Non-timber forest incomes and economic welfare in the South-West region of Cameroon: The incidence of rural income inequality

By Etoh-Anzah Peter ANGYIE [a†]
& Njong Mom ALOYSIUS [b]

Abstract. With the aim of answering the question whether or not Non-Timber Forest Products can contribute in reducing rural income inequality in the South-West region of Cameroon, the study used primary data collected from a survey on 408 rural household heads. The Data was collected using a structured questionnaire. We adopted three different methodologies – The Gini Coefficient, The Lorenz curve, and The Income Decomposition by income sources to obtain identical results. The results revealed that incomes from non-timber forest products reduces rural income inequality in the rural parts of the region significantly, and occupy an important position amongst the different income sources which were investigated. We therefore recommend improved value-added for Non-Timber Forest Products through processing. A better management of the forest in general and the forest resources in particular will ensure improved benefits to the community as a whole especially in the areas of total income and income inequality.
Keywords. Economic eelfare, Rural income inequality, Non-Timber forest incomes, Gini coefficient income decomposition by income sources and Cameroon.
JEL. O11, E20, Q13, C30.

1. Introduction

Issues of households and individual welfare on the one hand, and livelihoods on the other are not only very crucial in eradicating poverty but also constitute a major development challenge. Proofs of this are seen from the Millennium Development Goals (MDGs) contained in the millennium declaration of the U.N General Assembly 55/2 of 18th September 2002 by 147 heads of States and Governments of the 189 members States. Even more, the issue has been re-emphasized in the new 17 goals referred to as the Sustainable Development Goals (SDGs). It is the wish of the U.N that each member state attains these goals by 2030.

A very predominant problem which remains pre-occupying in almost every developing economy, Cameroon not being an exception is rural poverty, which in its simplest form we define as poverty found in rural

[†] Faculty of Economics and Management Sciences, University of Bamenda, Cameroon.
☎. (237) 677 819 548 ✉. peterangyie@gmail.com
[b] Department of Economics, Higher Technical Teachers Training College (HTTTC), University of Bamenda, Cameroon.
☎. (237) 664 992 662 ✉. mom_aloys@yahoo.fr

areas. However, factors of rural society, rural economy, and rural political systems are considered to be contributing to a rise in this poverty. Considering that, 76 percent of the developing world's poor and an estimated overall proportion of about 58 percent of total world population live in areas referred to as rural (CEU, 2012), this has contributed to the urgent and global attention it is currently witnessing. Globally, rural people and rural places are characterised as relatively being disadvantaged when compared to their urban counterparts. Such comparisons are clearly observed in respect to poor infrastructure that hinder development and mobility; lack of or insufficient market access; educational and social service inadequacies; and lack of non-motorised load-carrying wheeled vehicles. The livelihoods of these rural households throughout the developing world are inherently fragile, exposed to a range of shocks, and above all, to seasonal fluctuations (DFID, 1999). Unfortunately too, these households have limited or no control over these unfortunates events.

Global research has also proven that only policy programmes in the form of land reform in favour of the women, adequate improvements on the infrastructure, the development of an appropriate technology, and the guarantee for the poor's access to credits as well as diversification of income yielding activities (livelihood) can effectively check and reduce this increasing gap. For sure such scaring poverty rates impact negatively on households' welfare and thus, improvements are needed urgently.

The concept of economic welfare is used here to focus on the impact of economic growth on the material living standards of households and individual citizens, rather than on production. And as such it includes in-kind services provided by government in the form of subsidized health care and educational services, while excluding defense and general government expenses which do not directly contribute to household consumption (Stiglitz *et al.,* 2009). Nonetheless economic welfare greatly emphasizes the distributive significance of incomes and wealth in the society which is measured using per capita GDP or per capita household consumption expenditure at constant currency values. In this respect, international comparisons are made in purchasing power parity equivalence. However, an urgent improvement in the measurement of economic welfare is recommended to permit a significant enhancement in the understanding of the impact of economic activity on human welfare like in the case of income inequality.

The terms Quality of Life, Welfare and Well-being are sometimes used interchangeably to reflect the need for a major re-orientation of public policy based on the view that economic growth is not an end to itself, but a means to a greater end that encompasses social, political, cultural and even psychological needs. It equally includes aspirations and values of individuals and the society as a whole. Actions that contribute to higher rates of economic growth and higher living standards may or may not enhance human welfare, well-being, and overall quality of life. So, economic welfare should be measured using the Human Economic Welfare Index (HEWI). This is a new composite index that focuses on the economic

dimension of human welfare, and has as components: household incomes and expenditure, income inequality, full employment, combined educational enrollment and energy efficiency.

While income inequality is considerably lower in countries such as Germany and Japan the cases of the USA, Argentina, Brazil, Malaysia, Mexico, and South Africa are not only seen to be high but may perpetuate disturbing effects. On the other hand, income inequalities are marginally lower in China and Russia. The levels of income inequality in sub-Sahara African countries (SSA) in general and Cameroon in particular are scaring and have had devastating consequences on both individuals and the economies as a whole. It has been proven that high levels of inequality are associated with a wide range of social ills. For example, studies on the United States of America reveal that states with greater inequalities in the distribution of income are also those with higher rates of unemployment, higher rates of incarceration, a higher percentage of people receiving and dependent on income assistance and 'food stamps', as well as a greater percentage of people without medical insurance (Yates, 2003; 2004).

Universally, income inequalities have a distorting impact on the validity of per capita GDP. It has been found internationally that high levels of inequality are associated with low levels of economic growth, decreasing life expectancy, poorer educational performance, increasing crime rates, higher levels of corruption, increased macro-economic instability, as well as low levels of human capital development. This leads to the conclusion that countries having the same level of per capita income but with wide variations in health and social problems is as a result of the differences in their income distribution (Wilkinson & Pickett, 2009). Thus, a more equitable income distribution is associated with higher levels of economic growth, while high inequality will reduce economic development by slowing down poverty eradicating, retarding investments in the educational sub sector, and discouraging entrepreneurship. It can therefore be concluded that income inequality is a more accurate predictor of problems than actual level of income (Aguayo-Rico et al., 2005).

Elsewhere, it has been observed that high levels of inequality are also associated with economic instability and increasing levels of income inequality result to an increased concentration of wealth, a major source of international currency flows and speculative investments and to traumatic economic events. Since the rich spend a much smaller proportion of their incomes than other income groups, a rise in income at the top will create fewer jobs and tends to slow down economic growth. A typical case of how inequality can down play on human economic welfare index (HEWI) is when rural land assets are concentrated in the hands of a landlord who employ landless laborers at subsistence wages. Similarly, high income inequality can also retard investments in human capital which is a very important component of rising living standards. Internationally, (ILO, 2008) observes that high levels of inequality are associated with lower levels of economic growth, decreasing life expectancy, poorer educational performance, increasing crime rates, higher levels of corruption, and

increased macro-economic instability, as well as low levels of development of human capital (ILO, 2008).

At the continental classification Cameroon occupies the third position in termsof tropical dense forest, only after the Democratic Republic of Congo (DRC) and Gabon. Her total surface area of 22.5 million hectares represents 47 per cent of its national territory and this forest is endow with many plant and animal species exploited by those living in and around the forest for a livelihood sustenance.

Beside the benefits of the forest through timber exploitation, there is a growing appreciation of the importance of Non-Timber Forest Products for rural poor households' welfare, through the income generated by the latter. Typical cases of exploitation are for nutritional needs, for employment generation, for making available raw material for the craft industry, medicinal needs, and for energy through fuel wood etc. Most studies have limited on the material contributions made by non-timber forest products in rural household welfare as just mentioned above. So in this study we sort to know if there are other contributions enjoyed by rural households from the collection of non-timber forest products, the case in question being rural income inequality.

Based on the questions raised, the paper intends to highlight the contribution of Non-Timber Forest Products in improving the welfare of those living in rural communities, and specifically:

1) We have investigated into Non-Timber Forest Products' rural income-inequality[2] reducing ability in the South-West region of Cameroon.

2) Determine how important the Non-Timber Forest Products activity is, relative to the other rural income sources especially in reducing income inequality in the South-West region of Cameroon.

2. Theoretical and empirical review

2.1. Theoretical review

The concept of income inequality is a spill over of income distribution which has been coiled to give a 'picture' of who receives how much within a specific society or community. However, there are two principal concepts of income distribution outlined in the literature: Functional and the Personal or Size income distribution. The functional approach demonstrates how much income is received by each production factor. That is, how total income is distributed between land, labour and capital. This is however referred to as factor incomes. Theories of functional distribution centre on the existence of three groups, otherwise known as classes of the society. These classes being the labourers, the capitalists, and the landowners, assumed within group homogeneity (Cesar, 2002). On the other hand, the "size distribution" of income shows how many individuals

---

[2]Inequality takes many forms – in terms of access to basic social services of productive resources, in terms of income, in terms of human development outcomes, in terms of regional, rural-urban differences, between borders and between socio economic groups. Here the emphasis is on incomes, but could lead to other forms.

or households receive how much income and attempts an explanation on how total income (incomes from all sources), is distributed among individuals or the various households of a society. This is similar to the S80-S20[3] concept of inequality. According to this concept, a higher ratio means a greater level of income inequality in the society and vice-versa.

Many theories have been developed on "size income" distribution, such as the set of theories of personal income distribution that is classified into two major groups (Sahota, 1978). The first group is identified with theories ranging from the belief that income inequalities are largely as a result of voluntary choice, to those in which inheritance and institutions play the major role. While the second group referred to as the "Fatalist" group comprises of three schools of thought:

➢ Theories based on the fact that incomes are distributed among individuals according to their genetically determined abilities.

➢ Theories that postulate that income inequalities are principally determined by chance, and sometimes by stochastic factors and finally,

➢ The life-cycle theories which place much relevance to the age effect of earning capacities.

Other economic theories are based on and justifies how rising levels of inequality result from multiple causes, including a rising share of capital in total income as well as increases in earnings inequality, rural-urban and regional differences, technological change, trade and financial liberalization, privatization, taxation policies and changes in labour market institutions (Garry & Slaus, 2010). Proponents of redistribution argue that capitalism results in an externality that creates unequal wealth distribution. On the other hand, the "under-consumptionism[4]" School of thought suggests that wealth and income inequality jointly causes economic crises, and that reducing such inequalities will greatly prevent or ameliorate economic conditions. This is because according to them, redistribution will thus benefit the overall economy.

A variety of strategies exists in the "operationalization" of income inequality and has been explored by researchers in different fields, with the most prominent being the Gini coefficient (Fernando, 2007). The Gini coefficient (sometimes expressed as a Gini ratio or a normalized Gini index) is defined as a measure of statistical dispersion intended to represent the income distribution of a nation's residents or a sub group, and is a measure derived from the Lorenz curve framework. However, many other measures of income inequality exist including coefficient of variation, Sen Poverty measure, the deciles ratio, the proportion of income earned by the poorest 50%, 60% and 70% of households, the Robin Hood index, the Atkinson index and Theil's entropy measure. All these measures highly correlate with Pearson correlations ranking (Kawachi & Kennedy, 1997).

---

[3]This is the ratio of total disposable income of the richest 20 percent of the population to the income of the poorest 20 percent.

[4] This school of thought is nowconsidered as aspect of some schools of Keynesian economics.

2.2. Empirical review

Asmamau *et al.,* (2014) investigated into the contribution of small-scale Gum and Resin commercialisation to local livelihood and rural economic development in the Dry lands of Eastern Africa and found that non-timber forests collection reduced measured income inequality from 0.47 to 0.22 in Southern Ethiopia. With the aid of the Gini coefficient (Ouedraogo *et al.,* 2012), found that forest income when included in total household income, the estimated Gini coefficient reduced from 0.89 to 0.47.This shows a reduction in measured income inequality by 42%. Similarly, the findings of Yemiru *et al.,* (2010) were in consonant with other studies when in "Forest Incomes and Poverty Alleviation under Participatory Forest Management" in Bale Highlands of Southern Ethiopia it was revealed that there was an increase in Gini coefficient when forest income was excluded from total rural household incomes.

In another study aimed at measuring the role of forest income in mitigating poverty and inequality in South-Eastern Nigeria, (Fonta & Ayuk, 2013) used data from a survey of 1457. With the use of the Gini decomposition by income sources, the study concludes that an increase in the share of forest income other things being equal, will lead to a reduction in income inequality in the region. Similarly, a decomposition of income source in Southern Malawi showed that forest income reduced measured income inequality by 12%, and that diversification of income sources reduced income inequality across the sample. Jodha (1986) used a smaller sample size of 502 households in twenty-one Indian villages to found that dependence on common property resources declined with increasing income levels. Specifically, it was discovered that on the average poor rural households derive between 9 and 26 percent of their annual income from common property natural resources, while the relatively rich households derive barely between 1 and 4 percent of their annual income from these resources. Reddy & Chakravarty (1999)[5] used a data base of 232 households in twelve Himalayan villages and found that the rate of dependence on natural resources declined by 23 percent and 4 percent for the poor and rich households respectively. Fisher (2004) examines the economic reliance on forests and its effects on the welfare of the low income households in rural Malawi using data collected from three Malawian villages ranked highest in terms of poverty incidence, population density, and scarcity of forest resources. Using the Gini Coefficient[6] to compute and decompose data from six income sources, it was found that forest incomes reduced measured income inequality by up to 12 percent.

Nong & Xubei (2006) used LSMS data to investigate bydecomposing the Gini index (Pyatt *et al.,* 1980; Stark, 1991) and simulation of household

---

[5]Cavendish (2000), Reddy & Chakravarty (1999) categorizes households as being poor or rich on the basis of the household's total income.

[6]The Gini Coefficient is a common measure of income inequality across individuals or households. It measures differences in income between a state in which all households in the population have the same income and the Lorenz curve which measures the actual distribution.

income into the impacts of non-farm income on rural inequality in China. The results obtained show that non-farm activity income reduced rural income inequality by widening the occupation choice that disproportionately favours poor households. Secondly it was observed that non-farm income was a potential substitute for farm income, and therefore rather than raising inequality, the non-farm sector actually prevents inequality from rising even further (Barret *et al.,* 2001; Chapman & Tripp, 2004). Lebmeiter *et al.,* (2016) researched to measure the annual economic contribution of NTFPs to local livelihoods in two villages of south-eastern Burkina Faso focusing on the average share of NTFPs in local household livelihoods. Adopting the structured household survey, findings proofed that the poorer households depend more on NTFPs than the wealthier will do, even though the latter earn more from NTFPs in absolute terms. Here the conclusion is that NTFPs incomes contribute in reducing inequality amongst inhabitants of these villages.

Getachew *et al.,* (2007) Investigated into the economic dependence on forest resources in the Dendi District of Ethiopia to found that measured income inequality dropped from 0.41 to 0.28 when non-timber forest incomes were included in total household income. This shows an improvement in the inequality index.

3. Methodology

3.1. Data collection

We used primary data which was obtained using a questionnaire comprising questions, which were directed to and responded by rural household heads. Several households, including male and female of different ethnic backgrounds, marital status, and age brackets, were surveyed. The historical, geographical, political and institutional features of the S.W Region, which has important implications on forest use, are highlighted. However, it is worth mentioning here that the inhabitants of the South West Region of Cameroon is not a socially homogeneous forest-dwelling people, but rather is constituted of communities that largely consist of cosmopolitan and dynamic people with contrasting livelihood strategies. These people form an integral part of the regional economy. The questions responded to were based on the collection of fuel wood, foodstuffs, vegetables, fruits, tree barks as well as other non-timber forest products.

The questionnaire was developed and tested through a pilot survey, to ensure that ambiguously structured questions were avoided. This permitted greater clarity and understanding to respondents who in the majority did not have a good mastering of English language. We adopted (Poate & Daplyn, 1988) definition of a household, which is considered as a group of people who eat from a common pot, share dwelling houses and are known to be cultivating the same land. Every member of this household recognizes the authority of only one person who is considered as the 'Pot head' or household head, and he is the decision maker

For obvious reasons, we limited the survey to the rural forested areas of the South West Region of Cameroon which include Meme, Manyu, Fako and Ndian Divisions; but also some isolated parts of Kupe Muanenguba which harbours rainforest. A total of 408 questionnaires were returned from 89 villages.

3.2. Models

We give preference to the Gini coefficient, first for its high degree of intuitiveness and because it has a neat correspondence to the Lorenz Curve. These two characteristics permit an easy interpretation of income decomposition effects when compared to the different inequality indices that meet the five basic properties identified by Ray (1998).

According to Lerman & Yitzhaki (1985), it is easier to investigate into the impacts of forest income on total rural income inequality using the Gini coefficient technique. The Gini coefficient for any particular income source k is given by:

$$G_k = 2\text{cov}\frac{[y_k - F(y_k)]}{U_T} \qquad (1)$$

k ranges between k = 1, and k = k

Where y_k reflects the different components of household income, $F(y_k)$ represents the cumulative distribution of income source k, and U_K, the household's mean income. However, if we assume that G_T defines the Gini coefficient of total income, then following the properties of covariance decomposition, G_T is stated as:

$$G_T = 2\sum COV\frac{[yk, \ F(yk)]}{U_T} = \ \sum S_K G_K R_K \qquad (2)$$

k ranges between k = 1, and k = k

Where S_K stands for the share of component ᴋ (income source) in total income, G_K the income source Gini, corresponding to the distribution of income from source ᴋ. R_K is the Gini correlation of income from source ᴋ with the distribution of total income.

Equation 2 will permit the decomposition of the influence of any income source on total income. Thus, we shall decompose our Non-Timber Forest Products' income source alongside other sources upon total household income to show:

   i)   The importance of NTFP income with respect to total income (S_K).

   ii)   How equally or unequally the NTFP income source is (G_K).

   iii)   And whether or not the NTFP income source correlates with total income (R_K).

Two possible outcomes can be interpreted from the process of income decomposition. The first being that incomes from NTFPs can be unequally distributed and flow disproportionately towards the wealthier class of households (where R_K will be large and positive). This will imply a positive contribution or an exacerbation in the rate of inequality. On the other hand,

it could result to unequal distribution but in favour of poor households – whereby such income source will have an equalizing effect on income distribution. Here the Gini coefficient will be lower with NTFPs' incomes than without it.

The second methodology will permit the use of the Lorenz Curve analysis whereby two curves are compared (the curve of all other incomes sources combined is compared to that of total incomes which includes those derived from NTFPs collection). If the deviation from the equal distribution line and Lorenz Curve is reduced, then inequality has been reduced through incomes from NTFPs. The Lorenz Curve is a line or curve demonstrating the shift from the diagonal line[7] and which demonstrates how the addition of NTFPs incomes to total household income will cause the departure (shifting) of the curve from the line of equal distribution.

Our third and last methodology is the Gini decomposition method. In this methodology we evaluate the effect of NTFP incomes in reducing inequality by holding incomes from all other sources constant and estimate the effect of small changes in NTFPs incomes through the Gini decomposition coefficient of income sources as proposed by Lerman & Yitzhaki (1985). To do this, we shall consider a small change in income source k equal to ey_k where e is close to 1. We therefore show that the partial derivative of the Gini coefficient with respect to a percentage change in source k is equal to:

$$\frac{\partial G_T / \partial k}{G_T} = \frac{S_k G_k R_k}{G_T} - S_k \qquad (3)$$

The percentage change in inequality resulting from a small percentage change in income from source k equals the initial share of it in inequality minus the share of it in total income.

4. Discussion of results

Table 1 below presents the descriptive statistics of the household heads of our survey. This is in respect to age, sex, place of origin, marital status, why engage in the collection of NTFPs, the use of NTFPs, household head's principal economic activity, the educational level of respondents as well as whether the household head is retired or in active service.
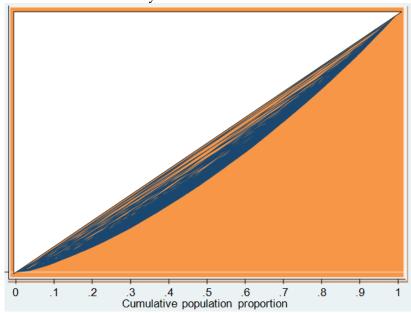
---

[7]A Lorenz Curve passing through the diagonal show a situation of perfect distribution, perfect equality or zero inequality. Therefore, large shifts from the diagonal will portray a high level of income inequality and vice versa.

Table 1. *Descriptive statistics of households characteristics*

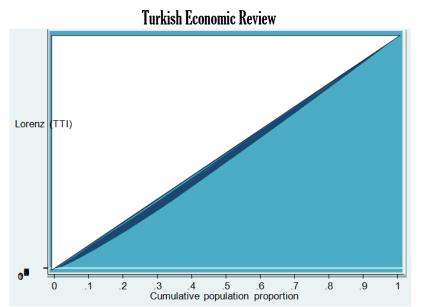| Variable	Obs	Mean	Std. Dev.	Min	Max
Ntfp_coll_yes	408	.6053922	.4893664	0	1
Ntfp_coll1_no	408	.3946078	.4893664	0	1
male	408	.6584767	.4748042	0	1
female	408	.3390663	.4739750	0	1
noedu	408	.2426471	.4292097	0	1
FSLC	408	.5318627	.4995964	0	1
AL	408	.1813725	.3857996	0	1
Gradu	408	.0441176	.2056086	0	1
Marry_yes	408	.7328431	.4430182	0	1
Single	408	.2647059	.4417181	0	1
Nativ_yes	408	.5931373	.4918520	0	1
Nativ_no	408	.4019608	.4908961	0	1
Farmer	408	.662531	.4734341	0	1
Teach_er	408	.101737	.3026779	0	1
Retire_work_r	408	.0620347	.2415185	0	1
Ntfp_gathe_r	408	.1736973	.3793199	0	1
For_cons_only	402	.1616915	.3686264	0	1
For_sale	402	.1368159	.3440811	0	1
Both_cons_sale	402	.7014925	.4581735	0	1
Oth_income_yes	402	.6765432	.4683740	0	1
Oth_income_no	405	.3086420	.4625044	0	1
Restric_ti_yes	401	.6683292	.4714016	0	1
Restric_ti_no	401	.3241895	.4686560	0	1
Age	408	34.56863	14.38451	10	66

Source: By Authors Using Survey Data

We shall see the analysis of the influence of non-timber forest incomes on reducing income inequality in three ways: the Lorenz Curve, the Gini coefficient, and the Gini Decomposition by income sources.

4.1. The Lorenz curve analysis

Figure 1. *The Lorenz curve of total household incomes without those from NTFPs.*
Source: By Authors Using Survey Data

Figure 2. *The Lorenz curve of total income (including incomes from the NTFP sector).*
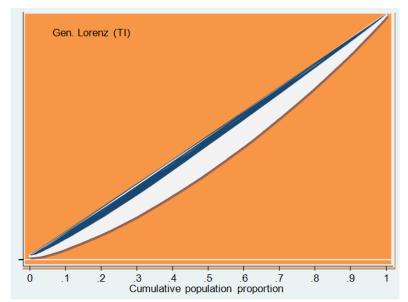**Source:** By Authors Using Survey Data

Figure 3. *The Lorenz curves first without, then with incomes from the NTFP sector*
incomes
Source: By Authors Using Survey Data

Figure 1 above, presents the Lorenz Curve for rural households' other income sources such as main occupation, small family businesses, owned properties, and assistance from family members especially those abroad in the form of unilateral transfers all combined. Incomes from Non-Timber Forest Products are not included. Fig.2 on the other hand, represents the Lorenz Curve for households' total incomes from all the sources including those from NTFPs collection. Finally, Fig. 3 shows the difference between Fig 1 and Fig 2.

Making a comparison of the first two curves (Figures 1 & 2), the impact of NTFPs income on income inequality is clearly observed. The Lorenz Curve for data of total household's income demonstrates that the inclusion

of NTFPs income in total income will reduce the departure of the curve from the line of equal distribution or diagonal line (perfect equality). This is the NTFPs' sectoral contribution in reducing inequality in the distribution of rural incomes. This implies that the addition of forest income to total household income reduces measured income inequality by the area of departure of the Lorenz Curve.

Based on the Lorenz Curve analysis, we uphold our first hypothesis, which states that incomes from the collection of non-timber forest products have a significant influence in reducing total rural households income inequality. And because NTFPs have proven to have an influence on income inequality in the rural South West Region of Cameroon, we conclude that they equally play a significant role on the welfare of those living in or close to the forest and are involved in this activity.

4.2. The Gini coefficient analysis

The Gini Coefficient is used to measure the concentration of any distribution, and is an appropriate and complementary tool in measuring and presenting information about inequality (how concentrated rural incomes are). Defined as the ratio of the area between the Lorenz Curve and the line of absolute equality, and the whole area under the line of absolute equality[8], a higher concentration translates into higher inequality, while lower concentrations mean lower income inequality (Salvatore, 2012).

Table 2. *Showing the Gini coefficient index without and with incomes from the NTFPs sector*

Variable	Mean Dev.	Mean Dev. Median	Mean Diff	CV	CD	Gini	SE mean	Max % Dev.
Gi1 (Y) without	37080	36802	49103	0.739	0.714	0.4230	2124	149.51
Gi2(Y) with	53254	53234	70791	0.630	0.567	0.3685	3034	114.47
	16174	16432	21688	-0.101	-0.147	-0.054	910	-35.04

Source: By Authors Using Survey Data

Definition of Variables
Gi1(Y): Total household income excluding NTFPs incomes.
Gi2(Y): Total household income including NTFPs incomes.

Table 2 above reveals that the Gini Coefficient for total incomes from other sources (NTFPs non-inclusive) was 0.4230 and when incomes from the NTFPs were included into total household income, the coefficient drops to 0.3685. This confirms that the inclusion of NTFPs income in total households' income has a reducing effect on rural income inequality of 12.9 per cent. It is equally remarked that the mean for these Gini index coefficients stands at 0.3685 which is not very different from the Gini coefficient index for Cameroon of 0.389 before 2015 (WB, 2013). Again, this permits the conclusion that the collection of NTFPs contributes significantly to the reduction of rural household income inequality in the South West Region of Cameroon.

[8] [Retrieved from].

Thus, the forest offers large potentials for poverty alleviation and reduction in income inequality among forest dependent households as have been equally demonstrated and emphasized by (Das, 2010; Babulo *et al.,* 2009; Druckman & Jackson, 2008; Ouedraogo, 2009; Fisher, 2004; Pattanayak *et al.,* 2004; Kumar, 2002; WB, 2001; Wunder, 2001; Kumar *et al.,* 2000; Cavendish, 1999; Reddy & Chakravarty, 1999; Adams, 1994; Chinn, 1979; Shand, 1987).

4.3. The Gini decomposition analysis

Table 3. *The Gini decomposition by income sources*

Income Sources	S_K	G_K	R_K	S_G	MEF_G
NTFP	0.2970	0.4289	0.1534	0.2795	-0.0176
EMPT	0.2904	0.5101	0.0730	0.1546	-0.1358
PROP	0.1843	0.6571	0.0769	0.1332	-0.0511
SFBU	0.1295	0.6011	0.1830	0.2037	0.0742
FASS	0.0989	0.6791	0.2389	0.0.2291	0.1302
Total Income	1.0000				

Source: By Authors Using Survey Data

Definitions of Variables NTFPI: Non-Timber Forest Products income.
EMPTI: Employment Income.

PROPI: Property Income

SFBUI: Small Family Business Income.

FASSI: Family Assistance Income.

S_K: represents the shares of each income source in total income.

G_K: the Gini Coefficient of each of the income components.

R_K: is the measurement of the Gini correlation with total income.

S_G: measures the share in Gini of total income, and

MEF_G: measures the marginal effect on Gini of total income and reflects the impact of a percentage change in respective income sources on the overall inequality measure.

We use the Gini decomposition to estimate the effect of small changes in natural or forest resources' income on inequality, holding income from other sources constant. The results obtained indicate that $R_K < G_K$ i.e. (0.1534 < 0.4289), implying that a small change in that income component has an equalizing effect on total income inequality. In the case of our study for example a 10 per cent increase in NTFPs income other things being equal, will reduce the Gini Coefficient of total income inequality by 0.18 per cent.

In line with our findings, (Getachew *et al.,* 2007) found that inequality dropped to 0.28 Gini coefficients when incomes from the collection and sale of NTFPs were included in rural total household income on a study of Dendi District in Ethiopia. In the case of the Bale Highlands of Southern Ethiopia, (Yemiru *et al.,* 2010) concluded that the Gini coefficient struck the lowest mark of 0.45 when incomes from NTFPs were included in households' total income.

We still refer ourselves to Table 3 above toexplain the second research pre-occupation of this paper, which intended to compare the various rural

households' income sources of the South West region of Cameroon in terms of their respective impacts on reducing rural income inequality. Based on the evaluation of the Gini Coefficient of each of the income components (G_K), which show how much each income source impacts on income inequality, we found that the NTFPs income source has the lowest Gini Coefficient of 0.4289.This is followed by 0.5101 for EMPT and 0.6571 for PROP. This permits us to conclude that NTFPs income impact more on total rural household income inequality than any other single income source in our area of study, and confirms to the hypothesis that NTFPs income contribute more than any other income source in equalizing rural households' income.

The equalizing character of NTFPs income can be analyzed in two ways: First, it is a widespread activity in the rural areas whereby almost everyone takes part in it: the men, women, and children alike. However, must note that the purpose for collecting may differ from one household head to another as well as the degree of participation. Thus, there is a wider spread or distribution of income from this income source as compared to other sources like property income where only a few privileged people (mostly the indigenes) are involve. Secondly, it was realized that the poorer segment of the population is more involve in the collection of non-timber forest products than those who are better off. This group are more competitive in this activity than all others, especially activities that require large startup capital such as Property ownership, small family business etc. This is clearly demonstrated on Table 4 below.

Table 4. *Cross tabulation showing level of income against number of gatherers*

Income from Occupation	NTFPs Gatherer or not				Total
	Yes	%	No	%	
1 000 - 28 500	126	32.9	12	60	138
29 000 – 50 000	124	32.4	1	5	125
51 000 – 100 000	81	21.1	4	20	85
101 000 – 150 000	32	8.4	2	10	34
151 000+	20	5.2	1	5	21
Undefined	-	-	-	-	5
Total	383	100	20	100	408

Source: By Author Using Survey Data

Looking at Table 4, we see that the amount of total income from household head's main occupation vary inversely with the number of household heads involve in the collection of non-timber forest products, i.e. the higher the income from main occupation, the smaller the households involved in the collection exercise. This ranges from 32.9 per cent through 32.4, 21, and 8.4 and down to 5.2 per cent. We therefore draw the conclusion that NTFPs income serves as an equalizer to other income sources and constitutes a major complementary source for total household incomes.

5. Conclusions

Using three different methodologies of Lorenz Curve, the Gini Coefficient, and the Gini decomposition by income sources, we obtain identical results. First it reveals that non-timber forest incomes contribute significantly to total rural households' incomes, and also impact significantly in the reduction of rural income inequality between rural households in the South West Region of Cameroon. For example inequality was reduced by 12 per cent when NTFPs income was included in total household income. Using the Gini decomposition by income sources it was revealed that a 10 per cent increase in NTFPs income will reduce inequality by 0.18 per cent. Finally, the departure of the Lorenz Curve from the perfect equality line had narrowed out when non-timber forest incomes were included in total rural household incomes. Again, this shows a reduction in income inequality. And because it reduces inequality between households, welfare certainly improves.

The link between income inequality and economic welfare can be clearly analyzed considering that both the poor and rich of a society buy from the same market. The rich will likely influence some market conditions and make the poor worse-off. But if the gap between the rich and the poor is narrowed down, each class will easily afford for its needs. Therefore to increase the welfare of a society requires that incomes are fairly distributed. According to (Todaro & Smith, 2009), social welfare relates negatively with the level of inequality. With respect to those living above the poverty line, income inequality can cause the following harmful effects:

i) Extreme income inequality leads to economic inefficiency considering that at any given average income, the higher the inequality the smaller the fraction of the population that qualifies for loans or other sources of credit. This is explained by the fact that high inequality leads to an overall decline in the rate of savings of an economy. Inequality might also lead to inefficiency in the allocation of assets by laying too much emphasis on higher education to the detriment of quality universal primary education.

ii) Income inequality might undermine social stability and solidarity. This is capable of strengthening the political power of the rich as well as their economic bargaining power.

iii) And lastly, extreme inequality is generally viewed as unfair.

Taking into Consideration the fact that non-timber forest incomes contribute enormously to reducing inequality in the South West Region of Cameroon, it cannot be denied that it does same to economic welfare of the rural inhabitants. It is therefore recommended that a good forest management policy be put in place to check harvesting of these resources, and that the products are processed for easy storage and increased value-added. These measures will certainly ensure sustainability of the benefits obtained.

References

Adams, R.Jr. (1994). Non-farm income and inequality in rural Pakistan: A decomposition analysis. *Journal of Development Studies*, 31(1), 110-113. doi. 10.1080/00220389408422350

Aguayo-Rico, A., Guerra-Turrubiates, I.A., & Montes, R. (2005). Empirical dvidence of the impact of health on economic growth, *Issues in Political Economy*, 14, 1-17.

Alejandro, H. (2006). Does natural resources extraction mitigate poverty and inequality? Evidence from Mexico. *Environment and Development Economics*, 12(2), 251-269. doi. 10.1017/S1355770X06003494

Amin, A.A., & Jean-Luc, A. (2000). A 1999 update of the Cameroon Poverty Profile: Reducing the current Poverty and Tempering the Increase Inequality, The World Bank Country Paper, Washington D.C.

Asmamaw, A., Pretzsch, J., Secco L., & Mohamod, T. (2014). Contribution of small-scale gum and resin commercialization to local livelihood and rural economic development in the dry lands of Eastern Africa. *Forests*, 5(5), 952-977. doi. 10.3390/f5050952

Atkinson, A.B. (1975). *The Economics of Inequality*. Oxford: Clarendon Press.

Atlas of the United Republic of Cameroon, (1980). *Editions Jeune Afrique*, MaisonMame, Tours - France.

Babulo, B., Muy, B., Nega, F., Tollens, E., Nyssen, J., Decker, J., & Mathias, E. (2009). The Economic Contribution of Forest Resource Use to Rural Livelihoods in Tigray, Northern Ethiopia. *Forest Policy and Economics*, 11(2), 109-117. doi. 10.1016/j.forpol.2008.10.007

Bahadur, B.K.C. (2014). *Inequality and Forest Dependence on Community Forest Resources in Kaski, Nepal*. Institute of Forestry, Tribhuvan University, Pokhara Nepal.

Barret, C.B., Reardon, T., & Webb, P. (2001). *Non-Farm Income Diversification and Households Livelihood Strategies in Rural Africa: Concepts, Dynamics and Policy Implication, Department of Applied Economics and Management*, Cornell University, Ithaca.

Becker, S.G., & Murphy, K.M. (2007). *The Upside of Income Inequality*. The America Economics Review. [Retrieved from].

Cavendish, W. (1999). Poverty, inequality and environmental resources: Quantitative analysis of rural households. Centre for the Study of African Economics. Oxford, *Working Paper Series*, No.99-9. [Retrieved from].

Chinn, D. (1979). Rural poverty and the structure of farm household income in developing countries: Evidence from Taiwan. *Economic Development and Cultural Change*, 27(2), 283-301. doi. 10.1086/451093

Das, N. (2010). Incidence of forest income on reduction of inequality: Evidence from forest dependent households in milieu of joint forest management. *Ecological Economics*, 69(8), 1617-1625. doi. 10.1016/j.ecolecon.2010.03.003

Druckman, A., & Jackson, T. (2008). Measuring resource inequalities: The concepts and methodology for an area-based Gini coefficient. *Ecological Economics*, 65(2), 242-252. doi. 10.1016/j.ecolecon.2007.12.013

Ellison, G.T. (2002). Letting the Gini out of the bottle? Challenges facing the relative income hypothesis. *Social Science & Medicine*, 54(4), 561–576. doi. 10.1016/s0277-9536(01)00052-1

Fernando, G., & De Maio, A. (2007). Income inequality measures, *Journal of Epidemiology and Community Health*, 61(10), 841-841. doi. 10.1136/jech.2006.052969

Fisher, M. (2004). Households welfare and forest dependence in Southern Malawi, *Environment and Development Economics*, 9(2), 135-154. doi. 10.1017/S1355770X03001219

Fonta, W.M., & Ayuk, E.T. (2013). Measuring the role of forest income in mitigating poverty and inequality: Evidence from South Eastern Nigeria, *Forests, Trees and Livelihoods*, 22(2), 86-105. doi. 1080/14728028.2013.785783

Fonta, W.M., Ichoku, H.E., & Ayuk, E. (2009). The distributional impacts of forest income on household welfare in rural Nigeria, *Journal of Economics and Sustainable Development*, 2(2), 1-13.

Garry, J., & Slaus, I. (2010). Indicators of economic progress: The power of measurement and human welfare, *Cadmus*, 1(1), 49.

Getachew, M., Sjaastad, E., & Velded, P. (2007). Economic dependence of forest resource: case from Dendi District, Ethiopia. *Forest Policy and Economics*, 9(8), 916-927. doi. 10.1016/j.forpol.2006.08.001

Jagger, P. (2012). Enviromental income, rural households, and income inequality in Western Uganda. *Forest, Trees and Livelihoods*, 21(2), 70-84. doi. 10.1080/14728028.2012.698846

Jodha, N.S. (1986). Common property resources and rural poor dry regions of India, *Economic and Political Weekly*, 21(27), 1169-1181.

Kawachi, I., & Kennedy, B.P. (1997). The relationship of income inequality to mortality: does the choice of indicator matter? *Social Science and Medicine*, 45(7), 1121-1127. doi. 10.1016/s0277-9536(97)00044-0

Kumar, S. (2002). Does participatory in common pool resource management help the poor? A social cost-benefit analysis of joint forest management in Jharkhand, India. *World Development*, 30(5), 763-782. doi. 10.1016/S0305-750X(02)00004-9

Kumar, S., Saxena, N., Alagh, F., & Mitra, K. (2000). *India Alleviating Poverty through Forest Development – Evaluation Country Case Study*. The World Bank, Washington DC.

Lerman, R., & Yitzhaki, S. (1985). Income inequality effects by income sources: A new approach to the U.S. *Review of Economics and Statistics*. 67(1), 151-156. doi. 10.2307/1928447

Ouedraogo, A. (2009) . *Aménagement Forestier et Lutte contre la Pauvreté au Burkina Faso*, Développement Durable et Territoires.

Makoudjou, A., Levang, P., & Chupezi, J.T. (2017). The role of forest resources in income inequality in Cameroon. *Forest, Trees and Livelihoods*, 26(4), 271-285. doi. 10.1080/14728028.2017.1297258

Ouedraogo, B., & Ferrari, S. (2012). Incidence of Forest Income in Reducing Poverty and Inequalities: Evidence from Forest Dependent Households in Managed Forests' Areas in Burkina Faso. *Cahiers du GREThA*, 20, 12-28.

Ray, D. (1998). *Development Economics*, Princeton, No.5: Princeton University Press.

Reddy, S.R.C., & Chakravarty, S.P. (1999). Forest dependence and income distribution in a subsistence economy: Evidence from India, *World Development*, 27(7), 1141-1149. doi. 10.1016/S0305-750X(99)00057-1

Sahota, G.S. (1978). Theories of personal income distribution: A survey, *Journal of Economic Literature*, 16(1), 1-55.

Shand, R.T. (1987). Income distribution in a dynamic rural sector: Some evidence from Malaysia. *Economic Development and Cultural Change*, 36(1), 35-50. doi. 10.1086/451635

Todaro, P.M., & Smith, C.S. (2009). *Economic Development*, Dorling Kindersley, Pvt Ltd, India.

World Bank, (2001). *A Revised Forest Strategy for the World Bank Group* (Draft). The World Bank, Washington D.C.

World Bank, (2013). *The World Bank Annual Report 2013*, Washington D.C.

Wunder, S. (2001). Poverty alleviation and tropical forests – What scope for synergies? *World Development*, 29(11), 1817-1833. doi. 10.1016/S0305-750X(01)00070-5

Yates, M. (2003). Naming the system. Inequality and work in the global economy, *Monthly Review Press*, pp.58-60,

Yemiru, T., Roos, A., Campbell, B., & Bohlin, F. (2010). Forest incomes and poverty alleviation under participatory forest management in the bale highlands, Southern Ethiopia. *International Forestry Review*, 12(1), 66-77. doi. 10.1505/ifor.12.1.66

E.-A.P. Angyie, & N.M. Aloysius, TER, 7(1), 2020, p.40-56.