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Using Dagum's Gini decomposition to assess households' asset-based gap in the regions of Burkina Faso

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Abstract

We consider the multidimensional wealth index constructed with a tetrachoric principal component analysis (PCA) to assess regional inequality in Burkina Faso using Dagum's Gini decomposition. The data used come from the 2014 Burkina Faso Malaria Indicator Survey (MIS). The results suggest that there are greater gaps (more heterogeneity) and less inequality (more homogeneity) in living standards between and within groups respectively. The decomposition of the total gross intergroup inequality shows that the most pronounced wealth gaps are between households in the urban Centre and those in the following rural regions: Sahel, Est, and Boucle de Mouhoun. These regional findings reflect particular conditions in these localities. The difficult living conditions inherent to these rural regions require effective policies to enable them to catch up with the urban Centre. However, the breakdown of the intragroup disparity showing evidence that the urban Centre and rural Est are more uneven should not be neglected in the political agenda.

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1. Introduction

Burkina Faso is one of the poorest countries in the world. Located in West Africa without access to the sea, it is surrounded by Mali to the NorthWest, Niger to the East, Benin to the SouthEast, Togo and Ghana to the South, and the Ivory Coast to the Southwest. Burkina Faso is composed of 13 regions (see map Figure in Appendix 1). According to the 2016 United Nations Development Program (UNDP) report, with a Human Development Index (HDI) of 0.302 and a Gini coefficient of 0.313 in 2015, the country comes 185th out of 188 in the world rankings. This finding reflects poverty and inequality problems despite the country's economic performance in recent years. In fact, the real growth rate per capita of Burkina Faso increased from 1% in 2015 to 5.5% in 2017 (AfDB et al., 2017) with decreasing inflation estimated at 1.5% in 2017 against -0.2% in 2016 according to AfDB (2018).

The monetary indicator (expenditure or income) is not sufficient to correctly assess the level of well-being of households in Burkina Faso. Well-being is multidimensional, and the monetary approach does not take into account this complexity, which reduces the effectiveness of targeting policies. Even households have financial means it is necessary that there is infrastructure in their areas of residence. For example, households that are monetarily rich can be deprived of electricity if they are located far from the electricity grid. This is why a multidimensional approach provides a much broader vision, informing policy-makers more extensively to enable them to implement adequate policies. Sen (1992) distinguishes the notion of "capabilities" by emphasizing the concept of "functioning", i.e. a set of ways of "being" and "doing" that range from satisfaction of basic needs (being adequately nourished, in good health etc.) to more complex achievements (being happy, taking part in the community, etc.). Since capabilities are not directly observable and can only be determined on the basis of presumptions, achieved functionings are true deprivations (or reflect true well-being) and will be retained in this inequality study.

Several recent studies, inter alia Chantreuil and Trannoy (2013), Urban (2016), Mussard and Richard (2012), have addressed the issue of inequalities and decomposed them into subgroups, illustrating the importance of inequality in the literature. Soltow (1960) and Bhattacharya and Mahalanobis (1967) were the first to formulate methods to decompose the Gini index into subgroups (intra and intergroup inequality). Ebert (1988), on the basis of a theorem, has shown that the Gini index has the properties of additive decomposability when the distributions do not overlap. Deutsch and Silber (1997), and Dagum (1997a, 1997b) were the first to introduce a third element considered as a residue (Mookherjee and Shorrocks, 1982). These authors have shown that this third term is a concept introduced by Gini (1916): transvariation. Transvariation shows the level of inequality in the overlap area of distributions. Beyond the disparity between a poor group of people and a rich group, transvariation highlights inequality between some households in poor groups that are wealthier than other households in rich groups. Thanks to these works, the Gini index is now decomposable into two or three elements, each of which makes a clear contribution to total inequality. Hence, according to Dagum (1997a, 1997b), overall inequality is the sum of intragroup, net intergroup (without overlap) and transvariation inequalities, bearing in mind that gross intergroup disparity is equal to net intergroup disparity plus transvariation components.

This research, based on a multidimensional index (wealth index) aggregating the achieved functionings, aims to study household inequality in the regions of Burkina Faso employing the Dagum Gini decomposition. The data used come from the Burkina Faso Malaria Indicators Survey (MIS) conducted in 2014 and provided by the demographic and health surveys (DHS) Program. Studies exist on inequalities in Burkina Faso. Wouterse's (2010) studies on remittances and inequality in Plateau Centre reveal that funds from intercontinental migration account for a higher share of total income inequality compared to monetary resources from intra-African migration. Gräb and Grimm (2011) conducted research on the importance of households, communities and regions in Burkina Faso. Based on the results of income decomposition, 60% of the total income variance is derived from the variance between households, and 20% from the variance between communities. Futhermore, less than 5% of the overall income variance comes from the variance between provinces, and about 10% from the variance between agro-climatic regions. Calves et al. (2013) analyzed the privatization of education

and inequality in the labor market. In their view, private-public inequality related to the transition from school to paid work is caused by a higher proportion of unpaid family work and apprenticeships among those who have most often attended public school (21%) compared to their counterparts who received private school education (11%). Badolo and Traore (2015) studied the impact of global rice prices on poverty and inequality and showed that an increase in rice prices leads to overall growth of expenditure inequalities ranging from 0.4% to 0.5%. However, the impact is higher in urban areas than in rural areas. Other authors including Ouedraogo and Ferrari (2012) and Dowd-Uribe (2014) have conducted research on inequalities in Burkina Faso.

To the best of our knowledge, no studies have been conducted in this country applying Dagum's Gini decomposition. Hence, we answer the following question: What is the household inequality profile in the regions of Burkina Faso according to Dagum's Gini approach? Lessons based on economic reality are provided by this approach, which policy-makers can use in the implementation of redistribution policies. This study fills the gap in the literature on inequalities in Burkina Faso.

In the following sections, we first present the methodological framework and data, then the results, and finally the conclusion as well as the policy recommendations.

2. Methodological framework and data

2.1. Multidimensional wealth index

Several methods exist to construct an indicator of well-being. These include the entropy approach from the field of dynamic mechanics (Maasoumi, 1986), fuzzy logic (Cérioli and Zani, 1990; Dagum and Costa, 2004) and the inertia approach originating from the field of static mechanics. The weakness of the first two methods is the arbitrariness guiding the choice of weights for each attribute. In addition, the fuzzy set technique does not provide well-being scores for each household allowing the use of Gini inequality measures and its decomposition. The best solutions results from the inertia approach, based on factor analysis techniques (Sahn, 2003; Bry, 1996; Volle, 1993; Meulman, 1992; Escofier and Pagès, 1990). These tools include Multiple Correspondence Analysis (MCA) and Principal Component Analysis (PCA), which allow the construction of a composite well-being indicator with as little arbitrariness as possible.

We run a PCA based on the tetrachoric correlation matrix in order to generate a score for each household. Pearson (1901) introduced tetrachoric correlation for a two-by-two contingency table as an improved measure of correlation between two binary variables. The questionnaire from the 2014 Burkina Faso MIS survey provides information on the different dimensions of household well-being. The housing characteristics retained include dimensions such as electricity, floor materials, wall materials, roof materials, and fuel used for cooking. The dimension such as source of drinking water is also retained. Finally, regarding household possessions, we consider equipments, means of transport, agricultural land and livestock/farm animals. These dimensions are binary variable as their modalities are encoded 0 or 1. For example: a) if a functioning is achieved (e.g. a household has electricity or resistant floor materials), a value of 1 is assigned and 0 otherwise; b) if a household has achieved a functioning such as possessing a radio, this modality is encoded 1, and if not 0.

The scores generated for each household aggregate the various dimensions of aforementioned non-monetary well-being. Each axis of the PCA associated with percentage values (eigenvalues) reflects their explanatory power. The first two axes are those with the greatest explanatory power of household living conditions, notably the first axis (28.39%), followed by the second (11.59%). We therefore consider the scores on the first axis for our analysis. The other axes that explain household living conditions less strongly are irrelevant. The description of variables used for the construction of scores is presented in Table 1. Table 2 provides the coordinates (scores) of these items used in the PCA.

Finally, note that DHS data are suitable for this study of decomposition of inequalities. Indeed, other studies have constructed scores with these data and applied them to the decomposition of

inequalities into intragroups and intergroups. We can cite the study by Harttgen and Vollmer (2011), who broke down the Atkinson index for Burkina Faso, Bolivia, Indonesia and Zambia. Similarly, Noglo (2014) employed 2006 QUIBB data from the DHS Program to measure inequality for Togo by breaking down the Gini coefficient according to Shapley's approach.

Table 1. Information on the dimensions of well-being used in the MIS to construct the wealth index

	Dimensions	Modalities and descriptions
Housing characteristics	Electricity	(Yes / No)
	Floor materials	Resistant (cement, tiles). Non-resistant (clay, sand, dung).
	Wall materials	Resistant (cement, stone with cement, bricks, cement blocks). Non-resistant (bamboo/cane/clay).
	Roof materials	Resistant (metal, zinc/cement fiber, tiles/slate, cement, shingles). Non-resistant (palm leaf, sod, rustic matting, palm/bamboo, wood planks, cardboard).
	Fuel used for cooking	Modern (natural gas / biogas). Non-modern (charcoal, wood).
Drinking water supply	Water source	Drinking water (tap water in housing, public tap, pump wells, protected wells). Non-drinking water (rainwater, non-protected wells, surface water).
Households possessions	Equipments	Radio, TV, mobile phone, refrigerator, table, cupboard, stove/cooker, plow, watch (Yes/No)
	Modes of transportation	Bicycle, animal-drawn cart. (Yes / No)
	Agricultural land	(Yes / No)
	Own livestock, herds/farm animals	(Yes/No)

Source: authors

Table 2. List of items and PCA scores

Variables and modalities	Scores on factor 1	Variables and modalities	Scores on factor 1
Electricity	0.803	Table	0.500
Floor materials	0.551	Cupboard/Library	0.630
Wall materials	0.674	Stove/Cooker	0.748
Roof materials	0.333	Plow	-0.355
Fuel used for cooking	0.667	Watch	0.367
Source of drinking water	0.267	Bicycle	-0.238
Radio	0.231	Animal-drawn cart	0.220
TV	0.732	Agricultural land	-0.715
Mobile phone	0.220	Own livestock, herds/farm animals	-0.536
Refrigerator	0.555		

Source: Authors' calculation

2.2. Inequality using Dagum's Gini decomposition

Let P be a population with n wealth units $y_i (i = 1, \dots, n)$. P is partitioned into k sub-population $P_j (j = 1, \dots, k$ of size n_j. The partitioning is carried out according to the socioeconomic properties of groups (gender, education, region, etc.). The cumulative income function, mean income and Gini coefficient of P are $F(y)$, μ and G respectively. $\mu_j (j = 1, \dots, k)$ is the mean income of the j^{th} group (P_j). Hence, Gini coefficient for P is given by:

$$G = \frac{\sum_{i=1}^{n} \sum_{r=1}^{n} |y_i - y_r|}{2n^2 \mu} \quad (1)$$

The Gini coefficient associated with sub-group P_j yields the income inequalities within P_j :

$$G_{jj} = \frac{\sum_{i=1}^{n_j} \sum_{r=1}^{n_j} |y_{ij} - y_{rj}|}{2n_j^2 \mu_j} \quad (2)$$

The Gini coefficient associated with two sub-groups P_j and P_h quantifies the income inequalities between P_j and P_h:

$$G_{jh} = \frac{\sum_{i=1}^{n_j} \sum_{r=1}^{n_h} |y_{ij} - y_{rh}|}{n_j n_h (\mu_j + \mu_h)} \quad \forall j, h = 1, \dots, k \quad (3)$$

The weights are the population share and the income share for the sub-population P_j and are defined as follows:

$$p_j = \frac{n_j}{n} \text{ and } s_j = \frac{n_j \mu_j}{n \mu} \quad (4)$$

The income units in the overlapping area of the two distributions are the main reason for using group means in the former methods to calculate the contribution of intergroup inequality, and the source of the belief in the literature that Gini is not decomposable. Dagum defined two concepts for these units of the intersection area.

The first one, ***gross economic affuence*** between j^{th} and h^{th} groups, is defined as:

$$d_{jh} = \int_0^{\infty} dF_j(y) \int_0^{y} (y - x) dF_n(x), \qquad \forall\, \mu_j > \mu_h \tag{5}$$

Where $\mu_j > \mu_h$ and $y_{ij} > y_{rh}$. This term uses the differences between all income pairs $x_{ij} - x_{rh}$ only when each x_{ij} of j^{th} group is higher than x_{rh} of h^{th} group given that j^{th} group's mean income is higher than h^{th} group's mean.

The second concept is the ***first-order moment of transvasriation*** which shows the income differences between j^{th} and h^{th} groups, where $\mu_j > \mu_h$ and $y_{ij} < y_{rh}$,

$$p_{jh} = \int_0^{\infty} dF_h(y) \int_0^{y} (y - x) dF_j(x), \forall \mu_j > \mu_h \tag{6}$$

This term, contrary to the previous one, is computed over the differences between all income pairs $x_{ij} - x_{rh}$ only for each x_{rh} of h^{th} group is higher than x_{ij} of j^{th} group given that j^{th} group's mean income is higher than h^{th} group's mean.

According to these two concepts, the normalized measure of the distance between two sub-populations, ***relative economic affuence (or economic distance)***, is defined as follows:

$$D_{jh} = \frac{(d_{jh} - p_{jh})}{(d_{jh} + p_{jh})} \tag{7}$$

The values of D_{jh} lie in the interval [0, 1]. $D_{jh} = 1$ when the two probability density functions of P_j and P_h do not overlap. $D_{jh} = 0$ when the two distributions are identical $(\mu_j = \mu_h)$. In other words, when the two distributions move away from each other, D_{jh} tends towards one. In this case, the ***net intergroup Gini coefficient is***:

$$G^{nb} = \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} D_{jh} (p_j s_h + p_h s_j) \tag{8}$$

G^{nb} measures inequality in the non-overlapping area of j^{th} and h^{th} groups' income distributions, that is, those generated by the high incomes of the richest sub-groups (as a mean). This component is the expression of the net contribution of intragroup inequality to total income inequality.

The contribution of intensity of transvariation intergroups G^t to the overall Gini index is the second component of the Gini coefficient and shows inequality computed from the overlapping area of the j^{th} and h^{th} groups:

$$G^{t} = \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} (1 - D_{jh}) (p_j s_h + p_h s_j) \tag{9}$$

G^t measures the overlap disparities between distributions, that is, the inequalities inherent to the high incomes of the poorest sub-groups (as a mean). The sum of ***net intergroup Gini coefficient*** and ***the contribution of intensity of transvariation between groups gives the gross intergroup Gini coefficient***.

$$G^{gb} = \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} (p_j s_h + p_h s_j)$$

$$= \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} D_{jh} (p_j s_h + p_h s_j) + \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} (1 - D_{Jh}) (p_j s_h + p_h s_j)$$

$$G^{gb} = G^{nb} + G^{t} \tag{10}$$

Thus, intergroup income inequality measure G^{gb} is derived from all income units, not just from the income means, as it is in the decomposition of generalized entropy indexes.

The third and last component is ***intragroup Gini coefficient*** G^w, defined as follows :

$$G^w = \sum_{j=1}^{k} G_{jj} p_j s_j \quad (11)$$

Consequently, the Gini coefficient is decomposed by group as:

$$G = G^w + G^{gb} \quad (12)$$

Finally, Dagum's theorem (1997) is stated. Hence, the Gini coefficient computed on a population P of size n, partitioned into subpopulations of size $n_j (j = 1, \dots, k)$ is given by:

$$G = G^w + G^{nb} + G^t \quad (13)$$

Using this Gini decomposition method, the total Gini coefficient is equal to the sum of the three components, and the interpretation of the components is rather easy.

2.3. Data, sampling design

The sample comes from the 2014 MIS for Burkina Faso. It is a random, two-stage stratified sample. The primary sampling unit is the zone of counting (ZC) as defined in the 2006 census. Each region is divided into urban and rural areas to form the two sampling strata in the region. At the first stage, 252 ZCs were selected with a probability proportional to the size of the ZC (number of households). At the second stage, from each ZC chosen in the first stage, 26 households with equal probability were selected. In total, of the 252 selected clusters, 52 are located in urban areas and 200 in rural areas. In the 252 clusters, 6,552 households were selected in total (26 households per cluster) with 1,352 and 5,500 households in urban and rural areas, respectively.

3. Spatial results of Dagum's Gini decomposition

Burkina Faso has 13 regions that we distinguish by their urban and rural areas, giving 13 urban regions and 13 rural regions, making a total of 26 groups in the sample ($j = 1, \dots, 26$). Note that when we talk about groups in our analysis, this means households in different localities (urban and rural regions). Table 3 provides the elementary statistics of households' non-monetary mean wealth levels represented by mean scores in each region. Table 3 also shows the mean scores for urban and rural households in each region. A higher mean score for households in a given locality compared to that of households in another locality means that the former are on average richer than the latter

Note that the scores generated for each household have negative (poor households) and positive (rich households) values. The negative values are problematic to assess inequality and it is preferential to have only positive values. In order to obtain elementary statistics of household wealth, we add to each original score per household the absolute value of the minimum value of the set of scores. The new scores (translated scores) will all be positive by construction but the level of household well-being remains in the same order between the original and the translated scores (Duclos and Araar, 2006).

Conversely, it is problematic to assess inequality from the translated scores, as this transformation may influence the mean of the distribution and thus the inequality measures (Sahn and Stifel, 2003). In doing so, we retain the original positive and negative scores of households, make our calculations with the mean difference (numerator of the Gini index), and adapt it to Dagum's Gini decomposition.

The national inequality that must be broken down is G = 0.3817. The estimation of the fundamental equation (13) gives the following decomposition:

$$G = G^w + G^{nb} + G^t = 0.0151 + 0.2047 + 0.1619 \text{ (see Table 4)} \quad (14)$$

This breakdown indicates that the total intragroup contribution to total inequality (G^w/G) is very low and amounts to 3.96%, while the proportion of net intergroup inequality (G^{nb}/G) and the contribution related to transvariation (G^t/G) are respectively 53.63% and 42.42% (see Table 3). These results indicate that the net inequality between the groups is higher than the disparities from the overlap of distributions. The degree of overlap is significant but not excessively, reflecting that the rural and urban area distributions are moderately close.

This contribution of net inequality reflects the difference in wealth between poor households living in rural areas of regions and rich households in urban areas of regions. Indeed, it can be seen in Table 3 that overall, average household wealth is lower in rural areas (score = 0.96) than that in urban areas (score = 1.82). This rural-urban dicrepancy is also observed for each region. This is a classic result which is generally the case in poor countries where hardship is a scourge in rural areas (see e.g. Alkire and Seith, 2015 for India; Ray and Sinha, 2015 for China, India, Vietnam; Noglo, 2017 for Togo).

Considering the contribution of transvariation, this method estimates the difference in living standards for some households in rural areas that are better off than other households in urban areas. This situation is due to the fact that in rural Burkina Faso, the rich are often annuitants with higher incomes.

Through equation (12), we observe that the gross intergroup inequality contribution (G^{gb}/G) is overwhelmingly much higher (96.04%) than that of the overall intra-group (3.96%) (see Table 4). The estimation of equation (12) gives the decomposition in equation (15) (see Table 4). This therefore indicates homogeneity (less inequality) in living standards within the 26 groups, while the heterogeneity (greater inequality) of well-being between these different areas is more striking. Policies to address inequality should focus on intergroup disparities in order to correct wealth imbalances. However, household inequality within these localities should not be excluded from the political agenda.

$$G = G^w + G^{gb} = 0.0151 + 0.3666 \quad (15)$$

The breakdown of gross inequality (G^{gb}) between groups gives 351 intergroup indices. These are combinations of 2 groups in a set of 26, leading us to target the most important elements (see Table 4). This aspect is paramount because it has never been documented in the literature on Burkina Faso and indicates where policy-makers should put greater emphasis to reduce gaps. The greatest wealth gaps are found between households in urban areas of the Centre region compared to rural households in other regions. However, the greatest disparities are noted between the urban Centre and the rural Boucle du Mouhoun, rural Est, and rural Sahel. Thus, the wealth gaps (see the figures in bold in Table 4) between the urban Centre and the rural areas of Boucle du Mouhoun, Est, and Sahel are 2.09%, 2.02%, and 2.02% respectively.

According to Zonon (2006), Centre is the most urbanized region (urbanization rate above 74%). Table 3 indicates that this region is where households are the best off with the greatest wealth (score = 2.57 is at least twice as high as households scores in other regions)[1], notably in its urban area (score = 2.88 which the highest in urban area). The urban Centre includes the country's capital (Ouagadougou), featuring the most developed economic activities (public sector and private sector) and the population

[1] This score is in bold in Table 3. The scores in bold in Table 3 are useful in interpreting the results. The scores behave as income. The higher they are, the wealthier households are. This helps explain the levels of inequality between households based on our knowledge and the literature.

with the highest level of education and the most skilled jobs. The income from these activities enables these households to enjoy good material living conditions.

With a score of 1.11 (Table 3), which is 2.3 times lower than that of the Centre region, households in the Sahel region are among which accumulate the least wealth in Burkina Faso. This region experiences severe droughts (Reardon and Taylor, 1996) leading to the lowest agricultural yields in the country. Livestock, the main activity in this region, also suffers from the arid situation. These difficult and unfavourable conditions for income accumulation characterize rural Sahel, and explain the low living standards there (wealth score = 1.00 is lower than the urban Sahel score and 2.88 times lower than that of urban Centre). Households in the Est region also have average low wealth (overall score = 1.12; score rural Est = 1.07). Paradoxically, the rural Est is a locality with fertile soil, and the deprivation of households living in this area is linked to its isolation, making it unaccessible for the sale of agricultural products (Renaudin, 2007). Moreover, the absence of modern agricultural techniques undermines profitability. The rural locality of Boucle du Mouhoun, which is the country's cotton-growing area (Zida and Kambou, 2014), features the same paradoxes as the Est in terms of soil fertility and isolation.

The situations of rural Sahel, rural Est, and rural Boucle du Mouhoun contribute significantly to widening the gap in living conditions with the urban Centre.

The second largest inequality is between the urban Hauts-Bassins and the rural areas of other localities (see Table 4). Nevertheless, inequalities are more acute (see the figures in bold) between the urban Hauts-Bassins and rural areas in regions such as Boucle du Mouhoun (0.73%), Centre-Nord (0.77%), Est (0.71%), and Sahel (0.71%). Table 3 shows that Hauts-Basins households are on average the second wealthiest (score = 1.45). The reason is that Hauts-Bassins has one of the highest urbanization rates (more than 26%) (Zonon, 2006) and hosts the economic capital (Bobo-Dioulasso). The prosperity of households in urban Hauts-Bassins (score = 2.27 is the second highest score in urban area) results from the fact that this area is industrialized and includes many workers, with the public administration being sufficiently established to employ a large number of civil servants. The differences in well-being between households in urban Hauts-Bassins and those in the rural areas of Bloucle du Mouhoun, Est, and Sahel can be put down to the explanations already given regarding the living conditions in these three rural localities.

Table 3. Elementary statistics of households' non-monetary mean wealth levels by area and region

Region	Mean wealth	Sample size	Urban area		Rural area	
			Mean wealth	Sample size	Mean wealth	Sample size
Boucle du Mouhoun	0.99	519	1.54	52	0.93	467
Cascades	1.04	490	1.70	102	0.87	388
Centre	**2.57**	488	**2.88**	384	1.42	104
Centre-Est	1.03	519	1.76	103	0.85	416
Centre-Nord	0.93	485	0.88	52	0.94	433
Centre-Ouest	0.95	485	1.76	71	0.81	414
Centre-Sud	0.89	491	1.42	78	0.80	413
Est	**1.12**	513	**1.60**	50	**1.07**	463
Hauts-Bassins	**1.45**	490	**2.27**	182	0.97	308
Nord	1.04	500	1.66	76	0.92	424
Plateau Central	1.17	472	2.11	49	1.06	423
Sahel	**1.11**	509	2.24	46	**1.00**	463
Sud-Ouest	1.02	487	1.78	73	0.89	414
Total	1.18	6448	1.82	1318	0.96	5130

Source: Authors' calculations

Let us now consider the breakdown of total intragroup contribution (G^w) displays in Table 4. This is another aspect that has never been documented in the literature on Burkina Faso. Two groups (urban Centre and rural Est) are distinguished by their higher level of inequality. The contributions of these localities (see the figures in bold) are respectively 0.83% and 0.32%. Households living in the urban Centre are the wealthiest as mentioned above (score = 2.88). The high inequality of wealth in this area reflects the fact that although wealth is widely distributed, a minority of excessively rich households concentrate a large part of this wealth. Thus, the gap in living standards is due to income from households in the business sector that is disproportionate compared to other types of income (households comprising salaried civil servants and other salaried households). The great inequality within the rural Est group stems from a great accumulation of wealth by a wealthy minority. Indeed, the rural Est is essentially a cotton-growing area in which the large farms are owned by this minority (Renaudin, 2007). The income from cotton production significantly improves the living conditions of these households. Furthermore, some poor households make do with subsistence farming while others work as laborers on cotton farms for low wages (Renaudin, 2007).

Table 4. Inter and intragroups inequalities with contributions to national inequality

Total gross intergroup inequality			Total intragroup inequality		Transvariation	
$\boldsymbol{G^{gb}}$	0.3666		G^w	0.0151	G^t	0.1619
$\frac{\boldsymbol{G^{gb}}}{\boldsymbol{G}}$	96.04%		$\frac{G^w}{G}$	3.96%	$\frac{G^t}{G}$	42.42%
Contributions of gross interregional groups' inequalities to national inequality			Contributions of intraregional inequality to national inequality at the urban and rural level		Net intergroup inequality	
($\%\boldsymbol{G^{gb}}$)	Urban Centre	Urban Hauts-Bassins	$\%G^w$	$\%G^w$	G^{nb}	0.2047
Rural area			Urban area	Rural area	$\frac{G^{nb}}{G}$	53.63%
Bouche du Mouhoun	**2.09**	**0.73**	0.01	0.02		
Cascades	1.78	0.63	0.04	0.21		
Centre	0.48	0.18	**0.83**	0.04		
Centre-Est	1.92	0.68	0.04	0.25		
Centre-Nord	1.95	**0.77**	0.00	0.24		
Centre-Ouest	1.94	0.69	0.02	0.24		
Centre-Sud	1.92	0.68	0.02	0.18		
Est	**2.02**	**0.71**	0.01	**0.32**		
Hauts-Bassins	1.37	0.49	0.16	0.05		
Nord	1.91	0.68	0.02	0.24		
Plateau Central	1.84	0.65	0.01	0.24		
Sahel	**2.02**	**0.71**	0.01	0.22		
Sud-Ouest	1.92	0.69	0.02	0.27		

Source: Authors' calculations

4. Conclusion and policy recommendation

Estimating inequalities using Dagum's Gini decomposition provides a comprehensive tool for decision-makers to put appropriate policies in place. To achieve this, the purpose of this article is to study regional inequalities in household living standards in Burkina Faso. The data used come from the 2014 MIS and the well-being variable is the composite wealth index, which aggregates various non-monetary dimensions of well-being.

The results show respectively strong homogeneity and heterogeneity within and between groups. These findings reflect the distance between urban and rural distributions due to the extreme low wealth characterizing the country's rural areas. Recommendations in term of policies to improve income and combat non-monetary inequality in rural areas are well documented in the literature.

Intergroup inequalities are greater between the urban Centre and the rural areas of Boucle du Mouhoun, Est, and Sahel. Added to this are inequalities between the urban Hauts-Bassins and the rural groups mentioned above. The most notable intragroups gaps are in the urban Centre and the rural Est.

As to recommendations concerning intergroup inequalities, the rural Sahel, which is subject to disastrous natural conditions, could benefit from Israel's desert fertilization technique. Households in the rural areas of Est and Boucle du Mouhoun suffer from their isolation (Renaudin, 2007; Zida and Kambou, 2014), and the construction of a quality road infrastructure is essential to open up these rural localities in order to connect them to the cities and the market (Ministry of Economic and Finance et al., 2007). Thus, households in these localities would be able to sell their agricultural products on the urban markets in their regions, improving their income and their material conditions.

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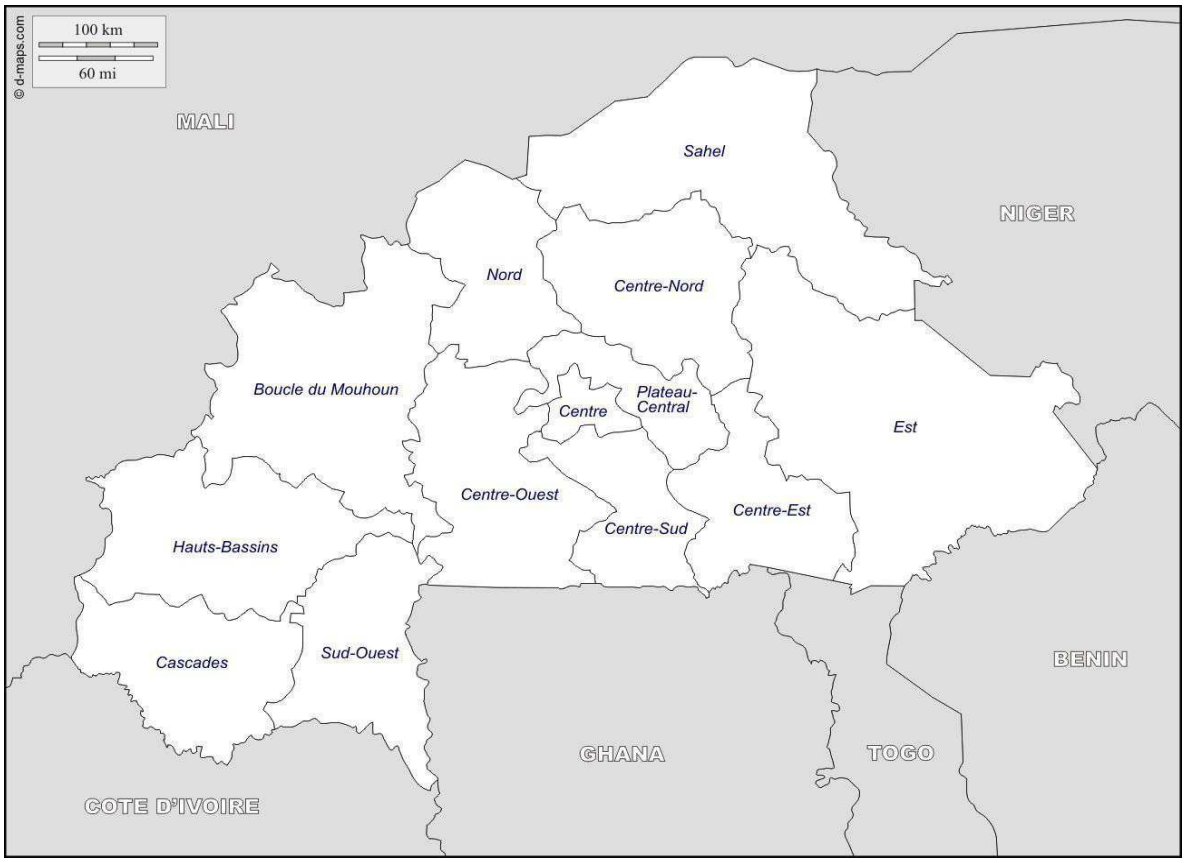
Appendix 1. Burkina Faso and its regions



Source: The authors