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Original Research Article

Decomposable Inequality Measures: Estimation for a Backward District of West Bengal

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Abstract

A decomposable measure of inequality simply refers as a measure such that the variability of total inequality can be divided into two parts: 'within inequality' and 'between inequalities'. By considering plural view of inequality measures (both absolute and relative) for two widely talked-about families of inequality measurement (Gini family and SD-CV family) in the literature, we propose that, variance (as an absolute measure in SD-CV family) is the most suitable measure for perfect decomposition of inequality. On the other hand, squared coefficient of variation (as a relative measure in SD-CV family) is far better measure for such purpose than Gini index (as a relative measure in Gini family) though they cannot be perfectly decomposed. An empirical study of a backward district of West Bengal is considered in order to analyse the effects of 'within' and 'between' components on inequality decomposition. Since one of the key points of inequality analysis is represented by the overlapping units, the effect of overlapping component on inequality decomposition is also considered.

Keywords: Absolute Inequality, Relative Inequality, Decomposition Analysis, Within Inequality, Between Inequality, Transvariation, Interaction.

1. INTRODUCTION

An important reasonableness criterion of inequality measures is therefore 'decomposability', i.e. the possibility of calculating the contribution of each group to total inequality. In its most general form, decomposability of inequality measures requires a consistent relation between total inequality (overall inequality) and its parts. More specifically, when dealing with decomposability, we must be able to distinguish between 'within inequality' (w) and 'between inequality' (b). The 'within inequality' element captures the inequality due to the variability of income within each group, while the 'between inequalities' element captures the inequality due to the variability of income across different groups.

For example, if the population is divided in rural and urban individuals, the 'w' element identifies the contribution to inequality of the variability of rural and urban incomes taken separately. The 'b' element, instead, captures the degree of inequality due to income differences between groups.

The most general decomposition of any inequality index I generates a within element, a between element and a residual term:

$$I = I_w + I_b + K; \text{ K denotes residual} \quad (1)$$

2. SUBGROUPS DECOMPOSITION OF GINI COEFFICIENT/INDEX

The Gini coefficient is the most popular relative measure of inequality and its welfare implications have been discussed by various authors [5]; Dasgupta, Sen and Starrett [2]; Yitzhaki, [10] etc.)

The methodologies for decomposition of Gini coefficient introduced by Dagum and his follower Costa [1] are very popular in literature.

2a. Dagum's / Costa's Proposal

Consider a population of 'n' individual, with income Y_1, Y_2,.......,Y_n and mean income μ , disaggregated in k subgroups of n_j individuals, with n $=\sum_{j=1}^{n}$ n, the Gini index can be represented as:

$$G = \frac{\sum_{j=1}^{k}\sum_{h=1}^{k}\sum_{i=1}^{n_j}\sum_{r=1}^{n_h}|y_{ji}-y_{hr}|}{2n^2\mu} \qquad (2)$$

Where k is the number of subgroups, n_j and n_h are the size of subgroups j and h respectively, y_{ji} is the income of the i^{th} individual of subgroup j, and y_{hr} is the income of the r^{th} individual of subgroup h.

By setting the subgroup j population share $p_j = n_j/n$, and the subgroup j income share $s_j = p_j\mu_j/\mu$, the Gini index between subgroup j and subgroup h can be expressed as:

$$G_{jh} = \frac{\sum_{i=1}^{nj}\sum_{j=1}^{nh}|y_{ji}-y_{hr}|}{n_j n_h(\mu_j+\mu_h)} \qquad (3)$$

The Gini index for total population G can be obtained as a weighted sum of G_{jh} with weight p_js_h:

$$G = \sum_{j=1}^{k}\sum_{h=1}^{k} G_{jh}\, p_j s_h \qquad (4)$$

In this case the within inequality of k subgroups can be easily expressed as:

$$G_w = \sum_{j=1}^{k} G_{jj}\, p_j s_j \qquad (5)$$

i.e., the sum of the k Gini indexes in the k subgroups weighted by p_js_j. This measure of the 'within' inequality is quite generally accepted in the literature, while the measurement of inequality 'between' represents the topic of a wide discussion related to the role, nature, and purpose of inequality decomposition [6]; Deutsch and Silber, [9]; Frosini, [3]. Many authors have proposed specific measures in order to evaluate inequality between and its sources. These proposals are different for either their objectives or the analysis of overlapping subgroups.

In order to measure the contribution to total inequality attributable to the differences between the k population subgroups as proposed by Dagum [7, 8], Mehran [4], is

$$G_b = \sum_{j=1}^{k}\sum_{\substack{h=1\\ j\neq h}}^{k} G_{jh}\, p_j s_h \qquad (6)$$

That is a quantity which takes into account not only the differences between the mean incomes of the k population subgroups, but also all other possible differences.

The Case of Two Non-Overlapping Subgroups (Rural & Urban)

Following Dagum's [7, 8] proposal, for the case of two subgroups the Gini index decomposition into 'within' inequality (G_w) and between inequality (G_b) can be written as:

$$G = G_w + G_b \qquad (7)$$

By considering the rural population share $p_1 = n_1/n$ and the rural income share $s_1 = p_1\mu_1/\mu$, and the urban population share $p_2 = n_2/n$ and the urban income share $s_2 = p_2\mu_2/\mu$, equation (7) becomes:

$$G = (G_{11}p_1s_1 + G_{22}p_2s_2) + (G_{12}p_1s_2 + G_{21}p_2s_1) \qquad (8)$$

Where, $p_2 = (1- p_1)$, $s_2 = (1- s_1)$, $G_{12} = G_{21}$

Comparing equation (7) and (8),

$G_b = G_{12}p_1s_2 + G_{21}p_2s_1$

$\quad = G_{12}(p_1s_2 + p_2s_1)$

$= (p_1s_2 + p_2s_1)\frac{\sum_{i=1}^{n1}\sum_{j=1}^{n2}|y_{1i}-y_{2j}|}{n_1n_2(\mu_1+\mu_2)}$

Let us assume that the poor are in the first group (rural) and the rich in the second (urban), i.e., $|y_{1i} - y_{2j}| = (y_{2j} - y_{1i})$; $\forall$ i and j and

$$G_b = \frac{p_1s_2+p_2s_1}{n_1n_2(\mu_1+\mu_2)}\sum_{i=1}^{n1}\sum_{j=1}^{n2}|y_{1i}-y_{2j}| = \frac{p_1s_2+p_2s_1}{n_1n_2(\mu_1+\mu_2)}\sum_{i=1}^{n1}\sum_{j=1}^{n2}|y_{2j}-y_{1i}|$$

Appling the basic properties of mean that leads to

$G_b = \frac{p_1s_2+p_2s_1}{n_1n_2(\mu_1+\mu_2)}\sum_{i=1}^{n1}\sum_{j=1}^{n2}|y_{2j}-y_{1i}| = \frac{p_1s_2+p_2s_1}{n_1n_2(\mu_1+\mu_2)} n_1 n_2 (\mu_2 - \mu_1)$

$= (p_1s_2 + p_2s_1)\frac{(\mu_2-\mu_1)}{(\mu_1+\mu_2)}$

$= (p_1s_2 + p_2 p_1\mu_1/\mu)\frac{(\mu_2-\mu_1)}{(\mu_1+\mu_2)}$; substituting the value of $s_1 = p_1\mu_1/\mu$

$= p_1 (s_2 + p_2\mu_1/\mu)\frac{(\mu_2-\mu_1)}{(\mu_1+\mu_2)}$

$= p_1 (\frac{s_2\,\mu + p_2\mu_1}{\mu})\frac{(\mu_2-\mu_1)}{(\mu_1+\mu_2)}$

$= \frac{p_1(p_2\mu_2\mu/\mu + p_2\mu_1)}{\mu} * \frac{(\mu_2-\mu_1)}{(\mu_1+\mu_2)}$; substituting the value of $s_2 = p_2\mu_2/\mu$

$= \frac{(p_1p_2\mu_2 + p_1p_2\mu_1)}{\mu} * \frac{(\mu_2-\mu_1)}{(\mu_1+\mu_2)}$

$= \frac{p_1p_2(\mu_2+\mu_1)}{\mu} * \frac{(\mu_2-\mu_1)}{(\mu_1+\mu_2)}$

$= \frac{p_1p_2}{\mu}(\mu_2 - \mu_1)$

$= \frac{p_1p_2\mu_2}{\mu} - \frac{p_1p_2\mu_1}{\mu}$

$= p_1 s_2 – p_2 s_1$; substituting the values of s_1 and s_2
$= p_1 (1- s_1) – s_1 (1- p_1)$
$= p_1 - p_1 s_1 - s_1 + p_1 s_1$
$= p_1 - s_1$ (9)

Thus following equation (7), $G = G_w + (p_1 - s_1)$ (10)

The Case of Two Overlapping Subgroups (Rural & Urban)

The case of overlapping subgroups corresponds to the notion of transvariation, introduced by Gini [1]. According to Costa, transvariation is a key issue in equality studies and is related to Gini index decomposition.

Without transvariation, inequality which is not captured by within element (G_w) is given by
$G – G_w = G_b$.

While with transvariation, inequality which is not captured by within element (G_w) is given by

$G – G_w = G_b + G_t$; G_t measures the contribution to inequality related to the presence of transvariation.

Following Dagum's proposal, Gini decomposition (10) for a population divided into rural and urban population,

$G – G_w = p_1 - s_1 + G_t$ (11)

Following Costa [1], in the case of overlapping units, at least one difference ($y_{2j} – y_{1i}$) is negative and, therefore, the quantity ($p_1 - s_1$), which corresponds to the sum of all differences ($y_{2j} – y_{1i}$), both negative and positive.

However, to generalize the expression $G_b = (p_1 - s_1)$ for the presence of transvariation it is sufficient to add to ($p_1 - s_1$) the value of negative differences ($y_{2j} – y_{1i}$), that is G_t, the effect on inequality related to the presence of transvariation.

Therefore, the equation (11) becomes,
$G = G_w + (p_1 - s_1 + G_t) + G_t$
$= (G_1p_1s_1 + G_2p_2s_2) + (p_1 - s_1 + G_t) + G_t$ (12)

Given G, G_1 and G_2, from equation (11) it is easy calculate G_t,
$G_t = (G - G_w - p_1 + s_1) / 2$

This expression for G_t also allows calculating 'between' inequality

$G_b = p_1 - s_1 + (G - G_w - p_1 + s_1) / 2$

2b. New Approach

The Case of Two Non-Overlapping Subgroups (Rural & Urban)

By considering the rural population share $p_1 = n_1/n$ and the rural income share $s_1 = p_1\mu_1/\mu$, and the urban population share $p_2 = n_2/n$ and the urban income share $s_2 = p_2\mu_2/\mu$, the 'between inequality' element of Gini coefficient can be calculated by a more simplified method which is very close to Dagum's/Costa's approach.

Let, p_i and s_i are the population share and income share of *ith* group, and cp_i denotes cumulative population share and cs_i denotes cumulative income share of *ith* group and from equation (8) we have $(p_1 + p_2) = 1$, $(s_1 + s_2) = 1$.

Subgroups	1(Rural)	2(Urban)
p_i :	p_1	p_2
s_i :	s_1	s_2
cp_i :	p_1	$(p_1 + p_2) = 1$
cs_i :	s_1	$(s_1 + s_2) = 1$

Thus,
$G_b = P_1*(p_1 + p_2) - S_1*(s_1 + s_2) = (P_1*1 - S_1*1) = P_1 - S_1$.

This technique can simply be applied for more than two subgroups. In the existing literature, most of the authors have tried to decompose Gini coefficient into 'within inequality' and 'between inequality' for two subgroups of non-overlapping and overlapping population which may be applied for sectoral decomposition analysis. However, if researchers in this field are also interested to analyse the Gini decomposition for the case of more than two subgroups (e.g. decomposition for four social groups or whatever it may be), it can simply be extended in the following way:

Let us suppose that, p_1, p_2, p_3 and p_4 indicate the population share of ST, SC, OBC and GEN categories respectively, s_1, s_2, s_3 and s_4 indicate the income share of ST, SC, OBC and GEN categories respectively, G_1, G_2, G_3 and G_4 indicate the within inequality measured by Gini coefficient for ST, SC, OBC and GEN categories respectively.

Subgroups	1(ST)	2(SC)	3(OBC)	4(GEN)
p_i :	p_1	p_2	p_3	p_4
s_i :	s_1	s_2	s_3	s_4
cp_i :	p_1	$p_1 + p_2$	$p_1 + p_2 + p_3$	$(p_1 + p_2 + p_3 + p_4) = 1$
cs_i :	s_1	$s_1 + s_2$	$s_1 + s_2 + s_3$	$(s_1 + s_2 + s_3 + s_4) = 1$

Thus,
$G_b = \{p_1(s_1 + s_2) + (p_1 + p_2)(s_1 + s_2 + s_3) + (p_1 + p_2 + p_3)(s_1 + s_2 + s_3 + s_4)\} - \{s_1(p_1 + p_2) + (s_1 + s_2)(p_1 + p_2 + p_3) + (s_1 + s_2 + s_3)(p_1 + p_2 + p_3 + p_4)\}$

$$= \{P_1(S_1 + S_2) + (P_1 + P_2)(S_1 + S_2 + S_3) + (P_1 + P_2 + P_3)*1\} - \{S_1(P_1 + P_2) + (S_1 + S_2)(P_1 + P_2 + P_3) + (S_1 + S_2 + S_3)*1\}$$

$$= \{P_1(S_1 + S_2) + (P_1 + P_2)(S_1 + S_2 + S_3) + (P_1 + P_2 + P_3)\} - \{S_1(P_1 + P_2) + (S_1 + S_2)(P_1 + P_2 + P_3) + (S_1 + S_2 + S_3)\}$$

Therefore, the general form of such type of decomposition can be rewrite as:

$$G_b = \sum_{i=1}^{k-1} cp_i cs_{i+1} - cs_i cp_{i+1} \quad (13)$$

$$\text{Therefore, } G_t = G - (G_w + G_b) \quad (14)$$

Application

The decomposition of the Gini index (by social groups) given by equation (5) is applied to the family income (expenditure) distribution of a backward district of West Bengal in 2004-05.

Table 1 represents the information necessary to decompose the total Gini index. The data in columns (2) and (3) are collected from the Indian National Sample Survey Office (NSSO). The weighting factors; population share (P_j) and income share (S_j), j=1,2,3,4 in columns (5) and (6) are calculated from columns (2) and (4) respectively. Column (7) presents the Gini index *within* each subgroup, calculated by authors from the raw data of consumption expenditure of Bankura in 2004-05 published by NSSO. Columns (8) and (9) give the cumulative population share and cumulative income share, are calculated from columns (5) and (6).

Table-1: Consumer Expenditure of Bankura in 2004-05

1	2	3	4	5	6	7	8	9
Social Groups	**Sample Size (n_j)**	**Mean Income (μ_j)**	**$n_j * \mu_j$**	**Population Share (P_j)**	**Income Share (S_j)**	**Gini Index (G_{jj})**	**Cumulative Population Share (CP_i)**	**Cumulative Income Share (CS_i)**
SC	1380421	467.76	645708785.77	0.424	0.325	0.223	0.424	0.325
ST	207419	468.93	97264593.14	0.064	0.049	0.175	0.488	0.374
GEN	1478644	739.60	1093608626.05	0.454	0.550	0.248	0.942	0.924
OBC	187678	807.28	151508508.00	0.058	0.076	0.236	1	1
TOTAL	3254162	610.94	1988090513	1	1	0.2686		
Within (%)	35.10							
Between (%)	43.64							
Transvariation (%)	21.26							

Following equation (5), taking the values of columns (5), (6) and (7) of table 1, we have,

G_w = (0.424*0.325*0.223) + (0.064*0.049*0.175) + (0.454*0.550*0.248)
+ (0.058*0.076*0.236) = 0.0943

Contribution of G_w to G = 0.0943/0.2686*100 = 35.10%

To estimate G_b and G_t given by equation (12) and (13), respectively, we make use the values of columns (8) and (9) of table 1, we have,

G_b = {(0.424*0.374) + (0.488*0.924) + (0.942*1)} – {(0.325*0.488)
+ (0.374*0.942) + (0.924*1)} = 0.1172

Contribution of G_b to G = 0.1172/0.2686*100 = 43.64%
G_t = 0.2685 – (0.0943 + 0.1172) = 0.0571

Contribution of G_t to G = 0.0571/0.2686*100 = 21.26%

Therefore,
G = 0.0943 + 0.1172 + 0.0571 = 0.2686 (100%)

3. VARIANCE DECOMPOSITION FOR THE CASE OF TWO SUBGROUPS (RURAL & URBAN)

A decomposable measure of inequality can be defined as a measure such that total inequality of a population can be divided into a weighted average of inequality existing within subgroups of the population and inequality existing between them. Let us suppose that, total population 'n' is divided into rural population denoted by n_1 and urban population denoted by n_2 and also let μ_1 and μ_2 be their average monthly consumption expenditures and s_1 and s_2 their standard deviations.

$$\text{Then, } \mu = (n_1\mu_2 + n_2\mu_2) / (n_1 + n_2) \quad (12)$$

Let us assume an income distribution with two groups, individuals in rural areas (n_1) and individuals in urban areas (n_2). Denote their incomes as y_i^1 and y_i^2, where the subscript refers to a generic individual, while the superscripts identifies the area of the individual belongs to. In a general form, the variance of total income might be decomposed as follows:

$$s^2 = \frac{n_1 s_2^2 + n_2 s_2^2}{n_1 + n_2} + \frac{n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2} \quad ; d_1 = (\mu_1 - \mu) \text{ and } d_2 = (\mu_2 - \mu) \qquad (13)$$

$$= \frac{n_1 s_2^2 + n_2 s_2^2}{n} + \frac{n_1 d_1^2 + n_2 d_2^2}{n} \; ; n = (n_1 + n_2)$$

$$= \left(\frac{n_1}{n} s_1^2 + \frac{n_2}{n} s_2^2\right) + \left(\frac{n_1}{n} d_1^2 + \frac{n_2}{n} d_2^2\right) \qquad (14)$$

Alternatively, equation (14) can be rewrite as,

$$V(y) = [P_s^1 V(y_1) + P_s^2 V(y_2)] + V[\bar{y}_1, \bar{y}_2] \qquad (15)$$

The first term of equation (15) is the sum of two elements

- The variance of rural incomes $V(y_1)$ multiplied by the share of rural population on total population (P_s^1)
- The variance of urban incomes $V(y_2)$ multiplied by the share of urban population on total population (P_s^2).

Therefore, the general form of such type of decomposition can be rewrite as

$$s^2 = \frac{1}{\sum_{i=1}^{k} n_i} \sum_{i=1}^{k} n_i s_i^2 + \frac{1}{\sum_{i=1}^{k} n_i} \sum_{i=1}^{k} n_i d_i^2$$

The first part of this expression is therefore the *'within'* element of the variance and it can be interpreted as the weighted average of the variance of the income of each group, with weights given by the population shares and the last part is the *'between'* element of the variance.

Squared Coefficient of Variation Decomposition for the Case of Two Subgroups

Now squared coefficient of variation can simply be written as $\frac{\text{Variance}}{\mu^2}$ and the expression is,

$$CV^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{(n_1 + n_2)\mu^2} + \frac{n_1 d_1^2 + n_2 d_2^2}{(n_1 + n_2)\mu^2}$$

$$= \frac{n_1 \mu_1^2 s_1^2/\mu_1^2 + n_2 \mu_2^2 s_2^2/\mu_2^2}{(n_1 + n_2)\mu^2} + \frac{n_1 d_1^2 + n_2 d_2^2}{(n_1 + n_2)\mu^2}$$

$$= \frac{n_1 \mu_1^2 CV_1^2 + n_2 \mu_2^2 CV_2^2}{(n_1 + n_2)\mu^2} + \frac{n_1 d_1^2 + n_2 d_2^2}{(n_1 + n_2)\mu^2}$$

$$= \frac{n_1 \mu_1^2 CV_1^2 + n_2 \mu_2^2 CV_2^2}{n_1 \mu_1^2 + n_2 \mu_2^2} * \frac{n_1 \mu_1^2 + n_2 \mu_2^2}{(n_1 + n_2)\mu^2} + \frac{n_1 d_1^2 + n_2 d_2^2}{(n_1 + n_2)\mu^2} \qquad (16)$$

Let, $\frac{n_1 \mu_1^2 + n_2 \mu_2^2}{(n_1 + n_2)\mu^2} = 1 + \lambda$

Equation (16) becomes

$$CV^2 = \frac{n_1 \mu_1^2 CV_1^2 + n_2 \mu_2^2 CV_2^2}{n_1 \mu_1^2 + n_2 \mu_2^2}(1 + \lambda) + \frac{n_1 d_1^2 + n_2 d_2^2}{(n_1 + n_2)\mu^2}$$

$$= \frac{n_1 \mu_1^2 CV_1^2 + n_2 \mu_2^2 CV_2^2}{n_1 \mu_1^2 + n_2 \mu_2^2} + \lambda \frac{n_1 \mu_1^2 CV_1^2 + n_2 \mu_2^2 CV_2^2}{n_1 \mu_1^2 + n_2 \mu_2^2} + \frac{n_1 d_1^2 + n_2 d_2^2}{(n_1 + n_2)\mu^2}$$

(17)

Therefore, the general form of such type of decomposition can also be rewrite as:

$$CV^2 = \frac{\sum_{i=1}^{k} n_i \mu_i^2 CV_i^2}{\sum_{i=1}^{k} n_i \mu_i^2} + \lambda\left[\frac{\sum_{i=1}^{k} n_i \mu_i^2 CV_i^2}{\sum_{i=1}^{k} n_i \mu_i^2}\right] + \frac{\sum_{i=1}^{k} n_i d_i^2}{n \mu^2}$$

The first part is this expression is therefore the 'net within' element of the squared coefficient of variation and the last part is the 'net between' element of it. However, it cannot be perfectly decomposed into 'within' element and 'between' element because of the existence of the term

$[\lambda \frac{n_1 \mu_1^2 CV_1^2 + n_2 \mu_2^2 CV_2^2}{n_1 \mu_1^2 + n_2 \mu_2^2}]$ in between the above mentioned two elements. One part of the term $[\lambda \frac{n_1 \mu_1^2 CV_1^2 + n_2 \mu_2^2 CV_2^2}{n_1 \mu_1^2 + n_2 \mu_2^2}]$ (this term may be called 'interaction') exists in the 'within' element and another part of it exists in the 'between' element.

4. EMPIRICAL SECTION

Decomposition Analysis by Different Measures in Bankura

From the estimated results given in table 2 it seems that, for Bankura in 2004-05 in presence of overlapping population, 35.10 percent of the variability of the relative inequality in Lorenz-Gini family measured by Gini index (G) is for within variability while 43.64 percent of the variability of G is for between variability and 21.26 percent of the variability of G is for transvariation. Similarly, in presence of overlapping population, 54.95 percent of the variability of the relative inequality in SD-CV family measured by squared coefficient of variation (CV^2) is for within variability while only 16.72 percent of the variability of CV^2 is for between variability and 28.33 percent of the variability of CV^2 is for interaction. On the other hand, by considering overlapping population as early mentioned variance can be decomposed perfectly, in Bankura in 2004-05, 83.28 percent of the variability of absolute inequality in SD-CV family measured by variance (V) is for within variability while 16.72 percent of the variability of V is for between variability.

In 2009-10 in presence of overlapping population, 33.66 percent of the variability of the relative inequality in Lorenz-Gini family measured by Gini index (G) is for within variability while 29.99 percent of the variability of G is for between variability and 36.35 percent of the variability of G is for transvariation in Bankura. In the same way, in presence of overlapping population, 47.29 percent of the variability of the relative inequality in SD-CV family measured by squared coefficient of variation (CV^2) is for within variability while only 6.24 percent of the variability of CV^2 is for between variability and 46.48 percent of the variability of CV^2 is for interaction. On the other hand, by considering overlapping population as early mentioned variance can be decomposed perfectly, in Bankura in 2009-10, 93.76 percent of the variability of absolute inequality in SD-CV family measured by variance (V) is for within variability while

6.24 percent of the variability of V is for between variability.

Table-2: Social Group Decomposition by different measures (Gini decomposition, Squared CV decomposition and Variance decomposition) in Bankura from 2004-05 to 2011-12

Year	Gini Decomposition			Squared CV Decomposition			Variance Decomposition	
	Net Within (Percent)	Between (Percent)	Transvariation (Percent)	Net Within (Percent)	Net Between (Percent)	Interaction (Percent)	Within (Percent)	Between (Percent)
2004-05	35.10	43.64	21.26	54.95	16.72	28.33	83.28	16.72
2009-10	33.66	29.99	36.35	47.29	6.24	46.48	93.76	6.24
2011-12	33.83	41.38	24.80	49.87	14.34	35.78	85.66	14.34

In 2011-12 in presence of overlapping population, 33.83 percent of the variability of the relative inequality in Lorenz-Gini family measured by Gini index (G) is for within variability while 41.38 percent of the variability of G is for between variability and 24.80 percent of the variability of G is for transvariation in Bankura. In the same way, in presence of overlapping population, 49.87 percent of the variability of the relative inequality in SD-CV family measured by squared coefficient of variation (CV^2) is for within variability while only 14.34 percent of the variability of CV^2 is for between variability and 35.78 percent of the variability of CV^2 is for interaction. On the other hand, by considering overlapping population as early mentioned variance can be decomposed perfectly, in Bankura in 2011-12, 85.66 percent of the variability of absolute inequality in SD-CV family measured by variance (V) is for within variability while 14.34 percent of the variability of V is for between variability.

By applying these measures for sectoral decomposition (rural sector and urban sector), table 3 shows that, in Bankura in 2004-05 in presence of overlapping population, 80.71 percent of the variability of the relative inequality in Lorenz-Gini family measured by Gini index (G) is for within variability while 4.64 percent of the variability of G is for between variability and 14.64 percent of the variability of G is for transvariation. Similarly, in presence of overlapping population, 95.69 percent of the variability of the relative inequality in SD-CV family measured by squared coefficient of variation (CV^2) is for within variability while only 3.59 percent of the variability of CV^2 is for between variability and 0.71 percent of the variability of CV^2 is for interaction. On the other hand, by considering overlapping population as early mentioned variance can be decomposed perfectly, in Bankura in 2004-05, 96.41 percent of the variability of absolute inequality in SD-CV family measured by variance (V) is for within variability while 3.59 percent of the variability of V is for between variability.

Table-3: Sectoral Decomposition by different measures (Gini decomposition, Squared CV decomposition and Variance decomposition) in Bankura from 2004-05 to 2011-12

Year	Gini Decomposition			Squared CV Decomposition			Variance Decomposition	
	Net Within (Percent)	Between (Percent)	Transvariation (Percent)	Net Within (Percent)	Net Between (Percent)	Interaction (Percent)	Within (Percent)	Between (Percent)
2004-05	80.71	4.64	14.64	95.69	3.59	0.71	96.41	3.59
2009-10	69.83	0.26	4.11	70.07	21.97	7.97	78.03	21.97
2011-12	78.96	15.43	5.62	88.22	9.19	2.59	90.81	9.19

In 2009-10 in presence of overlapping population, 69.83 percent of the variability of the relative inequality in Lorenz-Gini family measured by Gini index (G) is for within variability while 0.26 percent of the variability of G is for between variability and 4.11 percent of the variability of G is for transvariation in Bankura. Similarly, in presence of overlapping population, 70.07 percent of the variability of the relative inequality in SD-CV family measured by squared coefficient of variation (CV^2) is for within variability while only 21.97 percent of the variability of CV^2 is for between variability and 7.97 percent of the variability of CV^2 is for interaction. On the other hand, by considering overlapping population as early mentioned variance can be decomposed perfectly, in Bankura in 2009-10, 78.03 percent of the variability of absolute inequality in SD-CV family measured by variance (V) is for within variability while 21.97 percent of the variability of V is for between variability.

In 2011-12 in presence of overlapping population, 78.96 percent of the variability of the relative inequality in Lorenz-Gini family measured by Gini index (G) is for within variability while 15.43 percent of the variability of G is for between variability and 5.62 percent of the variability of G is for transvariation in Bankura. Similarly, in presence of overlapping population, 88.22 percent of the variability of the relative inequality in SD-CV family measured by squared coefficient of variation (CV^2) is for within variability while only 9.19 percent of the variability of CV^2 is for between variability and 2.59 percent of the variability of CV^2 is for interaction. On the other hand, by considering overlapping population as early mentioned variance can be decomposed perfectly, in Bankura in 2011-12, 90.81 percent of the variability of absolute inequality in SD-CV family measured by variance (V) is for within variability while 9.19 percent of the variability of V is for between variability.

5. CONCLUSION

In the light of the preceding analysis we can say that, a decomposable measure of inequality simply refers as a measure such that the variability of total inequality can be divided into two parts: 'within inequality' and 'between inequalities'. The 'within inequality' element captures the inequality due to the variability of income within each group, while the 'between inequalities' captures the inequality due to the variability of income across different groups. By considering plural view of inequality measures (both absolute and relative) for two widely talked-about families of inequality measurement (Gini family and SD-CV family) in the literature, the empirical results show that and also we conclude that, in a backward district of West Bengal say, Bankura district, the variance (as an absolute measure in SD-CV family) is the most suitable measure for perfect decomposition of inequality. On the other hand, squared coefficient of variation (as a relative measure in SD-CV family) is far better measure for such purpose than Gini index (as a relative measure in Gini family) though they cannot be perfectly decomposed. Since one of the key points of inequality analysis is represented by the overlapping units, the effect of overlapping component on inequality decomposition is also considered.

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