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# **Income sources and inequality in West Africa: the case of rural Southern Mali**

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**This article uses the income source decomposition of the Gini coefficient to analyze the impact of crop, livestock and non-farm income on household income inequality in rural Southern Mali. After pinpointing the importance of the different income sources for the whole sample as well as for different income groups, the article decomposes total rural income distribution among the above quoted sources. This decomposition shows that crop and non-farm incomes are inequality-decreasing, while livestock income is inequality-increasing. The study then decomposes crop income, the major contributor to income inequality, in food versus cash crop, namely cotton. This analysis reveals that cotton is an inequality-increasing income while food income is inequality-decreasing. It concludes with policy recommendations aiming at reducing inequality, with special attention to the poorest.**

**Key words: Rural households, Gini coefficient, income decomposition, inequality, Mali.**

## **1. Introduction**

Ever since the acknowledgement of the diversified nature of rural households (Haggblade and al., 1989; Reardon and al., 1992; Von Braun and Pandya-Lorch, 1991), there is an increasing interest in understanding the factors of diversification as well as the links between income sources and their effects on household welfare and rural income growth. The distributional effect of income sources on total income in rural West Africa is the focus of this paper.

Agricultural income is generally found to make the largest contribution to income inequality, its key determinant being the uneven land distribution, and to be inequality-decreasing (Adams and He, 1995; Estudillo, 1997; Reardon and Taylor, 1996). The contribution of cash crops to inequality is yet another issue. On the one hand, the introduction of cash

crops is been seriously criticized as having a major negative effect on the inequality of living conditions. Furthermore, the production of cash crops has often been accompanied by better access to technology (Le-caillon and al, 1984). Expressed briefly, the rich benefit more from the production of cash crops. On the other hand, cash crop production may be used to spread income and market risks. The increased income of cash crop producers can also result in growth linkages in the rural areas which can generate employment, benefiting the lower income households (Lele and Adu-Nyako, 1992; Delgado, 1995).

Livestock income effect on inequality is also problematic as outputs of this activity are of several natures and have various roles such as accumulation, prestige, risk-smoothing and production factor for crop. The few studies available in Africa found livestock ownership to be highly unevenly distributed (Collier and al, 1990; Reardon and Taylor, 1996). This might imply a negative effect of livestock income on total income. Empirical studies found mixed findings. In Asia, livestock income is inequality-decreasing (Adams and He, 1995), while in West Africa, the effect can be of opposite direction and depends on the agro-climatic zone (Reardon and Taylor, 1996).

The growing literature on non-farm income shows no general agreement on the impact of non-farm income on income distribution. Empirical reviews found an inequality-decreasing effect of non-farm income in various Asian countries and an inequality-increasing effect in Sub-Saharan Africa (Adams and He, 1995; Reardon and Taylor, 1996). This discrepancy has been argued by the mentioned authors in the settings. Land-scare and labour-rich areas such in many Asian countries may „push“ poorer households out of agriculture in non-farm activities, while in Sub-Saharan Africa, where land is more plentiful and more equally distributed and labour more constrained, only richer households might be able to overcome entry barriers to more remunerative non-farm income.

This paper estimates income inequality in a rural area where, to our knowledge, no such studies have ever been carried out. It uses household data to pinpoint the structure of income inequality and identify the contribution of crop, livestock and non-farm incomes to overall income inequality in rural Southern Mali. The impacts of food versus cash crop on total income inequality are also analyzed. The Gini elasticity of each income source is estimated. Inequality decomposition by income sources, allows identification of the contribution of the various household economic sectors to income inequality. This desegregation fulfils the prerequisites of meaningful policy recommendations.

The paper first describes of the decomposition procedure used in this paper. The region and the data set are then presented. The third section presents income sources. The decomposition analysis is then applied to the sample from rural Southern Mali. The contribution of the various income sources to overall income and to crop income are calculated. Finally, the last section summarizes the results.

## **2. Measurement and decomposition of inequality**

The Gini coefficient is selected as the measure of income inequality. One of its advantage lies in its interpretation which is intuitively understandable as it is easily conceptualized in terms of the Lorenz curve. Second, it allows interaction between productive activities and the addresses the problem of covariance among income sources. As Adams and He (1995) state, the decomposition of income inequality into income sources must reflect the fact that activities which influence a particular source of income are likely to have an effect on other activities that compose total income. Income sources can overlap and this must be accounted for. Third, it satisfies the axioms of scale irrelevance, symmetry and rank-preserving equalization. Furthermore, it is sensitive to income changes at the distribution mid-point. Finally, it permits measurement of the gross contribution of each income source to total inequality.

While estimation of the Gini coefficient of each income source does give a measure of income distribution, it nevertheless does not reflect whether inequality tends towards the lower or the higher income group (Reardon and Taylor, 1996). The Gini coefficient of total income can be misleading. Several decomposition methodologies have been developed based on the work of various authors (Shorrocks, 1982; Ercelown, 1984). Here an approach recently employed in Pakistan (Adams and He, 1995; Alderman and Garcia, 1993) and Burkina Faso (Reardon and Taylor, 1996) has been used. It can be shown that the Gini coefficient  $G$  can be decomposed by income sources as:

$$G = \sum w_i R_i G_i$$

with  $S$  = Share of income  $i$

$$w_i = Y_i / Y$$

$$R_i = \text{cov}(Y_i, r_Y) / \text{cov}(Y_i, r_{Y_i})$$

$$G_i = 2 \text{cov}(Y_i, r_{Y_i}) / nY_i$$

$Y$  = Total income

$r$  = Total income rank

The decomposition of the Gini coefficient can then be expressed with the following terms:

$$\sum w_i R_i G_i / G = \sum w_i g_i$$

$$\text{with } \sum w_i g_i = 1$$

where  $w_i g_i$  is the factor inequality weight of the  $i$ th source in overall inequality. It gives the proportion of inequality contributed by the source of income  $i$ .  $g_i$  is the relative concentration coefficient of the  $i$ th source in overall inequality. Assuming that additional increments of an income source are distributed the same way as the original units, an income source is defined as inequality-increasing or decreasing on the basis of whether additional shares of income from that source lead to an increase or decrease in overall income inequality. The income source  $i$  is inequality-increasing when the corresponding value of  $g_i$  is greater than one (and decreasing when it is smaller than one). The Gini coefficients for each income sources are then estimated. The closer the Gini coefficient is to the value 0, the more equal is the distribution. A value close to one indicates highly unequal distribution.

### 3. Data and geographical settings

The data used in this study come from a household survey that was carried out between 1994/95 and 1995/96 by the author. A two-stage sampling was used to select 120 households from 15 villages in the regions of Sikasso and Koutiala<sup>1</sup>. The sample size was determined with

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<sup>1</sup> Twelve households fell out of the analysis because of incomplete information

the configuration suggested by De Groot (1993) and based on the census statistics of rural production units from the Cellule-Evaluation of the Compagnie Malienne de Développement des Textiles (CMDT). Semi-structured interviews were conducted during the dry seasons with at least two active members of each household, a man and a woman. Additional survey data were obtained from the CMDT.

The study region is poor-to-intermediate agro-climatically, with mean average rainfall of 700-1100 mm (Berckmoes and al., 1990). Household activities are dominated by rain-fed crop production, mainly coarse grains, rice and cotton, and livestock. Coarse grain yields are low while cotton productivity is one of the highest in West Africa (Berckmoes and al., 1990). Cotton is grown by the majority of the rural households. Infrastructure is strongly related to the cotton sector which highly integrated. The CMDT is responsible for rural development, providing most agricultural services, such as inputs and extension as well as buying and selling cotton. Cotton is also the major collateral for credit in the area.

#### **4. Income sources in Southern Mali**

Total household income is defined as the imputed net value of food and cash crop production, plus livestock sales, and home consumption, plus net cash receipts from all non-farm sectors, plus transfers. Table 1 differentiates rural households by income quintiles. Results show that Southern Mali rural household economies are indeed diversified. Crop income makes the bulk of total income with 67 % on average for all households. Cotton accounts for 40 %, while food crops accounts for just 26 % of total household income per capita. On average, non-cropping income constitutes about 33 % of total income. This proportion is closer to the figure reported by De Groot (1994) and Dembele et al. (1996) in the same area. Most of non-crop income comes from livestock, mainly cattle. Cash-oriented non-farm activities provide only 6 % of total household income per capita.

The richer own more than 10 times overall income than the poorer. This result is similar to the findings of the Direction Nationale de la Statistique et de l'Informatique (DNSI, 1991). Food crop income share declines across income quintiles while the share of cotton income increases from 39 % to 61 %. Livestock income increases from 3 % to 21 %. No distinct pattern for cash-oriented non-farm activities, suggesting that income from non-farm activities is unlikely to account for the differences in income across quintiles.

Table 1: Income sources across income per capita quintiles, Southern Mali, 1995/96

	Total Income (1000 FCFA/capita)	Food crop (%)	Cotton (%)	Livestock (%)	Non-farm (%)
Lowest	54	57.8	38.8	2.8	1.4
Second	210	39.1	39.9	22.5	13.6
Third	366	17.5	47.4	23.6	11.4
Fourth	619	18.8	48.5	30.7	3.6
Highest	971	15.7	61.1	21.1	2.1
All	696	26.3	40.3	24.5	8.7

Note: N = 108

The correlations between land ownership and food crop, cotton and livestock incomes are lower than 0.5 but positive and significant, while it is negative, but not significant between land ownership and non-farm income. This might suggest that non-farm income is not linked with land ownership and might be of potential importance to small land size households.

Table 2 presents households ranked by size of landholding. The data reveals an inverse relationship between the size of landholding and the share of food and non-crop incomes. For the households with low size of landholding, non-farm income accounts for 20 % of per capita household income. Not only do the poor receive 20 % of their total income from non-farm sources, but the share of non-farm income decreases monotonically by size of landholding.

Table 2: Total income, income shares by sources and assets of rural households ranked by farm size, Southern Mali, 1995/96

	Farm size (ha/household)					All
	< 3.00	3.25 - 5.50	6.00 - 8.75	9.00 - 12.75	> 13.00	
Households distribution (%)	20.0	20.0	20.0	20.0	20.0	100
Population distribution (%)	8.4	13.0	20.9	33.6	33.6	100
Income composition						
Food crop (%)	36.9	34.6	23.5	18.1	18.8	26.3
Cotton (%)	9.9	33.2	50.7	53.7	54.2	40.3
Livestock (%)	33.6	18.6	21.8	23.6	25.0	24.5
Non-farm (%)	19.6	13.6	3.8	4.6	2.0	8.7
Net income distribution						
Per capita (%)	9.9	11.6	18.9	25.5	34.1	100

Notes: N = 108

## 5. Sources of total income inequality

The first column of Table 3 shows the shares of crop, livestock and non-farm incomes in total income as seen above. The second column indicates the „simple“ Gini coefficient for each income sources. Coefficients are 0.49 for crop and 0.85 and 0.86 for livestock and non-farm incomes. The latter two income distributions are far more uneven than the distribution of crop income, while all three are higher than overall income inequality, 0.46, due to the fact that the three incomes overlap. These figures show that the Gini inequality measure is only a mildly aggregate decomposition measure. To obtain the correct relationship between the overall coefficients, one has to calculate the so-called pseudo-Gini coefficient, given in column 4 of the same Table <sup>2</sup>.

<sup>2</sup> The latter corresponds to the Gini coefficient that would be obtained if households in that sector were not arranged with their incomes monotonically increasing (Fields, 1980).



The income inequality weight is estimated by taking the income shares and the correlation of both sources to overall inequality. This reveals that livestock contributes to more than half to total income inequality. All concentration ratios  $g_i$  are positive. This implies that the relationship between a factor income of a given type and total income is positive. None of the values are zero. A relative concentration coefficient over unity reflects inequality-increasing sources of income, while inequality-decreasing values lie between nil and 1. This implies that livestock income is inequality-increasing and crop and non-farm incomes are inequality-decreasing.

Table 3: : Share of income, simple Gini coefficient, correlation ratio, coefficient of concentration, pseudo-Gini and Gini elasticity for crop, livestock and non-farm income, Southern Mali, 1995/96

Income source	Income share in total income $w_i$	Source Gini $G_i$	$R_i$	$R_i * G_i$	Income inequality weight $g_i$	Factor inequality weight $S_i$	Gini elasticity
Crop	0.68	0.49	0.91	0.44	0.95	0.65	-0.04
Livestock	0.23	0.85	0.74	0.63	1.34	0.31	0.08
Non-farm	0.09	0.86	0.18	0.15	0.32	0.05	-0.04
Total	1.00	0.46				1.00	

Notes:  $N = 108$ ;  $R_i = (Y_i / rY)$ ;  $g_i = R_i * G_i / G$ ;  $S_i = w_i * g_i * 100$ ; Gini elasticity =  $S_i - w_i$

Crop income makes the largest share of overall income inequality with 65 %. Livestock represents about one third of overall income inequality while non-farm accounts for 5 %. The Gini elasticity of the examined income source, that is the change in  $G$  due to income source, is presented in the last column. Results show that an increase of one percent in crop income, everything else remaining constant, would induce a reduction of the total income inequality coefficient,  $G$ , by 4 %. A one percent increase in non-farm income at the same conditions would induce a reduction of total inequality coefficient of 4 %. Livestock income shows the opposite, namely an increase of total inequality coefficient of 8 %.

## 6. Sources of crop income inequalities

The same decomposition is used for crop income. Table 4 indicates that cotton is an inequality-increasing income source. An increase of one percent in cotton income would increase inequality 12 %, everything else remaining constant. This is due to the high share of cotton in crop income, the very high correlation between cotton income and total income and the high level of the Gini coefficient. The share of cotton in total crop income inequality represents more than 80 %.

Table 4: Share of income, simple Gini coefficient, correlation ratio, coefficient of concentration, pseudo-Gini and Gini elasticity for crop income sources, Southern Mali, 1995/96

Income source	Income share in total income $w_i$	Source Gini $G_i$	$R_i$	$G_i * R_i$	Income inequality weight $g_i$	Factor inequality weight $S_i$	Gini elasticity
Cereals (a)	0.19	0.52	0.36	0.18	0.39	0.07	-0.11
Cotton	0.72	0.58	0.98	0.57	1.16	0.84	0.12
Other crops	0.09	0.87	0.43	0.37	0.79	0.07	-0.02
Crop income	1.00	0.49					

Notes: N = 108, a) includes cereal in mixed cropping;  $R_i = (Y_i / rY)$ ;  $g_i = R_i * G_i / G$ ;  $S_i = w_i * g_i * 100$ ; Gini elasticity =  $S_i - w_i$

Cereals and the other crops are inequality-decreasing income sources. Their share of Gini inequality in overall crop income inequality is low, less than 15 %.

## 7. Summary and conclusions

This article has examined the impact of crop, livestock and non-farm incomes on income inequality in rural Mali using data from 108 households.

Crop income represents the largest source of rural household income, 68 %, but is also the major source of income inequality, namely for 65 % of total income inequality. This is largely because crop income is strongly correlated with asset holdings, namely land. With all other factors held constant, additional increment of crop income will reduce overall income inequality. Cotton, the main cash crop, is an inequality-increasing source of income and represents the major share of total crop income. It is also strongly correlated to land holdings. On average, cotton income accounts for less than 10 % of total net income. On the other hand, cereals and other food crops are found to be inequality-decreasing. Their added contribution to total income represents less than a third on average.

The share of non-farm income is the lowest, namely 9 % and merely accounts for 5 % of total inequality. However, the impact of non-farm income on total income distribution is positive. Furthermore, households with less than 3 ha rely for one fifth on non-farm income while the same income source represents less than 2 % for households with more than 13ha. Livestock income is found to be inequality-increasing and represents a third of total income inequality. It is positively correlated with land.

The formulation of policies aiming at inequality reduction should take into account the following issues. First, emphasis should be put on increasing food crops yields. Their income is inequality-decreasing and also accounts for more than a third of the poor total income. Second, even though non-farm income only represents 9 % of total income inequality on average, effort should be made on improving access to low capital-intensive non-farm activities, particularly for small farms. These recommendations do not reduce the need to continuously foster the sustainable production of cotton, the real „engine of growth“ in Southern Mali.

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## Zusammenfassung

In diesem Artikel werden die Verteilungseffekte des land- und viehwirtschaftlichen sowie des nicht landwirtschaftlichen Einkommens im ländlichen Süd Mali analysiert. Die Methode beinhaltet die Einkommensverlegung des Gini Koeffizient und basiert auf cross-sectionalen Daten. Diese Aufschlüsselung zeigt, dass das Einkommen aus Ackerbau sowie das aus nicht landwirtschaftlicher Tätigkeit einen positiven Effekt auf die Einkommensungleichheit hat, während das Viehwirtschafts-Einkommen negativ wirkt. Weiter werden die Auswirkungen von cash crops (hauptsächlich Baumwolle) und Nahrungsmittelproduktion auf die Einkommensverteilung analysiert. Dabei zeigt sich, dass Baumwolle die Einkommensungleichheit erhöht, während sie durch Einkommen aus der Nahrungsmittelproduktion verringert wird. Der Artikel schliesst mit Empfehlungen, um Einkommensungleichheiten zu reduzieren.

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