized Lorenz curves devices. We also follow the welfarist approach by assuming income X as a proxy for welfare. Rural and urban income distributions are assumed independent such that X^{RURAL} and X^{URBAN} represent rural and urban income X with corresponding cumulative distributions F^{RURAL} and F^{URBAN} that are continuous and differentiable to at least second order. Also the mean and variance of the random income variable X exist and finite. All incomes are positive and households are identical in all aspect except their income. Rural and urban centres have population of households represented by N with incomes ordered from the smallest to the largest such that $x_1 < x_2 < ... < x_N$ and mean income denoted by μ.

From the above, empirical Lorenz curve L^{rural}, L^{urban} is generated which is characterised by a set of Lorenz ordinates $\{L_i : i = 1....k\}$ corresponding to the abscissae $\{p_i : i = 1,....k\}$. Thus corresponding to a set of k abscissae ($p_1 < p_2 < ... < p_k$), we have a set of k population income quantile functions $X(p_1) < X(p_2) < ... < X(p_k)$ and a set of k population Lorenz curve ordinates $L(p_1) < L(p_2) < ... < L(p_k)$. An income quantile function $X(p)$ corresponding to the abscissa p on the Lorenz curve is the aggregate welfare level for the proportion of the population p and it is implicitly defined as $F(X(p)) = p$ where F is

assumed to be monotonic. According to Duclos, (2008), quantile functions simplify computation.

The quantile function aggregates p^{th} quantile having a population size, (n_i) into a single number defined as the conditional mean income or group mean income. The conditional mean income is defined as $x_i \equiv E(X : X \le X(p_i))$ and estimated as $\hat{x}_i = (1/n)\sum_{(j)}^{n} X(j)$ where $X_{(j)}$ is the sample order statistics and the sum is over the n_i observations in the i^{th} group. While the Lorenz curve ordinate is defined as $L(p_i) = p_i \frac{x_i}{\mu}$. The Lorenz ordinate is estimated as $\hat{L} = p_i \frac{\hat{x}_i}{\hat{\mu}}$ where $\hat{\mu} = (1/N)\sum_{j}^{N} X_{(j)}$ is the mean income of the sample size N . From the above, corresponding to a vector of k abscissae (p_i) we have a vector of k population conditional mean income groups estimates ($(\hat{x}_i,...,\hat{x}_k)^{rural}, (\hat{x}_i,...\hat{x}_k)^{urban}$) and a vector of k Lorenz ordinates groups estimates ($(\hat{L}_i,...,\hat{L}_k)^{rural}, (\hat{L}_i,...,\hat{L}_k)^{urban}$.).

In testing for dominance it is common practice to divide the process into two stages since making a distinction between distributional and efficiency aspects of alternative allocations, and viewing the ranking procedure as a two-stage process, may be a helpful analytical device(Shorrock,1983). In the first stage, given that the two income distributions have the same mean, rural welfare dominates urban welfare $W^{rural} \ge W^{urban}$ for all set of welfare function that is equity loving(Schur-concave $W(.)$) if and only if rural Lorenz curve is higher than urban Lorenz curve($L^{rural} \ge L^{urban}$ for all p).

In the second stage we introduce the efficiency preference. Rural welfare dominates urban welfare $W^{rural} \ge W^{urban}$ for all set of welfare function that is equity and higher income loving (non-decreasing-Schur concave welfare functions). This means that the sufficient condition for welfare dominance to hold is that rural income distribution has both a higher mean and a higher Lorenz curve or vice versa. That is $X^{rural}(p) \ge X^{urban}(p)$ for all $p \in (0,1)$ and $L^{rural} \ge L^{urban}$ for all p or vice versa. In a situation where these conditions become too strong to allow ranking, the generalized Lorenz curve is employed by scaling the Lorenz curve by the mean of the income distribution (Shorrock, 1983). Generalized Lorenz curve is defined as $GL(p) = \mu L(p)$ for all $p \in [0,1]$, and so rural welfare dominates urban welfare for all welfare function that belong to the set of non-decreasing schur-concave welfare function if $GL^{rural}(p) \ge GL^{urban}(p)$.

To have a robust ranking inferential statistics are used to complement ranking. Beach and Davidson (1983) proved the use of inferential statistics to test for robust ranking under the condition the vector of conditional mean income and Lorenz ordinates are asymptotically normal with mean zero and a variance-covariance Matrix. Thus used inferential statistics to test if the corresponding conditional mean income for the rural area is significantly different from that of the urban area. We follow the union intersection test as used in Bishop et al (1992). The test statistic is:

$$T_i = \frac{\hat{x}_i^{rural} - \hat{x}_i^{urban}}{\left[\left(\hat{\sigma}_{ii}^{rural} / N^{rural}\right) + \left(\hat{\sigma}_{ii}^{urban} / N^{urban}\right)\right]^{1/2}}$$

Where

T_i = Test statistic

$\hat{x}_i$ = conditional mean or average absolute income

$\hat{\sigma}_{ii} / N$ = Standard Deviation.

The studentized maximum modulus variate with k and infinite degrees of freedom is used to test for significance. For deciles, the 5% critical value is 2.80, and the 1% critical value is 3.29.

4. RESULT AND DISCUSSION

Table 1 shows the conditional mean income for rural and urban centres and the test statistic. The conditional means are arranged from the first deciles to the last deciles where each deciles represents 10 per cent of the population.

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Table 1 Conditional mean income

DECILES	**TABLE 1 CONDITIONAL MEAN INCOME PER MONTH IN ₦**		
	RURAL CENTRES	URBAN CENTRES	T-STATISTIC
1	627.95	596.60	0.14
2	1094.37	1075.62	0.08
3	1452.25	1470.88	-0.09
4	1813.93	1812.39	0.01
5	2199.39	2194.45	0.04
6	2636.31	2651.69	-0.16
7	3216.68	3238.30	-0.42
8	4007.50	4021.43	-0.45
9	5305.66	5313.80	-0.09
10	10420.2	11332.72	-2.19
TOTAL AVERAGE	3063.554	4160.916	

Source: Authors' calculation from Nigeria living standard survey 2003/2004

Three points can be inferred from the above table: first, excluding the test statistic, the conditional mean income across all deciles for rural centres is lower than the conditional mean incomes for urban centres. Second, for rural centres the conditional mean income per month for the last and first deciles, representing richest and poorest 10% of the population respectively are ₦10, 420 and ₦637 while for urban centres, the conditional mean income per month is ₦11, 332 and ₦596 respectively. This implies a wide gap in absolute mean income between the richest and poorest 10% and this gap is higher for urban than for rural centres. However, to substantiate this fact, test statistics were employed to test for significant differences across deciles. The T-test is shown in column 3 of table 1. No significant difference between rural and urban condtional mean incomes was found at all the deciles at 0.05%. Bishop et al (1992) documented that if we fail to reject the null hypothesis at all deciles, then we fail to reject the overall null hypothesis and we rank the two distributions as equal. This implies that rural and urban income distributions have the same mean. This is clearly depicted in figure 1 below showing the intersection of the two distributions.

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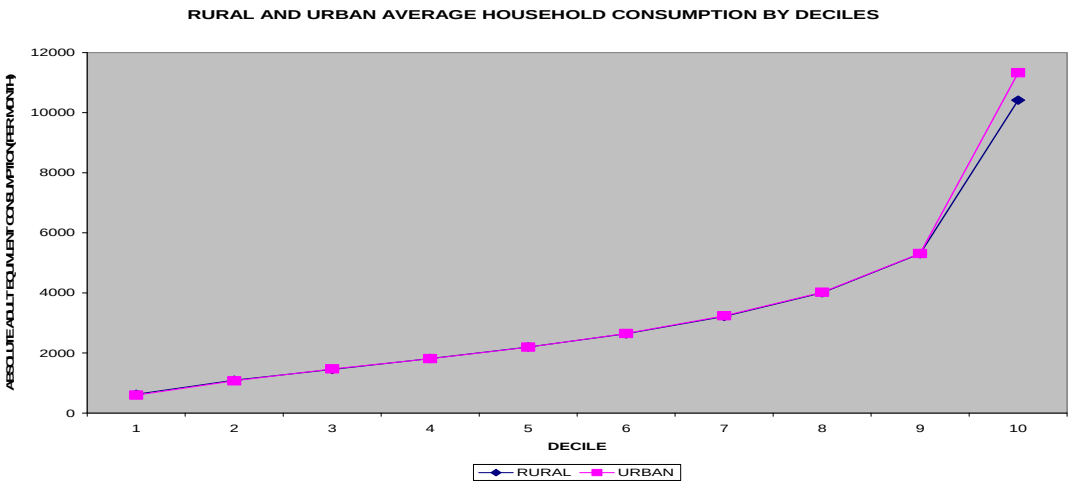

Figure 1 Rural and urban household consumption by deciles

Table 2 shows the Lorenz curve ordinates for both rural and urban centres and also the Lorenz curves as as shown in figure 2. These ordinates also represent the relative income. As the figure shows, Rural Lorenz curve is higher than urban Lorenz curve implying a better income inequality than urban inequality.

Table 2 Lorenz curve ordinates

DECILES	**Lorenz Ordinates**	
	RURAL CENTRES	URBAN CENTRE
1	2.05	1.43
2	3.57	2.58
3	4.74	3.53
4	5.92	4.356
5	7.18	5.27
6	8.60	6.37
7	10.50	7.78
8	13.08	9.66
9	17.32	12.77
10	34.01	27.23

Source: Authors' calculation from Nigeria living standard survey 2003/2004

Therefore, rural aggregate welfare dominates urban welfare for all social welfare function that is equity loving or schur concave. However, for all welfare function that is both equity and efficiency loving(non-decreasing schur concave), the dominance of rural aggregate welfare over urban is said to be inconclusive.

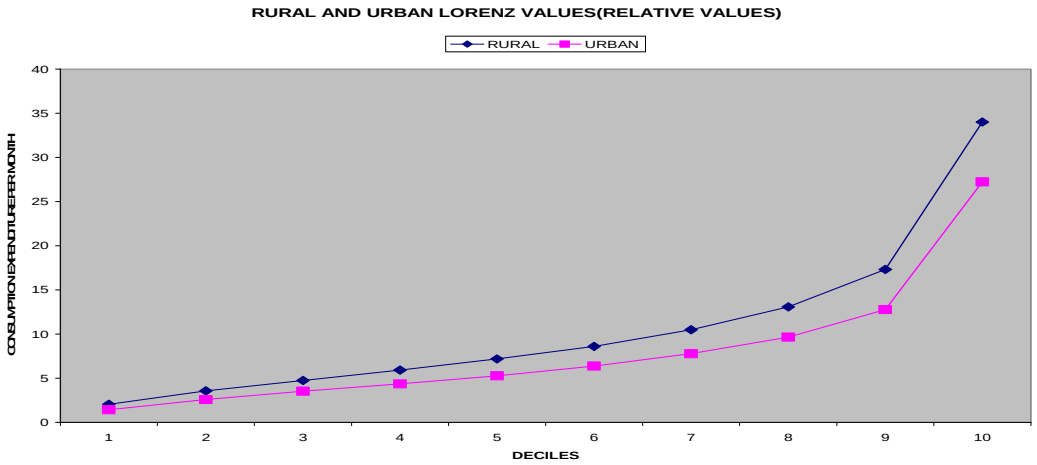

Figure 2 Rural and urban Lorenz values

To conclusively rank the distributions, we employed the generalized Lorenz dominance. This simply means scaling up the Lorenz values with the mean of the distribution (Shorrocks, 1983). The new values are shown in Table 3.

Table 3 Conditional mean income

DECILES	Mean Income Per Month in ₦		
	RURAL	URBAN	T-STATISTIC
1	678.70	473.44	1.01
2	1181.94	854.17	2.54
3	1569.30	1168.69	4.21*
4	1959.96	1442.16	7.55*
5	2377.12	1744.77	13.60*
6	2847.25	2108.95	28.49*
7	3476.29	2575.76	241.28*
8	4330.46	3198.18	54.54*
9	5734.22	4227.83	28.85*
10	11259.86	9015.17	14.34

*T=>2.8 is significant at 5% level of significance

Source: Authors' calculation from Nigeria living standard survey 2003/2004

As the table shows, there are clear differences across deciles and they are all significant at 0.05%. This suggests that the mean for rural income distribution is significantly higher than the mean for urban income distribution. Therefore rural aggregate welfare dominates urban welfare for all social welfare function that is non-decreasing schur concave. The policy implication is that increases in the incomes of the very poor may have much more effect on aggregate welfare than similar increases for the better off. Therefore expenditure on basic education and health services would have larger impacts on welfare relative to expenditures on universities or tertiary health centres.

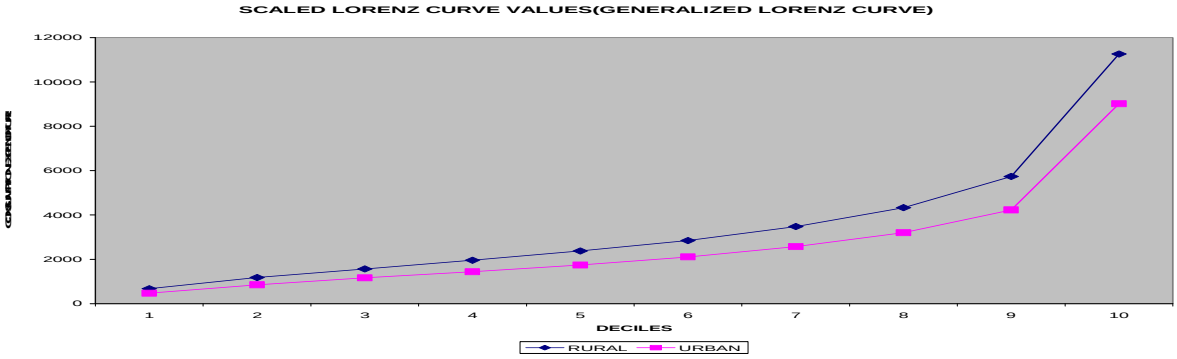

Figure 3 Scaled Lorenz curve values

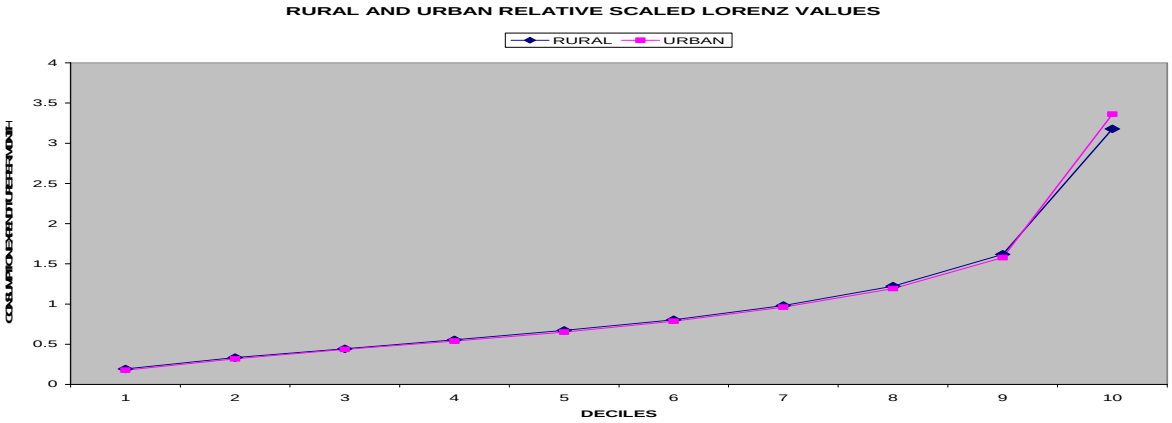

Figure 4 Rural and urban relative scaled Lorenz values

5. CONCLUSION AND RECOMMENDATIONS

This study applied stochastic dominance test to rank rural and urban welfare at a point in time using the household survey data for Nigeria collected by the national Bureau of Statistics. The welfarist approach of measuring welfare was adopted and consumption expenditure was chosen over household income following its practicability in a developing country context. Adjustments were also made so as to fit welfare distribution as much as possible.

The main findings are as follows: Although rural income distribution was better, there was no significant difference between rural mean income and urban mean income and as such rural welfare dominance over urban welfare was inconclusive. However, imposing the condition of transfer using the generalized Lorenz curve rural welfare showed dominance over urban welfare for all welfare functions that are equity loving and efficiency loving.

The policy implication is that increases in the incomes of the very poor may have much more effect on aggregate welfare than similar increases for those already better off. Therefore expenditure on primary education and basic health services would have larger impacts on welfare than would expenditures of equal size on universities or tertiary health centres. For further research this study suggests over time comparison using a panel household data and a general equilibrium analysis to elucidate winners and losers across sub-population groups.

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