

## A Factor Component Analysis of the Sources of Income Inequality in the Limpopo River Basin of South Africa

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**Abstract:** Income inequality is detrimental to economic development because of its direct linkage to crimes, political unrest and corruption. This study analyzed the contributions of different sources of income to inequality in the South Africa's Limpopo River Basin. The data used were for 704 households that provided information on sources of their income. The decomposition method proposed by Stark *et al* (1996) was used. The results show that incomes from crops, livestock and non-farm assets constitute the highest proportions of rural households' income. Inequality is generally high in all the districts with Rustenburg and Witrivier having the highest Gini coefficients. Out of the income sources, crop and livestock sources increased inequality. It was recommended that efforts to redress inequality should include promotion of non-farm enterprises and ensuring conducive environment for people to work in any part of the country without fear of molestation irrespective of race, among others.

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### 1. Introduction

Development economists have over the past few decades debated and seriously advocated for rapid reduction in poverty and inequality. Despite some commitments shown by many developing countries towards achieving these, in many cases, there is lack of strong political will and sincere commitments. In many countries, increase in income inequality raises serious humanitarian concerns and some fears of political stability. It is now clear that without equity in access to physical and financial resources, the policy environment that is required for rapid economic growth cannot be provided where wide inequality persists (Clarke *et al*, 2003; Oyekale *et al*, 2006).

Since the 1990s, development policy makers have been concerned about pertinent issues that are related to how much of the dividends of economic growth reach the poor (Kakwani *et al*, 2004). It has also become evident that economic reforms that are required for rapid poverty alleviation are those that can deliver more of the benefits of growth into the hands of the poor. This had been tagged *pro-poor growth* and emphasis had been placed on increase in the average income of the poor and concurrent reduction in inequality. Therefore, the theoretical and empirical attentions that are given by development economists to the distribution of income and wealth are worthwhile, because high level of income inequality produces an unfavorable environment for economic growth and human development.

The Millennium Development Goals (MDGs) provide a timely blueprint and urgent

reminder to policy makers about the need to prioritize their development agendas in a manner that achieves better living conditions for the marginalized poor population. In many instances, however, bridging the gaps between the few extremely rich and the extremely poor majority remains a daunting challenge. This is because of peculiar characteristics of the poor that facilitated their being trapped in poverty. For instance, most of the times, the poor lacks basic education, access to financial resources, access to land and ability to utilize emerging opportunities within the economy for the utmost benefit of lifting households' incomes above the national averages. Therefore, some targeted reforms do not often bring rapid results in the form of reduction in poverty and inequality.

There is now consensus among policy makers that poverty cannot be reduced if the level of inequality is high (Addison and Cornia, 2001). This finding has completely rebuffed earlier theories of development that emphasized inequality as a pre-condition for economic growth and poverty reduction (Aigbokhan, 2008). Conceptually, inequality implies dispersion of a distribution, whether one is considering income, consumption, or some other welfare indicators or attributes. Although distinct as concepts, income inequality is often studied as part of the broad analyses covering poverty. However, inequality is a broader concept than poverty because it is defined over the whole distribution (Litchfield, 1999; Cowell, 1999).

Decomposition of income inequality is desirable because it enables us to examine the

contribution to inequality of particular group or households with specific characteristics. It can also be used to assess the influence of different income components on overall inequality. Studying inequality is also important because its interaction with other economic problems often results in discontent, violence and corruption. Therefore, as part of microeconomic objectives, governments often give equitable distribution of income a priority (Oyekale, 2006).

In South Africa, the poverty situation is quite pathetic despite existence of social infrastructure that is comparable to what obtains in many developed countries. The country is sharply divided into two groups of the affluent and the destitute. It had been estimated that while more than half of South African population is poor, majority of the poor live in rural areas. Similarly, South Africa's income inequality in 1993 was the fourth worse out of 105 countries (Madzwamuse, 2010).

Specifically, high levels of inequality in South Africa can be traced to history of colonialism and apartheid. Majority of the black population were dispossessed of their land and denied access to vital development resources and adequate services such as health care, housing and education. After national independence and return to democratic government in 1994, policies and economic reforms to redress inequality in access to resources have been put in place. This is to ensure respect of fundamental human rights and provision of a development approach that focuses on human justice, resource equity and economic sustainability (Madzwamuse, 2010). However, not much success had been achieved because the bulk of the nation's resources are still concentrated in the hands few affluent segment of the population.

The situation in the Limpopo River Basin is more devastating due to small land holdings of majority of the farmers. In South Africa at large, commercial farming occupies 85 percent of the countryside farming activities. Although contributing a lot to South Africa's Gross Domestic Product (GDP), the Limpopo River Basin is particularly susceptible to adverse climatic situations like drought, flood and hailstorms. Increasing population pressure is putting serious pressure on the natural resources, with persistent degradation resulting from agricultural intensification. Therefore, currently available natural resources cannot provide rural people guaranteed livelihoods to escape from poverty. This paper therefore seeks to determine the sources of income inequality in the Limpopo River Basin. The remaining sections of the paper present the adopted methodology, discussions of the results

from data analysis and the policy issues that emanated from the findings.

## 2. Materials and Methods

### *The data and sampling methods*

This study used the data that were collected by the International Food Policy Research Institute (IFPRI) and the Center for Environmental Economics & Policy in Africa (CEEPA). Permission to download the data was granted by IFPRI. The survey was based on 794 households that completed the questionnaires out of 800 that were initially targeted. However, due to lack of data on income sources, only 704 households were used for this study. The multi-stage sampling method was used to select 20 districts in the South Africa's Limpopo River Basin. The selected districts reflect key Water Management Areas (WMAs) and agricultural production activities. At the first stage, total number of sample districts was identified. At the second step, 20 districts were selected out of the 5 WMAs. The third step involved determining the distribution of the 20 districts across the 4 provinces in the basin. The Gauteng (2), Limpopo (9), Mpumalanga (6) and North West (3) were selected. The fourth step involved random sampling of farm households that undertook some farming activities during the April 2004 to May 2005 farming season. The survey was carried out between August and November 2005.

### **Analytical methods**

We followed the approach of Lerman and Yitzhaki (1985) which was adopted by Azam and Shariff (2009). The specification begins by expressing Gini-coefficient for total income inequality  $G$  as follows:

$$G = \sum_{k=1}^K S_k G_k R_k \quad 1$$

where  $S_k$  represents the share of component  $k$  in total income,  $G_k$  is the source Gini corresponding to the distribution of income from source  $k$ , and  $R_k$  is the Gini correlation between income from source  $k$  and total income.

$$R_k = \text{cov}\{Y_k, F(Y)\} / \text{cov}\{Y_k, F(Y_k)\} \quad .2$$

where  $F(Y)$  and  $F(Y_k)$  are the cumulative distributions of total income and income from source  $k$  respectively. Stark *et al* (1996) submitted that equation 1 can be decomposed into three components which show how important the income source is with respect to total income ( $S_k$ ), how equally or unequally distributed the income source is ( $G_k$ ) and how the income source and the distribution of total income are correlated ( $R_k$ ). Lerman and Yitzhaki (1985) showed that using this approach, it is possible to determine effect of small changes in a specific income source on inequality, holding income from all

other sources constant. If there is a small change in income from source  $k$  that is equal to  $eY_k$ , where  $e$  is close to 1 and  $Y_k$  represents income from source  $k$ , we can show that the partial derivative of the Gini coefficient with respect to a percent change ( $e$ ) in source  $k$  is equal to

$$\frac{\partial G}{\partial e_k} = S_k(R_k G_k - G) \quad \dots 3$$

where  $G$  is the Gini coefficient of total income inequality prior to the income change. The percent change in inequality resulting from a small percent change in income from source  $k$  equals the original contribution of source  $k$  to income inequality minus source  $k$ 's share of total income:

$$\frac{\frac{\partial G}{\partial e_k}}{G} = \frac{S_k R_k G_k}{G} - S_k \quad \dots 4$$

### 3. Results

#### *Average income from different sources*

Table 1 shows the average income from different sources as reported by selected farmers in the Limpopo River Basin of South Africa. It shows that Cullinan and Tzaneen (Letaba) districts have

highest average annual nonfarm labour incomes with R 27425.00 and R 26618.60 respectively. However, Brankhortspruit and Brits have the lowest average annual non-farm labour incomes with R 3408.70 and R 3976.92 respectively. While many of the districts recorded no income for gifts, average annual incomes obtained through remittances are too small. The bulk of the incomes were derived from crops, livestock and non-farm assets. The largest annual average incomes from crops were recorded for Rustenburg and Lephalale (Ellistras) with R 425053.31 and R 147144.15 respectively. Lowest values were recorded for Brankhortspruit and Brits with R 1865.22 and R 2493.46 respectively. Under livestock average incomes, the highest were for Witrivier and Warmbad with R 496589.58 and R 82986.54, respectively. Incomes from non-farm assets are highest in Rustenburg and Witrivier with R 461235.97 and R 198022.92, respectively. Also, average total income is highest in Rustenburg and Witrivier with R 926772.45 and R 805008.67, respectively.

Table 1: Average incomes from different sources in selected districts of South Africa's Limpopo River Basin

District	Non farm labour	Gift	Remittances	Crop	Livestock	Pension	Savings	Farm asset	Non farm asset	Total income
Brankhortspruit	3408.70	295.65	217.39	1865.22	8413.04	4271.30	1153.48	260.87	16138.70	36024.35
Brits	3976.92	0.00	785.77	2493.46	21514.27	5612.31	0.00	0.00	33198.04	67580.77
Carolina	7080.00	0.00	120.00	26780.88	7322.80	4232.80	31.20	0.00	10789.60	56357.28
Cullinan	27425.00	0.00	0.00	11175.00	0.00	2340.00	0.00	0.00	45595.00	86535.00
Krugersdorp	14280.00	30.00	1248.00	49511.50	7545.00	7848.00	0.00	0.00	76978.50	157441.00
Lephalale (Ellistras)	10783.28	32.79	769.18	147144.15	5220.90	2599.18	306.89	0.00	46147.72	213004.08
Lydenburg	7495.29	0.00	664.71	37791.09	3290.47	4849.41	0.00	0.00	48783.29	102874.26
Makopopane	16336.00	20.00	108.20	20977.40	3604.84	577.20	96.00	0.00	41769.00	83488.64
Marico	6087.80	0.00	121.95	55229.88	35687.15	2961.95	0.00	0.00	69497.00	169585.73
Messina	4662.86	0.00	2057.14	102901.97	8858.86	1837.66	0.00	0.00	30163.69	150482.17
Middelburg	24430.87	239.13	272.61	12903.04	27048.39	4265.65	1173.91	43.48	117207.09	187584.17
Nebo	27677.78	0.00	453.89	18772.22	30551.72	5947.50	833.33	0.00	13481.67	97718.11
Nkomazi	14882.76	0.00	995.86	5217.93	7328.93	5257.24	0.00	0.00	33450.31	67133.03
Rustenburg	13996.55	34.48	0.00	425053.31	23871.79	2163.10	417.24	0.00	461235.97	926772.45
Soutpansberg	12673.49	5.56	782.70	5173.90	4843.19	2745.71	555.56	0.00	26408.79	53188.90
Thabazimbi	16340.67	4.50	65.33	11805.67	1575.00	4475.33	0.00	0.00	34617.67	68884.17
Thohoyandou	16266.67	0.00	5017.33	40347.07	2093.89	4601.56	422.00	0.00	45692.69	114441.20
Tzaneen (Letaba)	26618.60	0.00	2265.81	50261.47	11202.09	3482.79	190.70	2674.42	96191.93	192887.81
Warmbad	7573.08	80.77	2968.08	4983.27	82986.54	4296.54	230.77	923.08	18223.08	122265.19
Witrivier	9746.88	2.08	90.00	94931.38	496589.58	4430.00	1195.83	0.00	198022.92	805008.67

Table 2: Rural Gini-coefficients across the districts in Limpopo River Basin of South Africa

District	Estimated S-Gini	Population Share	Income Share	Absolute Contribution	Relative Contribution
Brankhortspruit	0.4625	0.0327	0.0059	0.0001	0.0001
Brits	0.5983	0.0369	0.0125	0.0003	0.0003
Carolina	0.7250	0.0355	0.0100	0.0003	0.0003
Cullinan	0.5766	0.0057	0.0025	0.0000	0.0000
Krugerdsorp	0.6783	0.0142	0.0112	0.0001	0.0001
Lephalale (Ellistras)	0.7930	0.0866	0.0925	0.0064	0.0075
Lydenburg	0.7385	0.0483	0.0249	0.0009	0.0011
Makopane	0.5433	0.0710	0.0297	0.0011	0.0014
Marico	0.7238	0.0582	0.0495	0.0021	0.0025
Messina	0.7597	0.0497	0.0375	0.0014	0.0017
Middelburg	0.7446	0.0653	0.0614	0.0030	0.0035
Nebo	0.6578	0.0511	0.0250	0.0008	0.0010
Nkomazi	0.6260	0.0412	0.0139	0.0004	0.0004
Rustenburg	0.9447	0.0412	0.1914	0.0074	0.0088
Soutpansberg	0.6350	0.0895	0.0239	0.0014	0.0016
Thabazimbi	0.5432	0.0426	0.0147	0.0003	0.0004
Thohoyandou	0.7473	0.0639	0.0367	0.0018	0.0021
Tzaneen (Letaba)	0.7272	0.0611	0.0591	0.0026	0.0031
Warmbad	0.8056	0.0369	0.0226	0.0007	0.0008
Witrivier	0.9370	0.0682	0.2751	0.0176	0.0208
Within Group	---	---	---	0.0486	0.0576
Between Group	---	---	---	0.4860	0.5757
Overlap	---	---	---	0.3097	0.3668

Table 2 shows the results of income inequality decomposition across the districts in the South Africa's Limpopo River Basin. It reveals that Witrivier and Rustenburg had the highest income shares with 27.51 percent and 19.14 percent, respectively. The districts with lowest shares of total incomes are Cullinan and Brankhortspruit with 0.25 percent and 0.59 percent respectively. Similarly, the table shows the Gini coefficient of incomes across the districts. It reveals that inequality is lowest among farmers in Brankhortspruit and Thabazimbi with 0.4625 and 0.5432 respectively. The districts with highest income inequality are Rustenburg and Witrivier with 0.9447 and 0.9370 respectively. The results generally show that income inequality is generally high across the districts. The results also show that out of the Gini coefficient of 0.893 that was computed for the combined data, Witrivier accounted for the highest relative contribution of 2.08 percent among the districts. However, between group inequality accounts for 57.57 percent, while within group inequality accounts for 5.76 percent. The interaction of within group and between group

inequality accounts for 36.68 percent of total inequality.

Table 3 shows the results of inequality decomposition based on the different sources of incomes that were reported by the farmers. It reveals that while the share of non-farm labour income in the total income is 6.79 percent, its relative marginal effect is with negative sign. It implies that holding every other thing constant, a one percent increase in non-farm labour income will reduce inequality by one percent. Therefore, promotion of economic activities that can lead to more income generating opportunities from non farm activities in the rural areas will deliver more incomes into the hand of the poor.

Incomes received as gifts accounts for very low percentage (0.01) of total income. However, its relative marginal effect reveals that if income in this category is increased by one percent, holding every other income constant, inequality will decline by 0.02 percent. This implies that efforts by the rural communities to exist in more cohesion by facilitating sharing will lead to reduction in inequality. This is expected because in many cases, it is the poor that are

unable to meet their needs and then seek for financial assistances.

Incomes received as remittances account for 0.50 percent of the total income. Its relative marginal coefficient reveals that holding incomes from other sources constant, a one percent increase in the incomes from that source will reduce inequality by 0.26 percent. Incomes realized from crops account for 29.61 percent of the total income. However, holding incomes from other sources constant, a one percent increase in the incomes from crops will increase inequality by 1.82 percent. Similar finding is reported for livestock, which accounts for 23.90 percent of total incomes, but would increase inequality by 2.0 percent if there is a one percent increase in the incomes to that source, holding every other income constant.

Income from pension accounts for 1.84 percent of the total income but have a relative

marginal effect of -0.0130. This implies that holding every other income source constant, a one percent increase in the income from pension will reduce inequality by 1.30 percent. The incomes that were generated from savings account for 0.19 percent of total income. However, holding incomes from other sources constant, a one percent increase in the saving income will reduce inequality by 0.08 percent. Farm asset income accounts for 0.10 percent of the total income. A one percent increase in income realized from that source holding every other income source constant will reduce total inequality by 0.01 percent. Non farm asset income accounts for the highest proportion of total income (37.04 percent). Also, a one percent increase in this income source, holding incomes from other sources constant will reduce total inequality by 1.16 percent.

Table 3: Gini decomposition by sources of income in the Limpopo River Basin of South Africa

Source	Coeff. of Concentration	Share	Relative Contribution	Absolute Contribution	Relative Marginal Effect
Non farm labor	0.7195	0.0679	0.0579	0.0489	-0.0100
Gift	-0.2653	0.0002	-0.0001	0.0000	-0.0002
Remittances	0.4086	0.0050	0.0024	0.0021	-0.0026
Crop	0.8962	0.2961	0.3143	0.2653	0.0182
Livestock	0.9150	0.2390	0.2590	0.2187	0.0200
Pension	0.2511	0.0184	0.0055	0.0046	-0.0130
Savings	0.5077	0.0019	0.0012	0.0010	-0.0008
Farm asset	0.7532	0.0010	0.0009	0.0008	-0.0001
Non farm asset	0.8179	0.3704	0.3588	0.3029	-0.0116

#### 4. Recommendations

The results have shown high levels of income inequality among farmers in the Limpopo River Basin. Although within group inequality accounts for lesser proportion of total inequality across the selected districts, it also very obvious that income inequality in districts like Rustenburg and Witrivier are intolerably high. Therefore, government needs to redress the contributing factors to inequality by profiling detailed resource endowments and access by poor households in each district and address the driving forces of inequality in a more critical manner.

The results have shown that promotion of economic activities that can lead to more income generating opportunities from non farm activities in the rural areas will deliver more incomes into the hand of the poor. There is therefore the need for government and private sector interventions in creating more opportunities for non-farm business operations in the rural areas. Such efforts can be

channeled through skill development for small scale business operations and provision of small loans. It should be emphasized that as more retail businesses develop and grow, rural income inequality will decline.

Gift income receipts reduce income inequality. Facilitation of social capital and networks in rural area will therefore be an important factor in reducing inequality. Also, because remittances reduce inequality, creation of conducive environment for people to move to other parts of the country to establish business or work without fear of molestation or sectionalism will go a long way in reducing inequality. Although incomes from crop and livestock account for significant proportion of total income, they are inequality increasing. There is the need for government interventions in identifying the pressing needs of poor small scale farmers to boost their farm income. Such efforts should address inadequate access to land and other production input.

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