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UNDERSTANDING THE IMPLICATION OF OCCUPATIONAL DISTRIBUTION ON INCOME INEQUALITY: EVIDENCE FROM NADOWLI-KALEO DISTRICT, GHANA

Agbenyo, F., Ngben, J. M., Alhassan, S.
University for Development Studies, Department of Planning and Management, Ghana.

Abstract
The paper seeks to establish the implication of occupational distribution on income inequality. Data was collected from five independent sub-groups, two from the formal and the other two from the informal sectors with a fifth sample generated from these four samples. Lorenz curves and Gini coefficients were used to measure income inequality. The results show that though formal sector income sub-groups generated higher incomes they produced lower inequalities than the informal sector income sub-groups which induced lower incomes due to salary harmonization using the single spine salary structure policy introduced in 2010. The paper also reveals that even though the Lorenz curve and Gini index are very useful in establishing intra sub-group inequalities their application to inter sub-group inequalities for comparative purposes is problematic since both tools are unable to deal with variations in income levels across income sub-groups. The bootstrap confidence intervals were constructed to deal with the statistical testability enigma of the Gini index. The results show that the empirical statistics and by extension Gini coefficients were significant at 95% confidence interval. The paper recommends that policies targeted at solving the inequality puzzle in low income countries should always be accompanied with growth generating policies for the expansion and sustained poverty and income inequality reduction.

Keywords: ***Income inequality, Poverty, Lorenz Curve, Gini coefficient, Nadowli-Kaleo District***

INTRODUCTION

In recent times in developing countries, particularly sub-Saharan Africa, poverty reduction is recognized as a seminal goal of development interventions. On the broad international front, the goal of achieving poverty reduction inspired the United Nations (UN) to establish the Millennium Development Goals (MDGs) for developing countries which expired in 2015 (UNDP, n.d.) and the Sustainable Development goals [SDGs] (United Nations, 2015). In spite of these efforts, poverty remains an inevitable bedfellow of majority of the world's population particularly in sub-Saharan Africa. Poverty can be measured, generally, on the basis of two approaches namely: the material and non-material (Maliki, 2011). However, as noted by Owusu and Mensah (2014), the concept of poverty is increasingly being recognized as multi-dimensional, and as such its definition and measurement based on only income does not provide a full picture of the command of resources that an individual or household possesses. This notwithstanding, the poverty line is still widely relevant, and in Ghana, even though public policy frameworks recognize poverty as multidimensional, the basis of analyses and projections is the poverty line (Aryeetey et al., 2009).

A key economic indicator for measuring poverty is income. This is because income remains an important measure of economic access to goods and services, choices that an individual can make in the face of available alternatives, freedom that one can enjoy and participation in the form of contribution to developments and decision-making that affects him/her (Kumar, 2002). The distribution of income at the global level remains uneven. Khan (2013) indicates that in 2010, countries with high-income status accounted for only 16% of the world's population but estimated to generate 55% of global income and that, low-income countries, on the other hand, produced slightly above one per cent of global income even though they hosted 72% of global population. Those individuals in the upper echelon of the society have invariably become wealthier while the relative situation of people living in poverty has seen marginal improvement. Numerous social groups suffer disproportionately from income poverty and disparities between these groups and the rest of the population have increased over time (Khan, 2013). In general, disparity in income distribution is most observable in some developing countries of the world than others. This is attributed to lack of equal opportunity in education, employment, health, political differences and access to productive assets (Adegoke, 2013).

Ghana has recorded impressive economic growth rates since the adoption of the Structural Adjustment Program, experiencing an average economic growth rate of 4.7 percent between 1983 and 2000, averaged 7.2 percent from 2000 until 2013 and reached a record high of 14.4 percent in 2011, which was believed to be one of the fastest growth rates in the world at the time. This culminated in reclassification of the country into the ranks of lower middle income countries status, as the per capita GDP increased from US$501.9 in 2005 to US$1,604.9 in 2012. The growth in the economy also resulted in an almost 50 percent reduction in poverty in 2006; that is from 52% of the population in 1992 to 29% of people in 2006 (Assibey, 2014).

However, the swift economic growth and significant poverty reduction in Ghana have proceeded amidst marginal reduction in inequalities. Exposing the issues behind the averages and scrutinizing the country's progress beyond the national level towards achieving the MDGs, reveal the gains so far have not been evenly distributed across regions as disparities in social and economic well-being are evident between various spatial units across the country, particularly north-south divide (Assibey, 2014; Aryeetey et al., 2009). A significant percentage (70%) of people whose incomes are below the poverty line can be found in the northern parts of Ghana. Although the proportion of the poor in the population continued to decline in both regions, the poverty rate in the southern regions fell much faster from 48 percent to 20 percent while it only declined marginally from 69 percent to 63 percent in the three northern regions between 1992 and 2006 (Assibey, 2014). This is corroborated by Assibey's analysis of the rounds four (1998 -1999), five (2005 - 2006) and six (2012 - 2013) of Ghana Living Standard Surveys indicating that the Gini index rose from 0.37 to 0.42 between 1992 and 2006.

The overarching effect of this income inequality lies in its ability to reduce the impact of economic growth on poverty reduction. Thus, the question many Ghanaians ask is "what is the real impact of economic growth amidst oil exploitation on poverty?" Coulombe and Wodon (2007) in their empirical studies, reason that the headcount index of poverty which reduced by 23.2 percentage points from 1991 to 2006 would have actually reduced by 27.5 points if there had been no increase in inequality. They concluded that Ghana would have achieved the MDG target of reducing poverty by half, years earlier but this did not happen because the increase in inequality slowed poverty reduction by 4.3 percentage points.

The degree of income disparities across countries is large, but so are disparities across individuals within each country (Khan, 2013). Therefore, given the high disparity in income distribution on regional basis in Ghana, one can conclude that there are inherent income inequalities within regions and even sub-groups within districts in a particular region. However, the available literature on poverty and inequality in Ghana invariably focuses on the regional level. As Korang (2012) contended, investigation of income inequality at the regional level in Ghana has not received much consideration in research literature, the limited literature on income inequality in Ghana had mainly centered on the differences between the southern and northern regions.

Furthermore, efforts have been devoted to analyzing the impact of overall growth in the economy in removing income inequality, with the notion that growth at the macro level will help remove poverty and reduce income inequality. Much effort has not been placed on micro level growth which can help reduce poverty and inequality. It is against this backdrop that this paper focuses on the micro level taking into consideration income earning sub-groups in the Nadowli District, using the Lorenz curve and Gini-coefficient approach. It seeks to establish the implication of occupational distribution for income and examine the efficacy of the Lorenz curve and Gini coefficient in measuring income inequality among income earning sub-groups. Its premise is that income remains a fundamental yardstick for measuring inequality and poverty in any scale of the spatial resolution, with the non-income measures being complementary. The rest of the paper is divided into theoretical framework, study area, methodology, results and discussions, and conclusions and recommendations.

Theoretical framework

This section expounds on the theoretical perspectives, elucidating on concepts including income, poverty and inequality and dilates on how occupational distribution determines income distribution and inequality with Lorenz curve and Gini coefficient as the chosen measure of income distribution.

According to Townsend (n.d.), the three alternative notions of poverty offered to guide international comparability include subsistence (Bendwald, 2008), basic needs (Emmerij, 2010; Santos et al., 2010; Streeten, 1979) and relative deprivation (Walker & Pettigrew, 2011; Connor, 2003; Walker & Smith, 2002).

Of the three, the third postulation of poverty - relative deprivation – is more in line with income inequality which derives from income distribution. Deprivation, however, constitutes not only income but also other resources including material and social conditions as well as power relations that relate to political deprivation (Connor, 2003). Under the relative deprivation approach, a threshold of income is envisaged, according to size and type of family, below which withdrawal or exclusion from active membership of society is common (Walker & Pettigrew, 2011; Connor, 2003).

UNDP (2006) identifies five clusters of the meaning of poverty as contained in contemporary literature. The first is income poverty or its common proxy consumption poverty, where people are deemed poor if they are deprived of income needed to obtain the conditions of life. The second meaning of the concept is material lack or want. For instance, people are entangled in poverty when besides income, they lack or have little wealth, food, shelter, and medical care, safety and other assets thought necessary based on mutual values of human dignity. Capability deprivation is another explanation of poverty. The capability approach to understanding poverty encapsulates human capabilities, including skills and physical abilities among others, wherein people without them are considered poor. The fourth cluster of meaning to the concept is multi-dimensional view of deprivation in which material lack is recognized as one of the mutually reinforcing dimensions. The last cluster is the multiplicity of meanings ascribed to the term by the poor, the objects of deprivation.

Measures of Inequality

Over the years, economists devised a number of approaches for measuring inequality. Notable among these measures are the Decile Dispersion Ratio (DDR), the Lorenz curve approach with its progeny, Gini Coefficient (GC), and the Generalized Entropy Measures (GEM). DDR presents the ratio of the average consumption (or income) of the richest 10 percent of the population to the average consumption (or income) of the poorest 10 percent. This measure, in addition to its simplicity and popularity, is easily interpretable. It, however, does not only ignore information about incomes in the middle of the income distribution, but also does not use information about the distribution of income within the top and bottom deciles, a situation that limits its practicability (Haughton & Khandker, 2009).

An alternatively attractive tool is the Lorenz Curve. It is a cumulative frequency curve that compares the distribution of a specific variable (income) with the uniform distribution that represents equality (Haughton & Khandker, 2009). It shows the actual quantitative relationship between the percentage of income recipients and the percentage of the total income that is received during a given year (Adegoke, 2013). The curve consists of a set of axes in which the cumulative percentage of income is measured along the y-axis while the cumulative percentage of households or population is measured along the x-axis. These axes are closed off to form a box that is actually the positive-positive sector of the Cartesian plane. The distribution of income and population are calibrated from the lowest until the point where 100 percent of income is owned by 100 per cent of the population. From this, an assumption is made of a truly equal society where, as a movement is made along the x-axis, each 10 per cent increment of households or population would own an additional 10 per cent of income, resulting in a diagonal line (the line of absolute or perfect equality) emanating from the origin establishing an angle of 45 degrees between the line of perfect equality and the x-axis (population axis). Finally, a line is plotted based on the empirical income distribution data available. Usually, the line deviates away from the line of absolute equality, and this represents the Lorenz curve. As a decision rule, the more unequal the society is in income, the further the curve digresses away from the line of absolute equality. The potency of the Lorenz Curve rests in its ability to provide a visual representation of inequality of income prevailing in the society. The pictorial view alone creates understanding for even a lay person with limited guidance. However, as Cowell (2007) notes, ambiguity or no clear-cut conclusion arises when comparison is made between two or more Lorenz curves, because in many instances the relevant Lorenz curves intersect and thus limiting their practicality for analyzing income distribution and inequality.

A refined way of resolving the ambiguity in the Lorenz curve comparison is to compute a summary numerical index known as the Gini coefficient for each Lorenz curve. The Gini index derived from Lorenz curve therefore is complementary to it. It is the ratio of the area between the Lorenz Curve and the line of absolute equality (numerator) and the whole area under the line of absolute equality (denominator). As Cowell (2007) argues, the index is intuitively done by taking the area trapped between the Lorenz curve and the equality line, the normalized value which yields the Gini coefficient. The index is an example of a summary statistic, in that it compresses a wider array of statistical information into a single figure. The measure succinctly determines and summarizes the distribution of income and the levels of income inequality among individuals or households in any spatial unit. It measures the magnitude to which the distribution of income among individuals or households diverges from a perfectly equal distribution. The index ranges from 0 (perfect equality) to 1 (complete inequality), where one person has all the income or consumption while all others have none. Accordingly, the closer the coefficient is to 1, the more unequal the income distribution and vice versa. Haughton and Khandker (2009) orate that a good measure of income inequality should essentially satisfy the mean independence criterion (index would not change if all incomes double), population size independence (if population changes, the measure of inequality should not change, all else equal), and the symmetry (a swap in incomes between any two people should not change the index). It should also meet the requirement of Pigou-Dalton Transfer sensitivity; the transfer of income from rich to poor reduces measured inequality. The Gini coefficient satisfies the above criteria and is recognized as more practical and widely used.

However, a good income inequality measure also needs to meet the decomposability and statistical testability criteria. That is, it should be possible to break inequality by population groups or income sources or in other dimensions. Unfortunately, the Gini index is not decomposable or additive across groups. Also, the total Gini coefficient of a society is not equal to the sum of the Gini coefficients of its sub-groups. It also defies the statistical testability criterion in that one is not able to test for the significance of changes in the index over time. This is however, less of a problem than it used to be because confidence intervals can typically be generated using bootstrap techniques. Even though these shortfalls of the Gini index are catered for by a family of generalized entropy (GE) inequality measures including the Theil indexes and the mean log deviation measure that satisfy all six criteria (Haughton & Khandker, 2009). Both the Lorenz curve and its progeny index, the Gini coefficient, are still widely used in analysing income inequality for two main reasons; first, the unresolved weaknesses discussed above do not negatively affect their applicability and second, they are simple to use. One cannot talk of income inequality without talking of employment and occupational distribution. In the light of this, two types of inequality can be discerned namely inter- and intra-occupation inequality.

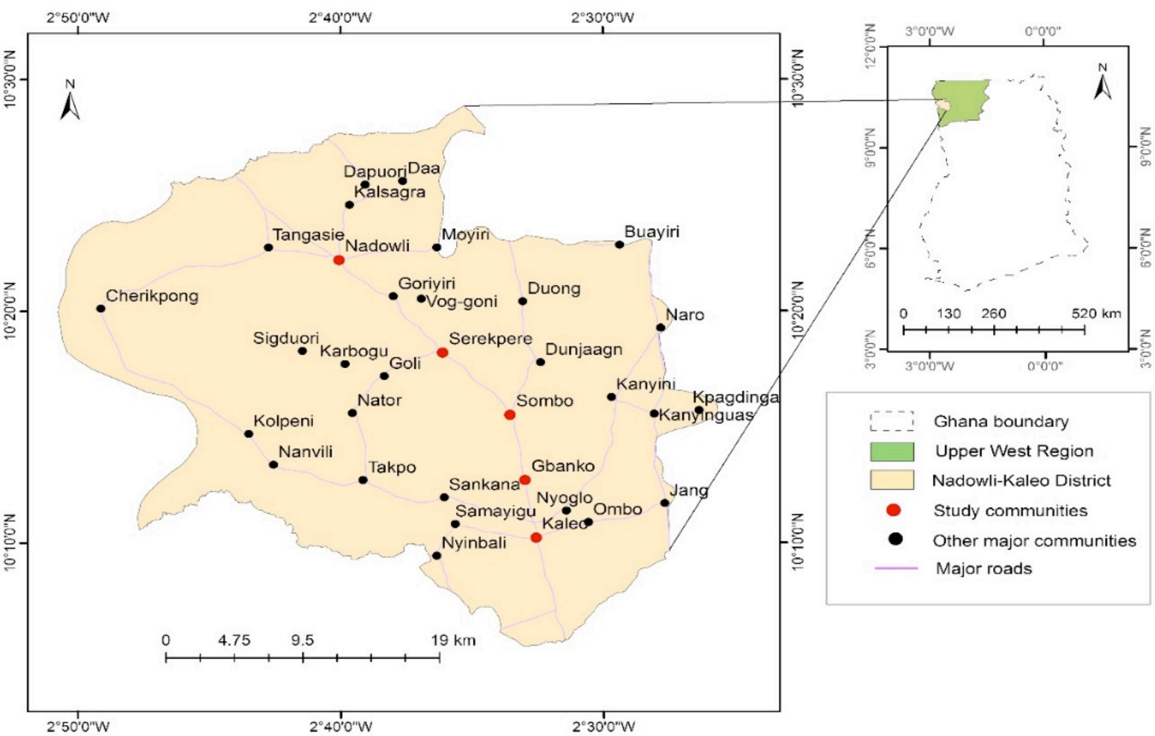
Occupational Distribution: Implications for Income Distribution and Inequality

The sector and status of employment of inhabitants in a particular spatial resolution has a consequence on income distribution and level of inequality. Coulombe and Wodon (2007) analyzed the first three rounds of the Ghana Living Standards Survey (GLSS) data and argued that industry and employment status of household heads has effects on the consumption-based share of population in poverty. They found that the highest probability of being poor occurs among household heads working in agriculture, followed by manufacturing and construction for all the years. It also reveals that, the poverty headcount declined substantially for all three groups over the period, from 65 percent to 39 percent in agriculture, from 39 percent to 17 percent in manufacturing, and from 42 percent to 13 percent in construction. With regard to employment status of the head in 2005/6, lowest rates of poverty were observed among public sector workers (8%), followed by private-formal-sector wage-earners (10%), the self-employed in non-agricultural activities (14%), private-informal-sector wage-earners (16%), and 40% for self-employed in agriculture.

The Study Area in the Light of Occupational Distribution and Income inequality

The study was conducted in Nadowli-Kaleo District in the Upper West Region of Ghana. The District is bounded by Latitude $10^{0}07'00"$ N, $10^{0}28'00"$ N and Longitude $2^{0}49'00"$W, $2^{0}34'00"$W (see fig. 1). According to the 2000 population and housing census, the District had a total population of 82,716 representing 14.3 percent of the region's population (GSS, 2005). In 2010, the District recorded a population growth of 14.1 percent with 51.7 percent in the working class (GSS, 2012). Also, 91.7 percent of the working class in the year 2000 was employed with 83.5 percent in agriculture and related works, 2.4 percent in services and 1.1 percent as sales workers among others (GSS, 2005). Although there are a number of small-scale enterprises and other occupations springing up, peasant agriculture dominates the District economy.

Figure 1: Map of Nadowli-Kaleo District in the National and Regional Contexts



Source: *Author's Construct, Department of Planning, University for Development Studies, 2016.*

Methods and Data Used

The cross-sectional survey design was used for the study. This design was chosen because it allowed for analysis of one-spot income distribution data. It also allowed for description of patterns of relationships among variables (income and occupation) studied (Puopiel, 2014) without necessarily resorting to past trends or future projections in income distribution. The target population for the study comprised all the employed persons in the District. As regards sample size determination, five sampled income sub-groups including workers from the Ghana Health Service (GHS), Ghana Education Service (GES), farmers, small-scale entrepreneurs (SSEs) and a cross-occupational sampling frames were derived from the population (See Table 1).

The formula, $ni = Ni/1 + Ni(\alpha)^2$: where n_i = sub-sample size, N_i = sub-population α = margin of error [0.1] and n = total sample size [see table 1] (Yamane, 1967) was used. It should be noted that, contrary to the normal practice where the formula is applied to the total population and proportions of the various sub-populations are used to do the distribution of the total sample size among the sub-samples, in this study, the above formula was applied to each sub-population separately to determine the sub-sample sizes which were aggregated to arrive at the total sample size. This approach was used for two main reasons. First, this was to ensure representativeness of all the sub-samples. Second, was the fact that the fifth sub-sample, which is the cross-occupational sub-sample, was derived from aggregation of the first four sub-samples (i.e. GES, GHS, SSE and farmers) which result was constituted into a sub-population to which the formula was applied. Aggregation of the first four sub-samples equated 266 while the addition of the cross-occupational sub-sample size of 75 gives a total sample size of 341 (see table 1). The percentages were then computed for each sub-sample.

Table 1. Nadowli-Kaleo District Income Sub-Population and Sub-Sample Groups

Sub-Sectoral Income Groups		**Sub-Population (N_i)**	**Sub-Sample (n_i)**	**Percentage**
Formal Sector Income Sub-Groups	**GES**	107	52	15.25
	GHS	157	61	17.89
Informal Sector Income Sub-Groups	**SSE**	111	53	15.54
	FARMERS	22,877	100	29.32
Both Formal and informal Sector Income Groups	**Cross-Occupational**	266**	75***	22.00
	Grand Total	23,252	n = 341	100.00

Source: Author's Calculations from Upper West Regional Controller and Accountant General's Department (2014), BAC of NBSSI, Nadowli-Kaleo District Assembly [NKDA] (2014) and Nadowli Kaleo District Agricultural Development Unit (DADU (2014).

** = The cross-occupational sub-population of 266 is the total sample size of the four sub-occupational samples (GES, GHS, SSE and Farmers). The essence of the cross-occupational population of 266 is to ensure a representative mix of income earners for the analysis to see whether inequality across occupational will be higher or otherwise than inequality within each occupational group. It is assumed that each income earner belongs exclusively to only one occupational group.

*** = The cross-occupational sub-sample of 75 is derived by considering the total sample size of the four sub-occupations (266) as the total population and applying the sampling formula used in the study.

From Table 1, the grand total of 23,252 excludes the 266** as these had been sampled out of each sub-population earlier. However, the 340-total sample size is inclusive of the 75*** sub-sample size because this is to depict the cross-occupational income distribution. It should be noted that all the elements in the 75*** cross-occupational groups have been sampled twice: the first one is within their sub-populations (sub-occupations) and the second one was when they were sampled out of the cross-occupational total sample. The use of the total sample of 266** as the population for the cross-occupational sample size of 75*** was to ensure representativeness of each of the sub-populations, some of which were too small and may not be represented in the cross-occupational sample if given equal chances of being selected.

Given the multiplicity of income groups in the District, a multi-stage sampling strategy (Puopiel, 2014; Creswell, 2009; Lynn, 2002) was adopted. The first stage was stratification (Puopiel, 2014; Anderson, et al., 2011; Creswell, 2009; Lynn, 2002) of the study population into five income strata (GES, GHS, SSEs, Farmers and the cross-occupational strata), with the occupational/income sub-groups considered as the stratifying factor. This was to ensure a fair representation of the five income sub-groups used in the study. Ensuring spatial representativeness of the sample used a second stage, cluster sampling, was used which involves the seven area councils (Interview with the NKD Planning Officer, 2014) considered as the clusters (Puopiel, 2014; Anderson, et al., 2011; Creswell, 2009; Lynn, 2002). The third stage was the lottery method of simple random sampling used to proportionately select the individual income earner with respect to the strata and clusters used. The stratification alone went through two stages; the first stage being the sub-occupational groups which constituted independent samples (Creswell, 2009; Opoku, 2004) at the first level of sampling while at the second level, all these sub-samples were merged and a representative sample of 75, which constitutes the fifth independent (cross-occupational) sample size, was drawn from the amalgamated (total) sample size of 266 (see Table 1 and Fig. 6 in the results section). This cross-occupational sample size is very crucial in that it forms the basis of the main proposition of the study which states that incomes distributed within occupational sub-groups are less skewed than those distributed across occupational sub-groups. The pay roll from the Upper West Regional Accountant General's office (2014) was used to generate independent sample frames for the Ghana Health Service and Ghana Education Service. These were grouped into lower, middle and upper income levels, based on their respective grades and simple random sampling applied to each level using proportion for each from which secondary data were obtained. For the farmers and small scale enterprises, primary data was collected from individual income earners, using questionnaires. The data collection targeted individual income earners and not households or community incomes. This was because the focus of the paper is occupational distribution as a determining factor for income inequality. This focus will be distorted with the introduction of household or community incomes since each of these will bring together income earners from more than one occupational group. To arrive at the monthly income figures for the farmer income earners, annual data was gathered on total outputs, unit price and total costs of crops, livestock and birds. With due consideration of the number of workers involved in the production process, annual income were determined which were reduced to monthly incomes that were used in drawing the Lorenz curve and Gini index for farmers. Small scale enterprises were grouped into three main categories namely, small scale industrial producers, service providers and those engaged in buying and selling, referred to as traders. SSEs monthly inflows were determined on weekly basis and multiplied by four to arrive at monthly inflows. The costs were deducted to arrive at the monthly incomes which were used in the analysis.

The data collected from the various sources and sub-groups were thoroughly edited to ensure credibility. The Lorenz curve was used to analyse the income distribution data obtained for each sub-group. In order to achieve this, the income collected for each sub-group was organized by levels and the proportion of income earned by each individual and his/her proportion on total population in the sub-group was defined. Following this, the cumulative proportion of income and the cumulative proportion of population were defined and a diagonal line indicating equality in income distribution was fixed. The cumulative proportion of income was then plotted on the vertical axis against the cumulative proportion of population on the horizontal axis that constitutes the Lorenz Curve, the convex curve below the line of perfect equality. A comparison was then made among the curves for each sub-group. In order to determine the efficacy of the Lorenz curve in analyzing income distribution in the entire district, a composite Lorenz curve was drawn by amalgamating the data from each of the four sub-groups. Similarly, the Gini Coefficient was determined regarding income distribution for each independent sample. This was done by taking the ratio of the area between the line of perfect equality and Lorenz curve and total area below the line of perfect equality (Todaro, 2000; Monga, 1995). This helped to compare the nature of income distribution among the five independent samples. To rectify the statistical testability anomaly of Gini index generated from each Lorenz curve the bootstrap strategy was used to construct confidence intervals on the descriptive statistics generated from each independent sample (see Haughton & Khandker, 2009). In generating these confidence intervals, bootstrap results presented in Tables 7, 8, 9, 10, and 11 are based on 1000 bootstrap samples.

Since the study analysed incomes of identifiable groups, which can further be decomposed into individuals, the ethical implications (Neuman, 2012; Berg and Lune, 2012; Silverman, 2010) of the data used was taken very seriously. To address these concerns, the principles of anonymity and confidentiality were employed. Again, implied consent was obtained from the payroll unit officer of the Upper West Regional Controller and Accountant General's Department, who after thorough discussion on how the issues of confidentiality, anonymity and informed consents were to be upheld, allowed access to the payroll (see Berg & Lune, 2012). Finally, there were informed consents from respondents to the questionnaires of the survey during the data collection stage of the study. Consents were also sought from a number of identifiable income earners on the payrolls (Berg & Lune, 2012). Statistical package for social sciences and excel were used in analyzing the data.

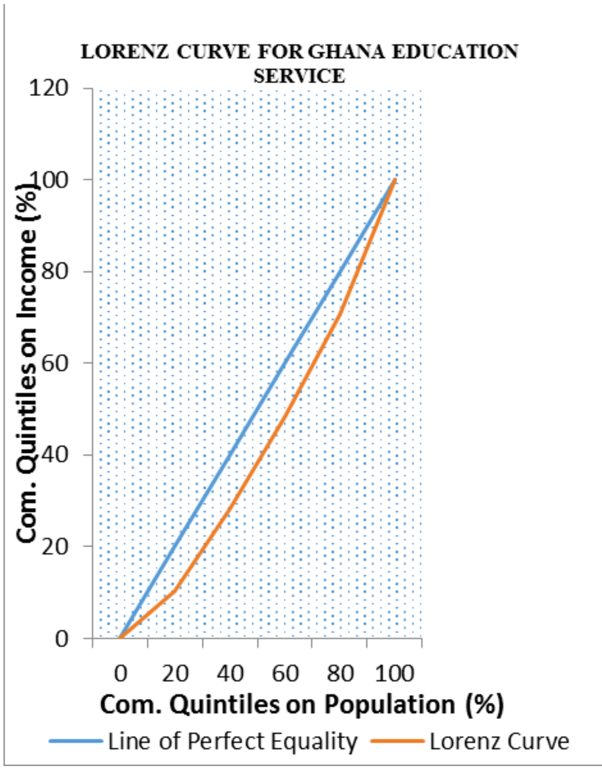
Findings and discussions

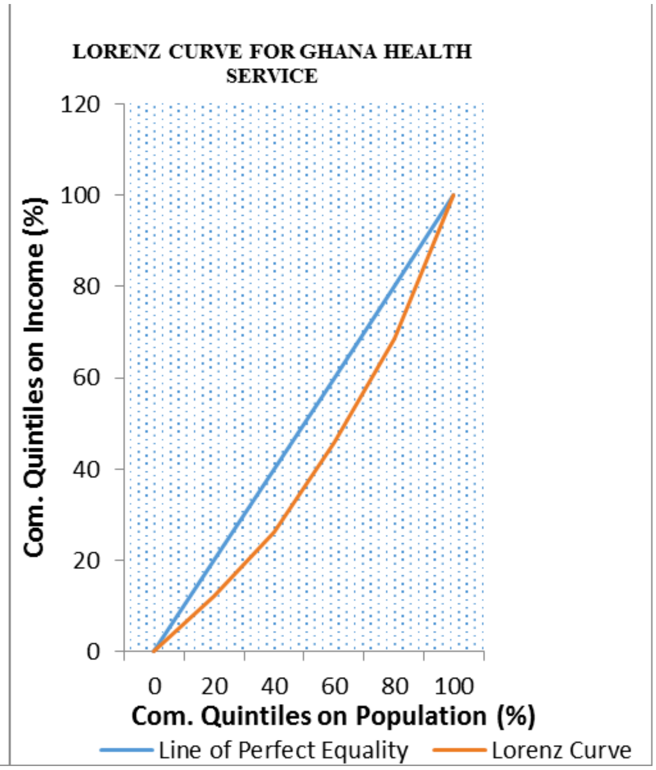
The proposition of the study is that generally, intra-occupational income distributions produce less inequality than inter-occupational income distributions. The empirical evidence from Nadowli-Kaleo, to a large extent, supports this position. In general, formal sector occupations appear to produce more equal intra-occupational distributions than the informal sector intra-occupations. Of the four Lorenz curves shown in figures 2, 3, 4 and 5, representing income distribution of GES and GHS workers, small-scale entrepreneurs and farmers respectively, the curvature of figures 2 and 3 and corroborated by their Gini Coefficients, 0.16 and 0.17 respectively, amply show higher levels of equality in intra-occupational income distribution. A possible explanation for the higher level of equality in the formal sector intra-occupational income distribution is the salary harmonization using the single spine salary structure policy introduced in 2010. Another reason is the upper cap wage policy in operation in the government and formal sector occupations. This is achieved by the introduction of grades and levels in the pay roll system, each of which has highest grade and level. For example, on the GES pay roll system in the study area the highest grade is Director II with level point 2 with an associated salary of GHS2,581.46 as of 2014 and the lowest grade is teacher trainee at level point 2 and with an associated salary of GHS435.23 while GHS has the highest grade being a specialist at level PSL 24 and point 1 with associated salary of GHS6,103.00 and the lowest grade is Senior Hospital Orderly at level PSL 9 and point 1 with associated salary of GHS614.00 (Upper West Regional Accountant General's Department, 2014). This shows that higher level incomes (desirable) have produced a low inequality (desirable) while lower level incomes (undesirable) have also produced low inequality (desirable). Empirical evidence from the Nadowli-Kaleo District can be seen in the similarity in curvature of the two Lorenz curves. This is further confirmed by the similarity between the Gini indexes of the two occupational groups. It is, however, worth noting that the absolute incomes of the GHS are generally higher than those of the GES, though they both have near the same level of inequality, as depicted by their respective minimum and maximum income values. In effect, it can be argued that the Lorenz curve measures intra- and inter-group relative income distribution rather than absolute income distribution.

Turning to the informal sector intra-occupational groups, that is SSEs and farmers groups, incomes are more inequitably distributed than in the formal sector. First of all, the Lorenz curve for the SSE intra-occupational group, shown in Figure 4, digresses more widely from the line of equality than those of GES and GHS in Figures 2 and 3 respectively. This is also confirmed by its Gini index which is 0.32 as against those of GES and GHS which are 0.16 and 0.17 respectively. Again, the Lorenz curve for the farmers' intra-occupational group, shown in Figure 5, has created a wider sector with the line of equality than those of the previous three. This implies that among the four independent samples, the farmers' incomes are the most inequitably distributed. The Gini index for Figure 5 is 0.45, which further confirms this observation.

Fig 2. Lorenz Curve for GES Income Distribution

Fig. 3. Lorenz Curve for GHS Income Distribution





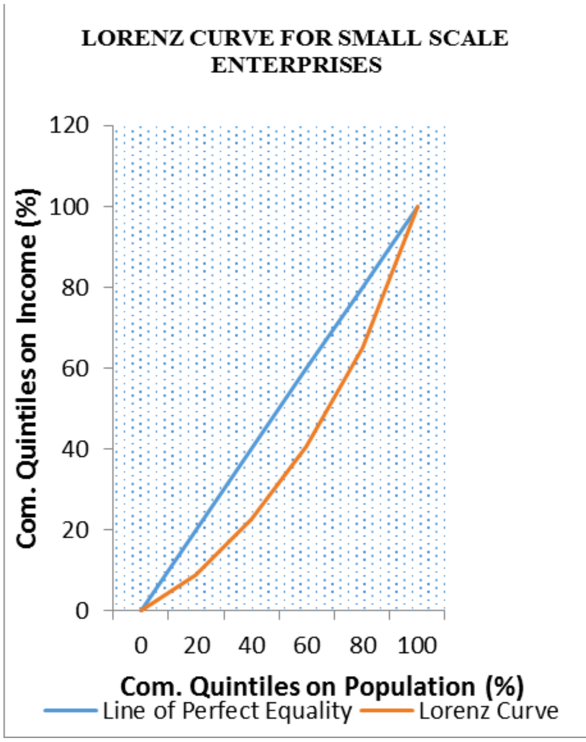
Gini Index for GES Income Distribution: 0.16 Gini Index for GHS income Distribution: 0.17

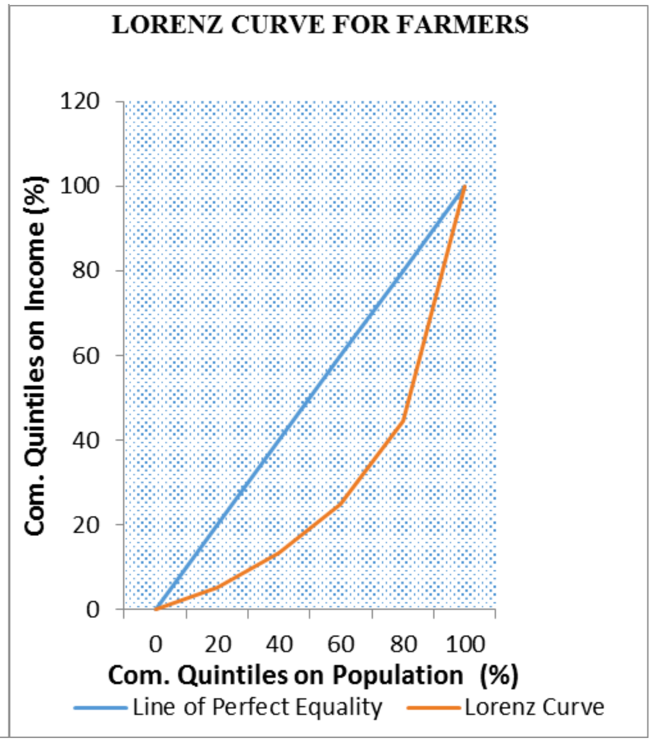
Source: Authors' Construct from Field Survey, October, 2014 **Source:** Authors' Construct from Field Survey, October, 2014

Two major conclusions have emerged from these findings; namely, it is possible to have higher level incomes more equitably distributed and also it is possible to have lower level incomes less equitably distributed within the income group. It can thus be asserted that income distribution policies (see Economicsonline, 2016; Todaro, 2000) may lead to development of sub-groups which may experience improvement in their total incomes but may not lead to increases in the aggregate income (that is GDP or GNP and associated per capita). Thirlwall (2003) and Todaro (2000) have analysed and discussed GDP/GNP and their associated per capita incomes and how these relate to inequality expressed by Lorenz curves and Gini indexes. This can lead to a reduction in the growth of the larger local economy. This is because for lower level income earners, the chunk of income increases is often spent on consumption goods and services. Rahman, Matsui and Ikemato (2013), using Engel's Elasticity ratios have demonstrated that the chronically poor have highest income elasticity for food items than all other cohorts. This has only indirect positive influence on the growth of GDP/GNP and per capita rather than direct investment that can induce value addition and consequently increases in GDP/GNP and the associated per capita in the local economy. This may create an expansionary effect on the larger local economy (see OECD, 2012), which can then be distributed among all income groups within the economy, using distributive policies (Economicsonline, 2016; Todaro, 2000). To this end, Khan (2013) argues that in countries where economic inequalities, of which income inequality is a critical part, have reduced policies and institutions have played a very critical role.

Based on an explanation of the differences in the income inequalities in the two sectors, it can be inferred that the level of informality is a key explanatory factor; that is the more informal the sector of the occupational group, the greater the inequality and vice versa. Results of the investigation as regards the farmers sub-group contradict the initial proposition of the study. It was posited that lower level incomes, as observed for farmers will necessarily lead to lower level inequality and higher level income sub-groups will induce higher inequality in income distribution.

Fig. 4. Lorenz Curve for SSEs Income Distribution **Fig.5. Lorenz Curve for Farmers' Income Distribution**





Gini index for small-scale enterprises is 0.32

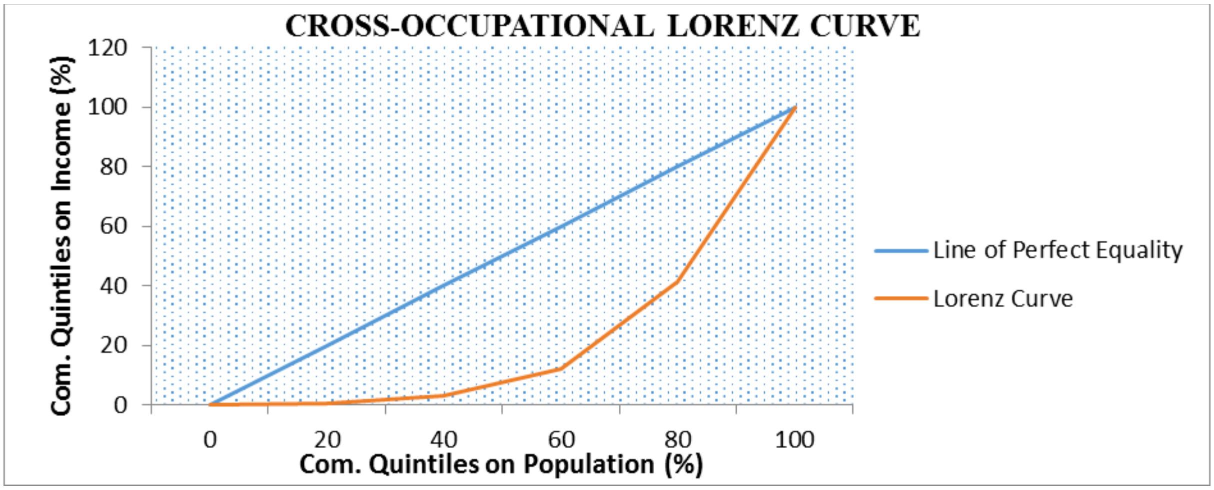
Source: Field Survey, October, 2015

Gini index for farmers is 0.45

Source: Field Survey, October, 2015

As regards the inter-occupational sub-group Lorenz curve (a combination of all sub-groups for the paper), the empirical findings of the composite Lorenz curve and its associated Gini index, computed from the representative sample drawn from a *mélange* of four sub-samples, upheld the guiding proposition of the study as shown in Figure 6. It was proposed that inter-group inequality would be higher than those of the respective intra-groups. The result is that this last sample was made up of the lowest and highest incomes within the whole data set, thus producing the highest inequality among the five Lorenz curves. As a derived indicator, the Gini Coefficient (0.70) has also corroborated the above result, which is in furtherance of the earlier finding that inter-sectoral occupational income inequalities are very high in NKD. The above value of the Gini Coefficient further strengthens Khan's (2013) assertion that generally, as economies develop, intra-country inequalities seem to be increasing in most cases, as shown in this study, and reducing in very few instances.

Fig. 6. Lorenz Curve from Amalgamation of four Independent Samples (Cross Occupational Curve)



Gini Index from Amalgamation of all Independent Samples: 0.70

Source: Field Survey, October, 2015

Weaknesses of the Lorenz Curve and Gini Index Analyses per the Study

The Lorenz curve and its associated Gini index are defective in accounting for income levels in two respects. The first area of concern in this study has to do with intra sub-group income levels that have been concealed as a result of the conversion of the absolute income values into percentages and used for the Lorenz curve and computation of the Gini index. A second concern is the sub-division of the whole data set into quintiles. This has reduced the outlier effect of individual income figures within the data set for an occupational group. Both the Lorenz curve and the Gini index are unable to account for the outlier effect in income distribution. For example GHS6,103.00 in GHS is clearly an outlier whose effect cannot be isolated from its quintile. Yet another concern that renders the Lorenz curve and Gini index analyses defective is the misleading inter-occupational income sub-group comparisons. Due to the fact that these two tools are unable to account for differences in income levels, what they actually are able to do is to compare the distribution of income across sub-groups regardless of their levels. However, income distribution alone does not disclose much about relative poverty across sub-groups as the levels of income. For example a critical scrutiny of income values used in this study indicates that the GES figures, with the lowest income of GHS435.23, highest income of GHS2,581.46 and a range of GHS2,146.23 are generally lower but generate same level of equality (i.e. 0.16) as those of GHS with lowest income of GHS614.00, highest income of GHS6,103.00 and a range of 5,489.00 (i.e. 0.17). This is what Cowell (2007) argued about that ambiguity or no clear-cut conclusion arises when comparison is made between two or more Lorenz curves. In the same vein, a perusal of the absolute income figures shows that income levels are lower in the farmers' sub-group (lowest and highest incomes being GHS 4.00 and GHS 253.00 respectively with a range of GHS 249.00), but with a higher level of inequality (with a Gini Index of 0.43) than the SSE sub-groups (which also has the lowest and highest incomes being GHS 80.00 and GHS630.00 respectively with an income range of GHS 550.00) but also has lower inequality (that is 0.32). Todaro (2000) showed that low incomes and low inequality, low income and high inequality, and high income and high inequality can coexist side by side across countries while Haughton & Khandker (2009) have also argued that the results of the Lorenz curve and Gini index have not provided enough grounds to conclude that developed countries with their higher levels of income have lower levels of inequality than developing countries which have lower levels of income. It can therefore be asserted that the fact that an income group is more equally distributed than another income group does not imply that necessarily the former has higher levels of income and welfare, and for that matter, lower levels of poverty than the former. In all these analyses, Haughton and Khandker's (2009) argument that Gini index does not lend itself to statistical testability still remains a conundrum. Relying on Haughton and Khandker's (2009) recommendation, the study employs bootstrap strategy in constructing confidence intervals to resolve this anomaly.

Bootstrap Confidence Intervals

Bootstrapping is a statistical, random or probability re-sampling strategy which is performed on an empirical data set by constructing confidence intervals (CI) around selected descriptive statistics computed from the data. The confidence interval involves lower and upper limits within which the population statistic is expected to fall. The decision criteria are that if a sample statistic falls within the CI then that particular statistic is significant at that CI; and for this study the CI is 95%. On the other hand, if a sample statistic falls outside the CI then that statistic is insignificant (Orloff & Bloom, 2014; Stine, 2005). For purposes of this paper, the bootstrap CIs have been constructed around the mean, standard deviation and variance. As depicted in Tables 7, 8, 9, 10, 11, the empirical sample statistics (mean, standard deviation and variance) are lying within the bootstrap CI, indicating that these sample statistics are significant at the 95% CI. By extension, the Gini indexes computed from the five sub-samples of the paper are also significant at the 95% CI. For example, the mean for the SSE sub-sample is 279.26 which falls within 244.36 as the lower limit and 316.47 as the upper limit. Again, the standard deviation for the same SSE sub-sample is 134.047 which also lies within the 107.430 lower and 156.994 upper limits. Lastly, the variance of 17968.621 occurs between the 11541.310 lower and 24647.031 upper limits. The analyses are the same for farmers', GES', GHS' and cross-occupational sub-groups. Thus, the various Gini coefficients (0.16 for the GES, 0.17 for the GHS 0.32 for the SSE, 0.45 for farmers and 0.70 for the amalgamated/cross-occupational sub-samples, computed from the respective Lorenz curves based the various sub-samples can be said to be significant at the 95 % CI.

Table 7. SSE Descriptive Statistics with Bootstrap Confidence Intervals (CI)

	Statistic	Bootstrap[a]		
		Std. Error	95% Confidence Interval	
			Lower	Upper
N	53		53	53
Mean	279.26	18.19	244.36	316.47
Std. Deviation	134.047		107.430	156.994
Variance	17968.621		11541.310	24647.031

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 8. Farmers Descriptive Statistics with Bootstrap Confidence Intervals (CI)

	Statistic	Bootstrap[a]		
		Std. Error	95% Confidence Interval	
			Lower	Upper

N	100		100	100
Mean	48.469600	5.6838874	38.354986	60.438867
Std. Deviation	56.8388741		38.2110592	73.6958472
Variance	3230.658		1460.085	5431.078

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 9. GES Descriptive Statistics with Bootstrap Confidence Intervals (CI)

	Statistic	Bootstrap[a]		
		Std. Error	b95% Confidence Interval	
			Lower	Upper
N	52		52	52
Mean	1151.059615	57.075081	1035.594054	1265.387145
Std. Deviation	405.9767252		296.9550464	513.6916222
Variance	164817.101		88182.310	263879.150

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table10. GHS Descriptive Statistics with Bootstrap Confidence Intervals (CI)

	Statistic	Bootstrap[a]		
		Std. Error	95% Confidence Interval	
			Lower	Upper
N	61		61	61
Mean	1701.231475	77.369768	1547.738689	1855.992598
Std. Deviation	620.7489881		503.7826145	712.7632930
Variance	385329.306		253796.947	508031.513

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 11. Combined Descriptive Statistics with Bootstrap Confidence Intervals (CI)

	Statistic	Bootstrap[a]	
		Std. Error	95% Confidence Interval

			Lower	Upper
N	75		75	75
Mean	725.24	97.194	540.81	917.50
Std. Deviation	841.722		678.400	973.303
Variance	708495.455		444943.847	964610.778

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

CONCLUSION AND RECOMMENDATION

Distributive justice is one of the recent development policy clichés in both developed and developing countries which various tools have been used to measure. Employing the Lorenz curve and Gini ratio to analyse both intra- and inter-sectoral occupational groups' income distributions in the Nadowli-Kaleo District, the results have made it evident that an income group with evenly distributed incomes does not necessarily imply lower level of poverty and for that matter better welfare and vice versa. As such income redistribution policies in lower income populations should necessarily be accompanied or preceded by policies that can improve the GDP, GNP and their associated per capita income. Inter-sectoral income distribution has shown greater variations in income inequality with the informal sector occupations (SSE and farming) depicting higher levels of inequality (Gini Coefficients of 0.32 and 0.45 respectively) as against the formal sector occupational (GES and GHS) income distribution which have lower levels of inequality (0.16 and 0.17 respectively). Generally, intra-sectoral occupational income distribution show less variation than inter-sectoral occupational income distribution. The difference in Gini Coefficient between GES and GHS is only 0.01, which indicates that inequality between the two occupations is almost the same. The difference in Gini Coefficient between SSE and farming is 0.13, which can be said to be negligible. These differences in intra-sectoral occupational income distribution can be accounted for by factors such as personal characteristics of income earners (including level of education, age, level of experience, which is a product of longevity in the service and gender), level of technology use, scale of production and general economic environment in which production is taking place. Determination of the extent to which these factors account for differences in Gini Coefficients fall outside the scope of this paper for want of space. This is one of the limitations of the paper and calls for further research to establish how factors other than occupation have accounted for intra-sectoral occupational income distribution. Just as any statistical tool, the use of averages (percentages) and subsequently aggregates (quintiles) in the Lorenz curve and Gini index is another limitation as this has resulted in concealing outlier effects in income cohorts in the analyses. It is therefore vital that the absolute figures or income per capita are resorted to in order to make full meaning of these averages and aggregates. Again, the absolute figures or income per capita will give an indication of the income levels of the spatial units being analysed. This will give an indication as to whether growth generating policies are to accompany the policy of distribution or the distributive justice alone will lead to the desired policy end. As regards the weakness of statistical testability of the Gini coefficient and its resolution, all the bootstrap CIs constructed on the various statistics from the empirical data are significant at the 95% CI level, leading to the conclusion that the Gini coefficients are as well significant at the 95% CI.

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